

Article

Cognition and Psychosocial Effects of Digital Transformation in the Wake of the Industry 4.0: Introducing a novel triangulation design for research using AI ideation, literary refinement, and empirical enrichment

Abstract

The present discussion has two main goals: First, it is to introduce a novel triangulation method suggesting how modern AI models may be used as helpful added tools for empirical research, perhaps most relevant in the fields of sociology, psychology, and business economy. The method consists of three phases, namely AI ideation, literary refinement, and empirical enrichment. The method may be most helpful for research in complex, broad and dynamic domains where the landscape could be rapidly changing. As such, here it is applied to discovering the effects of digital transformation in the wake of industry 4.0 on human social psychology, which is the second goal of the present paper. The analysis takes place on three levels: human cognition, human emotion, and psychosocial effects. At the end, estimations about the directions in the realms of societal trends, organizational trends, as well as the future of work are made, and practical suggestions for management, organizations, and governing bodies are formulated to help navigating in the complex modern landscape.

Introduction

The modern digitized world is changing fast. Digital innovations are modifying the societal and business landscape at an unprecedented pace. This becomes especially manifest in the current AI developments where every week new natural language processing (NLP) and computer vision models are presented (Thompson, 2022b, 2022a). The adoption of digital tools has accelerated, especially under the pressures of the COVID-19 pandemic, which necessitated the switch from physical to digital modes of interaction in many companies and social settings (Ahmad, 2020; Amankwah-Amoah et al., 2021; McKinsey & Co., 2021).

The turn from physical systems and interactions onto digital ones is generally referred to as digital transformation (Owoseni, 2022) and it is said to herald a new era called Industry 4.0, which is characterized by a wave of technological interconnectedness and cybernetic automatization (Lasi et al., 2014). A hallmark of this era is the propagation of cyber-physical systems with networks where machines are connected to one another to regulate themselves and integrate humans with generative machines. Some exemplary key elements thereof are autonomous robots, big data, system integration, cloud computing, augmented reality, the Internet of Things (IoT), additive manufacturing, and the importance of cybersecurity (Roth, 2016).

The adoption of digital technologies in almost all areas of life has a transformative impact on humans at both an individual as well as on a collective level. There are interdependent effects on cognition, emotion and on the dynamics of social psychology. One example would be the implementation of AI systems that require human trust in order to be adopted but at the same time this leads to large language models (LLMs) like ChatGPT by OpenAI becoming increasingly more anthropomorphic (Walter, 2022). There are often reinforcing feedback loops, i.e., when Instagram boosts content that generates a lot of clicks in order to facilitate even more clicks, which itself motivates content creators to produce more material of this sort. A detrimental case has become visible in the promotion of beauty standards by social media algorithms and filters where teenagers and young adults have been left with increasing levels of depression (Cunningham et al., 2021; Vidal et al., 2020). One interesting phenomenon that became possible through digitalization is the emergence of new groups that would have otherwise gone unnoticed. Due to the power of the internet to connect likeminded people, they have grown to become public and communal. *Incel*s (short for “involuntary celibate”) form such a group, consisting mostly of young men that appear to be unsuccessful in acquiring a sexual mate, and therefore they share their frustration and misogynic attitudes with one another. Of late, such novel groups have become the focus of sociological and psychological study (Daly & Reed, 2022).

There are many ways in which digital transformation is impacting both individuals as well as societies. Expert opinions and empirical evidence are scattered throughout the world wide web and discussed in innumerable articles. Any discussion about these effects necessarily suffers from two shortcomings. First, for a topic this vast, it is virtually impossible to include every evaluation, appraisal, assessment, and study. One would need a robot crawling through large parts of the internet and then summarizing the findings. Luckily, with the modern LLMs by OpenAI, Meta, and Google, we have exactly that. However, any such summary will only provide us with a partial and rather crude insight since it has to form

abstractions from a large pool of data. Second, since the literature in the domain is constantly accumulating and evolving, any discussion about such a dynamic subject can only be a snapshot in time. Nevertheless, given the tremendous relevance of cognitive and psychosocial impacts concerning digital transformation, it is important to engage in such a conceptual analysis that may be helpful for future research and discussions. This is especially relevant in the present advent of interconnectedness and automation provided by the Industry 4.0. Here are some AI-generated reasons why studying the cognition and psychosocial effects of digital transformation is important:

- *To understand the impact of automation on human cognition:* With the rise of Industry 4.0, there is increasing automation of jobs that were previously done by humans. Understanding the impact of this automation on human cognition is critical to ensure that people can adapt to the new work environment and be productive.
- *To identify potential risks to psychosocial well-being:* The digital transformation of the industry can have significant implications for people's psychosocial well-being, such as increased stress and job insecurity. Understanding these risks is crucial for developing interventions and support programs to help people cope with these changes.
- *To develop strategies to optimize human-technology interaction:* As the transformation in the Industry 4.0 continues to develop, humans and technology are becoming increasingly intertwined. Studying the effects of this integration can help identify strategies to optimize them, resulting in more effective and efficient processes in industries and societies.
- *To inform policy decisions:* Understanding the impact of these present dynamics is essential for policymakers to develop regulations that ensure that the benefits of digital transformation are shared equitably among all stakeholders.

The present paper should thus be a heuristic, helping future discussions to navigate in the landscape since to date there is a lack of such a unifying perspective. In order to do justice to the above-mentioned shortcomings, an innovative approach was implemented to structure the present analysis, which is based on a triangulation of three methods consisting of ideation using AI, refinement using a literature review, and enrichment using qualitative expert interviews. Together, they lead to a preliminary framework informing future discussions.

The primary question this paper's discussion is revolving around can be put as followed: "What are the main cognitive and psychosocial impacts stemming from the current advent of Industry 4.0.?" Given the pertinence in modern developments, a special emphasis was put on AI and, more specifically, on NLP. A strong motivation for the present discussion was to introduce a novel and innovative methodological design for the construction of these kinds of conceptual discussions. This is exactly why such a broad research question was used because the triangulated approach should help to act as a funnel, which may here be demonstratively implemented to handle such a rapidly evolving topic.

Methodology

Triangulation

The present design consists of a triangulation of three methods that can be seen as a three-step program (seen in Figure 1). The first step uses AI to help making sense of the vast amount of data that is present online about this topic. This is not supposed to be authoritative but rather it is used as a generative tool to form informed baskets of ideas of how the question can be answered. This AI-inspired brainstorming phase is here referred to as the *ideation phase*. Second, the categories provided from the ideation stage are then used to be further investigated through a literature review. In a sense, the data-driven ideation helps to inform the review stage where to start and which directions to take. Without this, the review would start with highly arbitrary decisions since the field itself is so broad and rapidly expanding. The review helps to make sense of the presented categories from the foregoing stage. It also may show if there are further categories missing and if some of the AI-produced categories might not be backed up by evidence from the literature – in which case they would be eliminated. The literature review stage is therefore called the *refinement phase* since the pool of informative categories is being refined through extension or elimination of categories. The findings are then transferred onto a last stage called the *enrichment phase*. Here, the categories are scrutinized and qualitatively enriched through the means of empirical research, in this case with the help of qualitative analyses using interview techniques that are regularly employed in social science and psychology.

The present use of the word “category” is drawn from content analysis where the qualitative information latent in a text is summarized and then encoded. Hence, the coding principles known in qualitative induction and deduction methods are applied (for a detailed introduction, see Mayring, 2015).

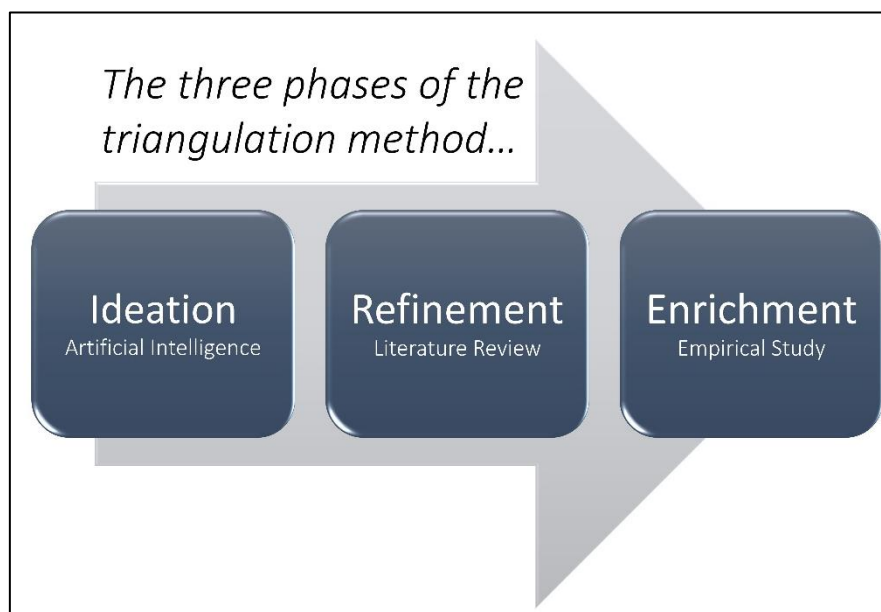


Figure 1. The three phases of the triangulation method used in the present paper.

Phase 1: Ideation – Artificial Intelligence

There are two main branches of what is commonly referred to as Artificial Intelligence (AI). On the one hand, there is *computer vision* that deals with image recognition and generation. On the other hand, we find *natural language processing* (NLP), which has to do with recognizing and generating text (Haugeland, 1985; Renda, 2019). Natural language, in this context, is language that does not necessitate any programming but is present in its general conversational form, such as people speaking in English, German, French, or any other language humans speak. Recently, large language models (LLMs) have become popular since the general public has realized their strong potential in everyday applications (Thompson, 2022b). Although very large models like ChatGPT, Google's LaMDA and Bard, or the new GPT-transformer implemented in Microsoft's search engine Bing are still rather young, due to their capabilities they have been propelled to the forefront of public awareness. Especially the new and large models from OpenAI, Meta and Google's Alphabet have been trained on large chunks of the internet, so that there is a lot of information stored in their weights and biases, meaning that for better or for worse, the models are informed by a large amount of data found in books, blogs, websites, studies, and news articles (e.g. OpenAI, 2022; Tingiris & Kinsella, 2021). This enables them to become the perfect brainstorming partners for an ideation phase if one wants to get AI-informed educated guesses that are driven by a significant amount of online data. None of the information gained from these models should automatically be taken as authoritative or necessarily true but as data-driven ideas that may provide researchers first directions of where to start with their endeavors. As such, they are ideal for a first ideation phase.

In the present study, ideation was effected using OpenAI's ChatGPT, which at the point being is based on the GPT-3.5-turbo model (an extension of the text-davinci-002 model). The results were extended by the new Bing search AI, which is based on GPT-4 and further incorporates real-time web search results (Microsoft, 2023). The present prompt engineering started with generic questions about the cognitive and psychosocial impacts of digital transformation and Industry 4.0, followed up by further prompting concerning the individual categories provided by the model. The prompts and the outputs are fully documented the supplementary materials.

Phase 2: Refinement – Literature Review

A literature review is usually carried out to gain an understanding on the available evidence, conceptual paradigms, and prevalent opinions about a given topic. It is supposed to deliver a state-of-the-art insight into what academic authors have to say and the studies performed in the domain. Depending on the need for rigor and systematization, different review strategies can be performed. The most common ones are known as systematic reviews (among which we find the meta-analyses that usually include objective metrics and statistical analyses), scoping reviews, and narrative reviews (Rhoades, 2011). For rather narrow research questions, if there is a lot of evidence on a certain research question that is rather static, systematic reviews are often preferred. It makes sense to summarize and statistically analyze published data for phenomena that might not change in the near future

and can be seized with a clear metric. This is not so useful, however, if the body of literature is still subject to notable change. A scoping review first defines a strong methodological approach and then spends considerable time following the outlined path with the goal that other researchers can reach the same outcome. In an environment that is rapidly evolving and even accelerating in speed (as can be seen in the present digital and AI developments), a narrative review makes the most sense (Knopf, 2006). This type of review is helpful when no systematic is currently present so that a thorough screening of the topic is in order. Narrative reviews can either start at random and then slowly try to weave the material together to a meaningful picture, or they can start with a predisposed logic so that it reduces weighting biases in the order of how the articles were detected (Dekkers et al., 2022). Since the present paper deliberately deals with a broader research question in a rapidly evolving field, the review uses a narrative approach that builds upon the categories from the AI-inspired ideation phase.

Phase 3: Enrichment – Expert Interviews

The final phase of the triangulation consists of an empirical sense-making of the narrowed-down categories using qualitative interviews. Whereas the ideation can provide us with interesting directions and the review can tell us which of them are backed up by the literature, the interviews can enrich the categories with qualitative information. This means that the interviews can provide knowledge about what the categories mean, how they relate to one another, and which future trends can be envisioned under the precept of the participants' professional experience. As such, five experts in the field of digital transformation were recruited to participate in qualitative interviews. All of them were selected from a pool of people that successfully passed an academic educational program at a University of Applied Sciences in Switzerland. Likewise, they all had professional experience and due to the program also had a research background in the field. Semi-standardized questionnaires were applied. Since all interviewees were employed in leadership and management positions, time was sometimes scarce. As such, the questions were held as tightly as possible. The interviews were transcribed and eventually analyzed with both deductive and inductive content analysis methods (for a theoretical introduction, see Mayring, 2015).

A word of caution concerning LLMs

Large language models (LLMs) have interesting capabilities. They can appropriate a conversational style and interact with people verbally in a more human way. This is what makes them so attractive because it means that users do not need to be equipped with programming skills but can simply use natural language, such as English, German, or any other language the model is trained on. There are, however, also significant problems with the models so that one should never blindly trust them. The problems lie in the realms of algorithmic and training biases, hindsight neglect, halo effects due to the order of prompts, instrumental convergence problems, and AI hallucination (Alkaissi et al., 2023; Bostrom, 2012; Frank et al., 2021; Roselli et al., 2019). Basically, this leads to three issues: the LLM

may not give you the full answer, it may give you a biased answer, or it may even give you a false one. As such, if the results from the AI may not be completely true, they should not be considered authoritative, like when interviewing a human expert with all the necessary credentials for truthfulness. One should rather treat the interaction like a conversation with an intriguing and naïve student that might have read up extensively on the subject but might occasionally fabricate statements that are not correct. Hence, the best use of LLMs is for ideation purposes that should then be further refined and enriched with additional research. This is also likely to be true in future AI models because first, such models are technically optimized for language processing and not for truthfulness, and second, it would be in principle impossible to optimize such a model for truth since it has no access to the real world and can only work on statistical processing based on the digital input data.

Cognitive and Emotional Effects of Digital Transformation

Preface

Digitalization may be *the* transformative process in modern times. The effects on humans are manifold, but can be conceptually summarized as influences on cognition, emotion, as well as on social relationships and constructs. The following discussion about the digital effects on these dimensions are based on the aforementioned triangulation study, namely there was an AI ideation for generating hints concerning the present dynamics, then there was a literature refinement where the hints were pinned to the available body of evidence, which was followed by qualitative sense-making and enrichment through the expert interviews (for the data generated in all of these steps, see the supplementary materials). All quotes provided from the expert interviews were translated from German in a way as to best represent their original tone and meaning.

Human Cognition

As the name suggests, digital transformation is the transformative process on all levels of psychology, society, and economy following from the adoption of digital means. One interview expert in this study said: “Digital transformation is actually a complete paradigm shift in all areas of life. This ranges from the way one *is* to the way one *thinks* and *feels*. It is comparable to a metamorphosis where one starts with a point of origin and develops towards an end goal [the successful adoption and implementation of digital means], which is accompanied by a profoundly significant change.” The same participant explained that Industry 4.0 is perceived as the latest standard of this digitalization process, within which AI is assumed to be one of the most disruptive technologies that has ever emerged. According to another expert, Industry 4.0 is a cornerstone of modern digitalization: “With Industry 4.0 we deal with connected systems where the processes are fully automatized in the background. Human action is not necessary anymore, only in emergency situations. Apart from this, it is pure automatization of the industry. Only a limited amount of human action is present.”

Yet another of the interviewed experts made the interesting remark that there appears to be a co-evolution of digital technology and human cognition. Technology needs to be adapted towards conforming to our thought structures, otherwise it cannot be adequately adopted. At the same time, the more it permeates society, the more our modes of thought accommodate the digital possibilities and limitations. One participant discussed some examples for digital transformation both on the business as well as on the personal front:

In terms of the business model, we ask how we can make our customers lives easier through digital means and how we can stay valuable on the market. As an organization, this means that we accompany our employees on their digital journeys, which also affects how we communicate, use the tools, and tailor the human-machine-interactions. This implies a transformative change with the focus of not being scared that one's job is at risk, but with the goal to motivate people to get educated in these new areas. Repetitive work can eventually be handed to the machines, and humans have more time for creative tasks – this would be an ideal scenario. Personally, as a mother, I now see how my children grow up with the technology as a natural part of life. It seems to have become normal that children in third grade work with the cloud and with mobile apps [...], which is why we call them digital natives. However, there are negative aspects to this, namely that kids use an iPad for playing with puzzles in kindergarten but have difficulty to play with a real, physical puzzle.

Another interviewee described that he is regularly consulting different organizations, and he explained that “There is currently an ongoing [digital] transformation in every single industry. For some, this means IoT, for others it has more to do with IT outsourcing, or the question of how an IT infrastructure can become more digital. We see this even in the way people now study at the university and how they write their term papers – just think about ChatGPT...” He went on discussing the danger we will experience in case AI might become smarter than humans (often referred to as the *singularity*), and he is certain that already today, digital media and AI have a strong influence on human cognition.

It has been shown that digital media can have both positive and negative consequences for our cognitive abilities, depending on how they are being employed. On the one hand, for example, a meta-analysis with 92 studies showed that digital tools can be helpful in increasing learning capabilities (Hillmayr et al., 2020). On the other hand, a study with 1,000 children showed that the higher the TV consumption, the stronger their problems became to focus and to maintain their attention to a specific piece of information (Christakis et al., 2004). One interview expert discussed that this manifests in different effects, such as the fact that ads have to become increasingly shorter, or that songs on Spotify are cut to two to three minutes and usually now have to start with the chorus. These are developments that the founders probably could not have anticipated. In fact, MRI research found that watching a lot of TV can lead to shrinkage of the grey matter in the brain (Takeuchi et al., 2015). Although digital media appears to influence brain development and sleep capability (Habermann, 2021), it became clear that the quality and meaningfulness of the digital content matters a lot. This was demonstrated in experiments where children's working memories were differently affected depending on what exactly they were watching (Lillard &

Peterson, 2011). Overall, there appear to be several categories of how digital processes and technologies in the wave of Industry 4.0. affect human cognition, which are multi-screen behavior, multitasking, and cognitive load (including cognitive overload, cognitive development, and aging), attentional control, memory and information retention, learning and education, perspective taking with creativity and innovation, problem-solving and decision making, critical thinking, cognitive biases, perception of reality (including more access to information, mis- and disinformation, as well as polarization), and ethical reasoning. These categories may be somewhat overlapping and shall be briefly discussed.

Digitalization increases multi-screen behavior, which is a form multitasking. For example, one of the most comprehensive studies on remote meeting behavior with the analysis of diaries from 715 U.S. Microsoft employees concluded that purely digital meetings significantly increased multitasking, such as working on e-mails and reading the news while participating in the meetings all at the same time (Cao et al., 2021). Almost 30% of the meetings consisted of e-mail processing (Rintel et al., 2020). There were also added digital problems that consumed employee's mental resources like camera or microphone issues, and awkward situations like participating in a meeting while sitting on the toilet (Karl et al., 2022). Such mental multitasking has become commonplace since our mail inbox, our phones, and other tools constantly fight for our attention. As a consequence, the cognitive load is increased, and the attentional control is reduced. A study with 80 young adults showed that increased media multitasking negatively affected memory function and led to shorter attention spans (Madore et al., 2020). Not surprisingly, the more people got interrupted by digital media, the less effective in task-fulfillment they became (Skulmowski & Rey, 2020). This does not mean that digital tools are always distracting, but the cognitive load has to be allocated to the tasks respectively in order to foster productivity (Skulmowski & Xu, 2022). Some authors have referred to the problem of the negative effects on attention span as "cognitive overload" and have suggested that a sort of digital detox may be in order to restore healthy attentional baselines (Schmitt et al., 2021). As one of the participants explained: "I see the biggest problem today in the constant information overload. In just seconds, information travels around the globe." It is not yet clear how cognitive development and aging are affected by the present ubiquitous digitalization, but it is known that younger generations are more ready to adopt new technologies, which means that they might be more prone to their psychological effects (Moret-Tatay & Murphy, 2019). Nevertheless, older people may benefit from digital tools just as much, as can be seen in technology helping older people suffering from dementia to remember things that are necessary for their daily lives (Hackett & Giovannetti, 2022).

Digital content now ages much faster than it used to, and there is new interesting content available online every advancing second. This diminishes our motivation and thus the ability to allocate prolonged attention to one specific thing, which would be important for many tasks like critical thinking, learning, and high-quality information processing. As one interview expert said: "Nowadays, we have to memorize less and less." A mathematical model has calculated how exactly our collective attention is decreasing as a result of this (Lorenz-Spreen et al., 2019). There are some amusing words associated with these trends: "brain drain" is supposed to refer to the phenomenon that mental resources are spent on irrelevant information, with "ringxiety" acting as an example of phones calling for our

attention even when they are turned off because they might still bring us a message, which can even produce “phantom vibrations” (Ward et al., 2017). One expert stated that young people nowadays have developed deliberate strategies to counteract these problems, namely, to consciously disable all push notifications on the phone so that information consumption occurs on a pull-basis only and not on a push-basis. This might imply that younger people now know more what exactly they want and what they do not want – at the very least, when it comes to the information they process.

Unfortunately, selfies have led to a considerable amount of accidents and deaths (Dokur et al., 2018) – there is even a Wikipedia page with an up-to-date list of “selfie-related injuries and deaths” ([see here](#)). An interviewee explained that the ubiquitous availability of digital media leads to a constant distraction: “We don’t get bored anymore, which would be the area in the brain necessary for relaxation. I get up in the morning and what do I do first? I make sure that I get a device in my hand.” However, this has led to interesting new business models, such as hotels offering digital detox-vacations. Whereas in the past, customers had to pay to get internet access, now in these hotels they are paying to escape the digital world.

It is still a matter of ongoing debate whether digital tools may overall be more beneficial or distracting for memory, information retention, learning and education. It appears as though digital tools may mediate a person’s motivation to concentrate and can therefore also be helpful (Huffaker & Calvert, 2003), but some studies hold that writing on paper by hand manifests in stronger brain activity and may hence improve memory retention (Umejima et al., 2021). At bottom line, it may well be a matter of individual choice, as Granito & Chernobilsky (2012, p. 17) state: “The results of this study support the idea that when given the choice of project, students retain knowledge no matter which project is chosen, traditional or computer-based.” In line with this, another study concluded that students believe that they can concentrate in an online lecture just as well as when they would be physically present, if they are allowed to choose for themselves (Mohi et al., 2021). However, this may not be the full truth, since experiments showed that digital learning enhancement only occurred when the tools were selected carefully and task-specific (Scheiter, 2021). At the same time, visual memory capacity including writing skills were aided best when there was a compelling digital storytelling (Sarica & Usluel, 2016).

There are some authors who found that digital training and video games improved cognitive mapping skills, more so for males than for females (Wauck et al., 2017). The evidence for this is not completely convincing because newer studies with more nuanced designs refuted the idea that online games would improve spatial skills (Safaei et al., 2022). Nevertheless, digital tools like Computer Aided Design (CAD) and Building Information Modelling Systems (BIMS) can certainly be helpful in graphic design, engineering and manufacturing (Isikdag et al., 2013).

Digital progress can boost human creativity, which in turn may lead to novel digital innovations, and this then can have a positive feedback loop on creativity (Hund et al., 2021). Especially for organizations, AI can be a powerful tool to foster creativity and innovation (Füller et al., 2022). As AI tools become more multimodal, the possibility to be creative with them increases – for example, text-to-image generators like Dall-E 2 or Midjourney provide new opportunities for everyday graphic design (Rezwana & Maher,

2022). But one might ask if this would dampen human creativity. Lee (2022) holds that there is both a dehumanization but also a rehumanization of creativity at play in the advent of AI, which becomes manifest on three levels: (i) the creative industries, (ii) AI creativity, and (iii) everyday creativity. Although in a study most students were convinced that AI would not make human creativity obsolete, those with better understanding of AI reported more positive thoughts about AI and creativity while also being less fearful (Marrone et al., 2022). Perhaps the value of human creativity may never be threatened by AI because what makes art interesting to us is that it raises the questions: “What did the creator think when working on this piece? And how does this make me feel?”

One of the most obvious use-cases for digital tools like AI is the domain of problem-solving and automated decision-making. Problem-solving tasks are ubiquitous in everyday life and AI can help with that (Wang, 2021), which is why decision-makers must recognize which sorts of problems should be handed to the AI and which ones a human managerial mind should handle (Park et al., 2021). This is why critical thinking and media competence become increasingly important – although it may be more difficult due to AI shortcomings like AI hallucination, biases, and alignment problems. This is why one educational paper was entitled: “Do Less Teaching, Do More Coaching: Toward Critical Thinking for Ethical Applications of Artificial Intelligence” (Park et al., 2021). Interestingly, one of the interviewed experts was quite hopeful as he discussed that biases are a distinct “human feature” and critical thinking may potentially become better with AI since machines are more disinterested and might enable more neutrality, if trained correctly. An early research paper supported this idea by showing that critical thinking skills could in principle be woven naturally and seamlessly into a computer class about AI (Krishna Rao, 2005). However, another interviewee was more skeptical than that and stated: “Well, think of the scenario when people predominantly use ChatGPT as their source of information and arguments, then they will be strongly influenced by the machines and don’t really have their own opinions anymore.” A recent poll with 453 respondents found that AI-based learning apps can boost self-confidence about the learning tasks (e.g. learning English) and at the same time may have a positive impact on critical thinking skills (Muthmainnah et al., 2022). Nevertheless, it is an important consideration that AI may be trained with skewed data, which in turn holds the potential to produce unidimensional outputs and may increase biases in the user (Rastogi et al., 2022; Srinivasan & Chander, 2021), whereas the non-transparent algorithms may even bypass the user’s critical faculties and influence them subconsciously (Busuioc, 2021; Muthmainnah et al., 2022).

Not just AI, but also social media can increase the possibility for people to end up in echo chambers where they are presented with skewed information, which reinforces stigmas and presuppositions (Cinelli et al., 2021). An interviewee uses the corona pandemic as an example where it was seen that some protagonists from the pro-vaccine camp and others from the counter-vaccine camp became radicalized because the online groups they joined and the algorithms that provided them with information only catered one-sided views to them. Some authors in the literature also dared to make controversial suggestions, namely to willingly implement human biases into AI systems in order to speed up the decision-making process (Hagendorff & Fabi, 2023). However, since such decisions could have far-reaching consequences, the implementation of biases could be dangerous for many people

and should arguably be avoided. Digital tools can, after all, significantly alter our perception of reality – for better or for worse. On the positive front, a study showed that animated agents improved students' perception, cognition, and motor control (Cinelli et al., 2021). Through AI and digital platforms, we now have access to more information, potentially positing faster cognition, steeper learning curves and more perspectives (Bawden & Robinson, 2020), although it may also lead to an information overload (Rutkowski & Saunders, 2018, 2010). On the negative front, there is the risk of involuntary misinformation (Wilner, 2018), deliberate disinformation (Baum, 2018), and accidental polarization of opinions (Maes & Bischofberger, 2015). Nevertheless, if the AI systems are constructed accordingly, as one interviewee stated, machines may help to be less biased since statements based on pure data can potentially be more neutral than the ones predominantly influenced on human opinions. This, of course, largely depends on how the AI was trained.

All of this leads to new forms of ethical dilemmas in the realm of digital ethics, like if automated cars should deem older or younger lives more valuable in case of an accident, or if AI agents should have the right to an attorney (e.g. Sommaggio & Marchiori, 2020). AI may have the potential for more objective ethical reasoning due to the fact that it was trained on a large amount of data (Morley et al., 2021). However, many might not agree with this idea. For example, Mittelstadt (2019, p. 501) stated that “principles alone cannot guarantee ethical AI”, which would imply that ethics should forever remain in the hands of conscious humans. One interviewee made an interesting addendum:

It is generally interesting to talk about such ethical questions. For example, are we already Cyborgs because we outsource our knowledge to a huge degree to our cell phones and then become dependent upon them? Would you hand over your cell phone to simply anyone because you would have nothing to hide? Or has it become a part of your own identity? I believe we all have a digital identity when considering that we already create an online representation of ourselves with our profile pictures.

Human Emotion

There are both positive as well as negative emotional effects stemming from digital transformation. Excessive technology use was shown to lead to negative emotional outcomes in adolescents, although the association was stronger for girls than for boys (Limone & Toto, 2022). On the upside, a study across 28 European countries found positive life satisfaction that correlated with internet and digital technology use (Elmassah & Hassanein, 2022). Hence, the results may be dependent upon the applied research methods.

When it comes to mental health and wellbeing, the findings are mixed since AI, social media, and digital platforms may have both positive as well as negative influences on human psychology. A study with 368 managers in a digital transformation process reported lower wellbeing due to higher choice overload, although not due to digitalization pressures *per se* (Zeike et al., 2019). However, there is an ongoing debate about whether social media and digital devices are detrimental to mental health. On the one hand, the statistics show that

teenage depression started to spike in 2012 when social media became more common, but on the other hand, a *Nature* publication discussed that they make timely intervention more possible (Haidt & Allen, 2020).

With the immersion of society into digital media platforms, they became a source for psychological validation. For example, it was shown that social media changed the urge to be seen, because from 2009 to 2019 a total of 30% more adolescents reported that they wanted to become famous or influencers (Lönneker & Imdahl Reingold, 2019). However, this can also become tremendously stressful. On this note, a new phenomenon called “technostress” made headlines, which refers to the notion that the ubiquity of digital pressures leads to higher workload, complexity, and work-life conflicts (Dragano & Lunau, 2020). The widespread nature thereof should not be underestimated since already more than fifteen years ago, a study among 1,573 Korean high school students demonstrated that 1.6% were internet addicts and 38% showed signs of possible addiction, whereas levels of depression were highest for addicts (Kim et al., 2006).

Although it is natural to infer from this that social media may have a largely negative impact on self-esteem, studies have shown conflicting results suggesting that the effects might be person-specific (Cingel et al., 2022). There seems to be the tendency that users compare themselves upwards with people who appear to have a “greater life” than oneself, which holds the potential for a dampened self-esteem (Jan et al., 2017). Online behaviors such as liking and commenting predicted lower self-esteem for girls but there was no effect for updating one’s profile (Steinsbekk et al., 2021). If anything, addictive social media behavior can be indicative of narcissistic traits and the need to feed one’s ego (Andreassen et al., 2017). Not surprisingly, then, the number of likes on a picture was felt as a booster of self-esteem, although a sense of purpose was moderating this effect (Burrow & Rainone, 2017). According to a survey among 467 Scottish adolescents, an increased social media consumption was associated with lower sleep quality and self-perception, and higher anxiety as well as depression (Woods & Scott, 2016). One interviewee explained that social media can reflect illusions and thus change a person’s perception: “Women orient themselves more socially and are more at risk of comparing themselves with beauty standards online. Through social media, there are new utopic standards. This distorts a person’s perception of reality and creates an illusory world with ideals that can never be reached.”

At first glance, social media use appears to increase a sense of social connectedness with others. Social platforms may come with an ease to form online communities. However, it may also produce higher ostracism since online it is easier to pick on people and exclude them (Allen et al., 2014), which again means that the effects seem to be person-specific (Ryan et al., 2017). In an interesting study, 61 participants performed a 7-day social media abstinence. After this period, they reported better mental health and lower levels of Fear of Missing out (FoMo). The motivators that made it difficult for them to abstain provide valuable insight into why people often use social media, namely coping, feeling bored, and notification distractions (Brown & Kuss, 2020). One interviewee explained that being constantly connected to the internet can reduce boredom but may increase stress and exhaustion, which evokes a rapid loss of focus because one is always interrupted: “Here a mail, there a message. It takes us at least six times as long to finish a task this way if we don’t

apply strategies to consciously ignore them.” In a literature analysis dealing with 58 studies, social media use was a significant predictor of FoMo (Tandon et al., 2021). It is therefore no secret that social media can be highly addictive, with numbers ranging from 5% to 25% of users depending on the country and definition of addiction, although the prevalence was twice as high in collectivist as opposed to individualistic countries (Cheng et al., 2021). Our online behavior hence leads to a digital identity, which comes along with the ability to construct an online avatar of oneself (Steven, 2012) and consists of all the information one posts online about the self (Warburton, 2010). As some authors have explained: “... the phenomenon raises the challenge of digital identity management on such platforms in order to maintain reputations and ensure information privacy preservation” (Adjei et al., 2020, p. 1).

With proper digital training, employees can learn to become more resilient to negative effects (Helkala & Rønnfeldt, 2022; Saleem et al., 2023) and people can become more empowered (Lagumdzija & Swing, 2017). As such, social media can be used as a compensation for people perceiving themselves to have low communication competence skills (Sheldon & Ware, 2022), and digital competences may be a new form of intelligence, which naturally can provide confidence if properly mastered (Oberländer et al., 2020). This may intersect with emotional intelligence and empathy. In fact, a discussion in the *Harvard Business Review* concluded that with the rise of AI, emotion and empathy become more importance because repetitive thinking processes can be outsourced to the machines and may become less relevant in human daily lives.

Psychosocial Effects of Digital Transformation

It is important to understand that there is a bidirectional relationship between digital diffusion and social trust in technology (Walter, 2022). Only if the technology appears to be trustworthy will there be a full-scale adoption of its powers, and if people do not lend trust to these systems, they will either not use them or might eventually ban them. This is currently visible in the domain of AI: Leading developers have recently made a call for a six-month moratorium in AI research concerning the largest LLM models because society may not yet be equipped to handle the technology (Clarke, 2023). Overall, there are three categories of users: (i) the skeptical shunners, (ii) the pragmatic conformists, and (iii) the enthusiastic activists (Hedman & Djerf-Pierre, 2013).

Human language and communication are in a constant flux, and they are a continuous process of societal negotiation. As the digital sphere naturally blends with our habitats, online behavior also influences these dynamics. One interview expert explained that the rise of Whatsapp and Instagram provoked a form of communication that largely consists of emojis and one-liners. The fact that communication now strongly occurs through the use of pictures (e.g. emojis) is something that is demonstrably new but may also be a source of misunderstanding since not everyone may interpret an emoji the same way. Interestingly, as AI becomes more adept in human language, it is bound to become a player in cultural language processing (Nah et al., 2020). AI and human communication are intertwined on three dimension: (i) the functional, (ii) the relational, and (iii) the metaphysical (Guzman &

Lewis, 2020). The latter refers to the idea that human-machine-interactions blur the boundaries between humans and computers. Bergner and colleagues (2023) provide a practical example by showing that AI communication actually influences consumer-brand relationships. Another interviewee stated that digital communication appears to have a degenerative effect on human language and communication skills. He makes the following observation:

We already see this when we analyze the language used in chat threads. Everything becomes faster and shorter as it gets more virtual. We can trace the beginnings back to the 1990s, and we see how it influences our language. There is a certain form of language degeneration at play where the vocabulary is shrinking. I am not sure if this is only the fault of chat apps, but both written and spoken language don't seem to be on a positive development track. Especially young people who send me their applications for a new job appear to have rather bad language skills. The ones who are eloquent writers have become the exception.

On a societal level, online communities gained not only in popularity but also in relevance. Originally, they were useful for gathering information and providing reviews. Especially during the corona pandemic where many people felt lonely and isolated, online communication and platforms were used for psychosocial benefits by providing social support, reducing the sense of loneliness and depression, as well as helping peoples' self-esteem (Carreon & Manansala, 2021). Online communities can not only lend a sense of belonging and social support, but also help with stressors such as illness, disability, and other life challenges (Saha & Sharma, 2020). Some of the interviewees discussed that this is a double-edged sword since social media can connect us with others, but they can never fully replace our need for physical connections and if the latter makes way for the former, then feelings of loneliness can emerge. This has interesting consequences for the dating market, as one expert explained:

In the past, you had to speak to a lady on the streets or at a bar, and then you had to bring in some effort. You could not find your dates on dating apps. Today, there is a much broader reach for more possibilities, but the quality of the interaction suffers from this. Virtual connections may hence be an alternative, but they cannot substitute the felt quality of social contacts in the physical space.

Another interviewee adds to this that AI can have an addictive nature, which may increase the time spent with the machine and reducing a sense of loneliness, but not in a healthy way since it may increase real-life isolation:

I read somewhere that there are people who continuously speak with ChatGPT for more than 12 hours a day. And I just thought to myself: Hey, something has to be psychologically wrong with such a person, if one sits there for 12 hours and talks to the AI instead of spending time with family, friends, or lovers. This person is likely hooked onto the digital world. There is a real danger of getting sucked into the online space. This can naturally damage one's social connections. If someone feels lonely and starts to primarily speak with a machine, then there may be a lessened sense of loneliness for the moment – but it's just fake. It's not real.

Today's children and teenagers grow up in an increasingly digitized world. A critical mindset and media socialization have thus become important for navigating in this landscape. There are three necessary elements to this: digital skills, attitudes, and digital literacy (Milenkova et al., 2018). Digital skills are the competences to handle the digital tools, whereas the attitudes are mindsets that allow them to stay healthy in a digital environment. One of the interview experts brought up the example of adolescent students that deliberately deactivate all the push notifications on their phones so that they do not suffer from a cognitive overload but can retrieve information on a pull-basis. Digital literacy refers to the capability to critically evaluate the digital tools and the effects they bring about. For example, it is an important feature of AI literacy to be aware of the fact that AI systems can hallucinate and provide wrong information that sound convincingly true (i.e. Alkaissi et al., 2023). Young people growing up in the digital sphere are often referred to as "digital natives" and the process of getting raised on the internet is called "digital socialization" (Smith et al., 2015), whereas Gruman and Saks (2018) refer to this as "e-socialization". The philosopher Slavoj Žižek (2017) adds that growing up digitally implies that new forms of social realities are being constructed with social media becoming a central place for personal discussions, which can now also be done anonymously. Some of the interviewees in the present study connected this idea with our new digital identities that we construct as online avatars, which by virtue of their potential anonymity lend the possibility for dissociative experimentation and thus to increased dissociation of a person's perceived gender with one's body and physical attributes. As one participant explained: "Most of us are constructing a digital identity, and we see some extreme examples in the woke culture. The gender debate suggests that your body is only a host of your being. These are cultural trends that are supported by the digital world since this is a space where the mental can be decoupled from the body". Another participant shared the story of a young boy who experimented on presenting as a woman anonymously online. The teenager first created a female avatar and only after intense phases of testing the waters started to dress as a woman and using a female name offline. This lends credence to the argument that the modern LGBTQI*-movement as presently construed may largely be born out of the internet and hence in a way is a digital phenomenon. The idea becomes further supplanted by the fact that such gender-political topics are highly 'clickbaitable' and are thus often virally transported across social media, even if it would only concern a small minority (for a detailed discussion, see Rawson, 2014; Shapiro, 2004; Webster, 2019). The new digital reality consists of a platformized ecosystem and a social evolution of the mind, which comes along through a "socio-cognitive concept of digital socialization" (Soldatova, 2018; Soldatova & Voiskounsky, 2021).

Naturally, the widespread impact of digital transformation leads to evolving norms and values. The dominant shift to online communication resulted in the emergence of new social 'netiquettes' (Heitmayer & Schimmelpfennig, 2023) and expectations around digital business models changed (Senyo et al., 2016). Some of these developments may also be 'badiquettes', because according to one interviewee, people have become accustomed to being much more flexible, which also increased their proclivity to cancel a meeting or a date on short notice, often to the chagrin of the other person who deliberately has set aside time for meeting the other. Another downside is that algorithmic manipulation can threaten

democracies as the case of *Cambridge Analytica* made public, and authoritarian regimes like the Chinese government are known to manipulate the systems to steer the norms into conformity with their political agendas (McKune & Ahmed, 2018). One of the experts added to this that digital communication tools enable people to speak to each other, even when one does not even know the language. For example, I can book a room on Airbnb on the other side of the globe, and I can text the owner of the apartment. The platform automatically translates my words into their language and *vice versa*. The problem is that this creates a false representation of oneself since it represents a person that is not the 'real me' who speaks this language.

There are mixed findings when it comes to the digital effects on social cohesion. For some people digital platforms may create a sense of connectedness and unity. For others, they may exacerbate their feelings of loneliness since tools like Instagram constantly signal a virtuous world where everybody is happy and surrounded by others, which often does not correspond to real life (Kusumota et al., 2022; Locsin et al., 2021; Rauschenberg et al., 2021; Sen et al., 2022). Add to this the problem that 'shit-storms' and bullying (known as 'cyberbullying') become a lot easier in the anonymous landscape of the digital space. An interviewee explained that bullying and mobbing at school now even haunts people into their children's rooms since these vices now also take place on WhatsApp and Instagram. This increases the levels of frustration and depression in the cohort. Strategies to combat cyberbullying consist of social support from one's family, friends, and teachers (Chisholm, 2014; Foody et al., 2015; Hellfeldt et al., 2020; Ngo et al., 2021). However, another participant made the case that the capabilities for social problem-solving are decreasing because it is more common now to unfollow and block a person on all channels if there are social tensions. At the same time, if one might want to discontinue the dating phase with a romantic prospect, people have become much more likely to 'ghost' the person and simply not text them back – disrespecting of what in earlier times would have been thought of as common courtesy. This might have negative effects on large-scale social and emotional maturation processes.

Synthesis: Multidimensional Interactions

Emerging platforms and technologies have an impact on human psychology and societies, with tangible implications for business economy. Technological adoption is dependent upon social trust and habituation, which itself may create a dependence on the adopted technology. As seen in the discussion above, when it comes to the digital influences on human psychology and social connections, there are effects on human cognition, effects on human emotion, as well as psychosocial effects, which is illustrated in Figure 2. All of these three dimensions have different categories explaining how exactly digital transformation affects our lives. These categories can be found in Figure 3 and are explained in more detail in the previous chapters (all evidence can be retrieved from the supplementary materials). The categories and different dimensions have strong interactions; however, they are presently portrayed as simplified depictions. Figure 3 therefore acts as an abstraction to provide a clean overview.

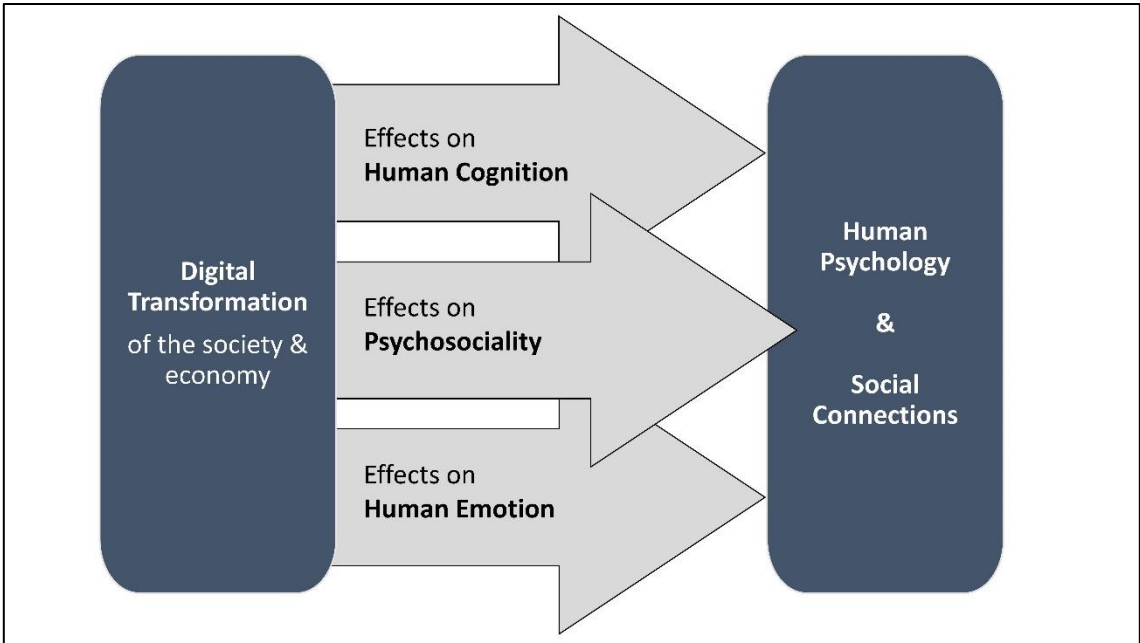


Figure 2. The three dimensions where digitalization affects human psychology and social connections.

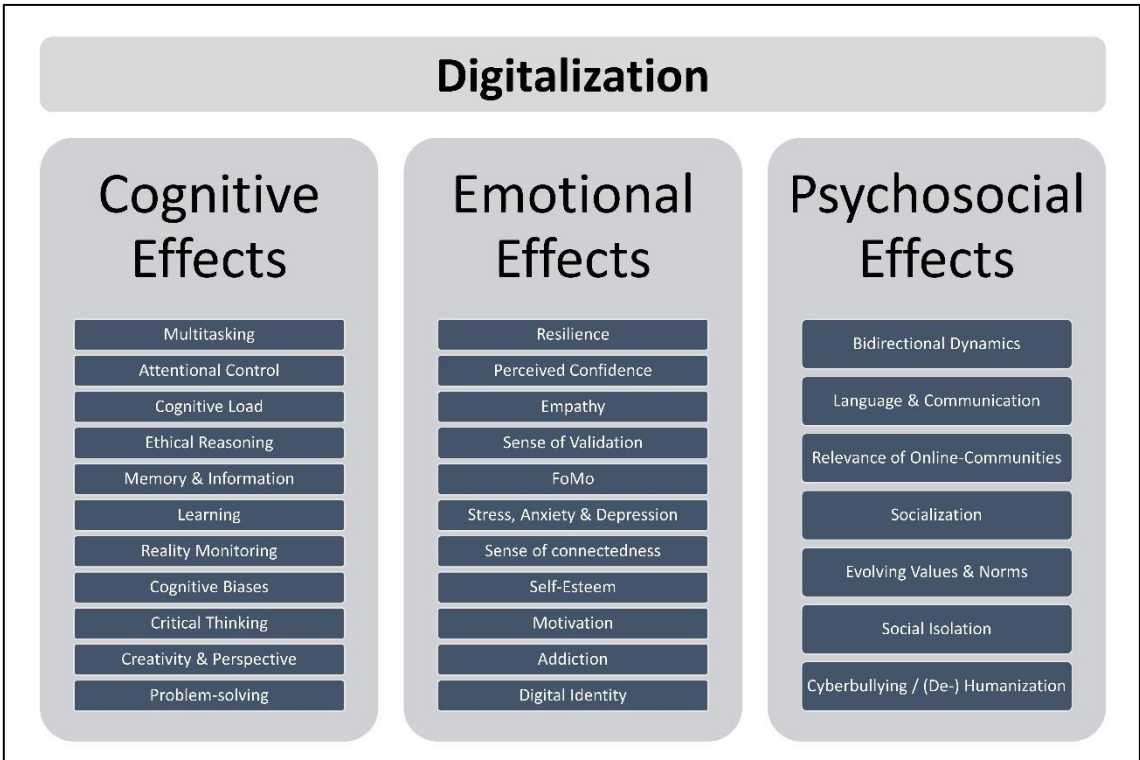


Figure 3. Evidential categories representing the dynamic effects of digital transformation on human psychology and social interactions.

Implications: The Future of Society, Organizations, and Work

Digital change is accelerating fast, especially with Industry 4.0 leading to increased automatization and interconnectedness, with Internet of Things (IoT) representing the self-governed machine-to-machine interactions, and Artificial Intelligence (AI) being the driver for more competent automated decisions as well as more natural human-machine integrations. There are three trend dimensions where digital processes appear to affect the evolution of our interactions, which are societal trends, organizational trends, as well as work trends. Although there is no crystal ball that allows crystal clear predictions about the future, the following discussion is an estimation of how digitalization will change these dimensions based on guesses generated by the AI, evidence from research in the literature that may provide a direction for the future, as well as the opinions provided by the interview experts.

Societal Trends

It is estimated that there will be a strong convergence between humans and technology. Today, there is already such a convergence at play, but it will likely become more prevalent. Current examples would be the pervasiveness of our smart phones that accompany us from the dinner table to the rest room, and from the bedroom to our offices. Many human-machine interactions presently occur via our hands by typing on a keyboard or touching a screen. As Large Language Models (LLMs) get better, voice commands likely become more prevalent. In the future, brain-computer interfaces may translate thoughts directly into computer commands. Some research at the moment already paves the way, for example with *Neurable*, which are headphones with electrodes that measure brain activity at the temporal lobes, or with *NextMind*, which is a sensor that can be strapped at the back of the head to analyze the brain waves at the occipital lobes. Both of these technologies use EEG brain waves to navigate the computer. More invasive tools like *Neuralink* will probably be mostly used in the medical context. At the moment, there is a massive improvement in the medical sector by converging human and artificial intelligence (Topol, 2019), and such a convergence of humans with technology can improve human capabilities (Roco & Bainbridge, 2002). There are speculations about neuro-technology tools that might eventually be able to read from and write to the brain like on a hard disk – although such ideas are highly contested and would also come along with many ethical problems (Dadia & Greenbaum, 2019). In any case, it is evident that in the future, humans will become even more dependent on technology. A *Pew Research* blog stated that AI will permeate all areas of life (Atske, 2018). The post was written even before the publication of powerful LLMs like GPT-3 and GPT-4, which makes its prediction even more plausible. Another article calls the increasing dependence on technology an “emerging trend in psychology” and holds that it could heighten symptoms like social phobia, social anxiety, and panic disorders (McCumber, 2020, para. 1). A discussion in *Forbes* holds that there will be five technologies that become embedded in our lives, which are AI, human-computer interfaces, extended reality tools, gene therapy, and 3D printing (Marr, 2022). Although AI bots will most likely become widespread as our assistants, they are already equipped to manage large datasets and to

make decisions automatically (Duan et al., 2019). Humans are thus predisposed to act as overseers of the decisions in the form of alignment quality managers (Aoki, 2021).

The possibility to stay constantly connected with others via the ubiquitous availability of the web may lead to the social demand of employers and customers to be responsive all of the time, which may have positive as well as negative effects on feeling connected to others (Ryan et al., 2017). One facet is visible today in that during the corona pandemic, screen time has skyrocketed and is likely to stay relatively high (Pandya & Lodha, 2021). However, having large sections of the society online also provoked a creator pull where, for example, education in the digital space became more prevalent. As a result, digitalization has increased access to education in many ways, for example by enabling both students as well as teachers to access resources online from anywhere in the world, and by making it easier to collaborate (Ahel & Lingenau, 2020). Digital tools, especially the ones powered by AI, hold the potential to bring us many new possibilities, like the streamlining of personalized healthcare (Paranjape et al., 2020). Some of the interviewed experts explained that social networks will certainly stay relevant in the future, however the AI developments will determine how we will deal with informational threats such as deep fakes. At the same time, almost all the participants mentioned that the metaverse may play an important role of social life in the future. A summary of the different societal trends is illustrated in Figure 4.

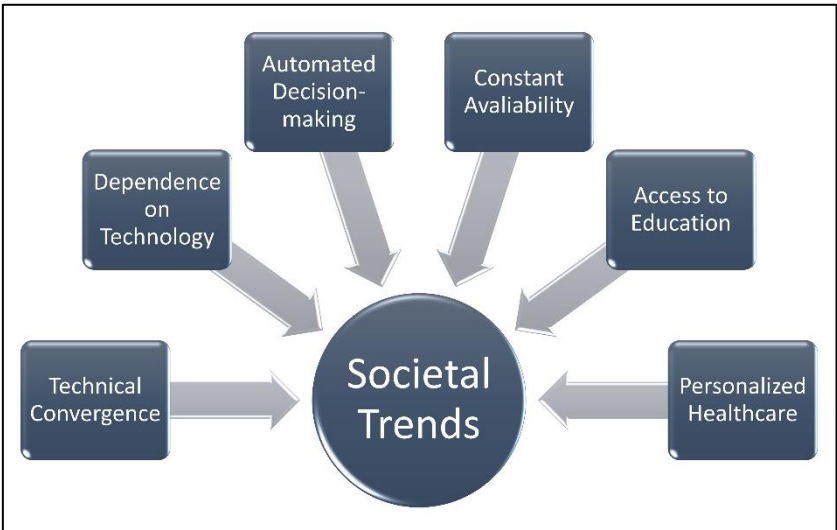


Figure 4. Future trends of digital transformation on society.

Organizational Trends

Robotics and process automation is considered a key driver of digital transformation in businesses (Siderska, 2020). Special features like intelligent sensors in smart factories allow for predictive maintenance (Pech et al., 2021), and predictive analytics can lead to better supply chain management since forecasting can now be done with AI based on big data and IoT that helps with decision-making (Aryal et al., 2018). Overall, modern ICT in organizations paves the way for more collaboration and closer connectedness, which also can make firms more inclusive for people with disabilities (Barlott et al., 2020).

Especially on the economic front, the digital sphere leads to wholly new digital business models that have their own peculiarities and follow their own logic (Wirtz, 2019). For example, the business of baking and selling bread is completely different from selling subscriptions for listening to music on Spotify. The more a bread is consumed, the less value it has (because there is less of it). However, the more a track is played online, the more valuable it becomes (more clicks mean that it is more interesting and will be featured on more playlists, which generates more revenues). As such, the role of data analytics is increasing. A big advantage that businesses can leverage is that there now is a lot of data available to cater to customers' needs (Bican & Brem, 2020). One of the most important features of newer business models is the centrality of personalization and customization. Digital products can be easily designed in a modular fashion, which means that they can be personalized by the customer so that it looks exactly as one desires. This can be done large-scale (referred to as mass-customization) with costs that are no greater than for one single product (Bican & Brem, 2020). A Spotify playlist, for example, can be personalized via AI algorithms to please the customer's taste and it does not matter if there is one playlist or if there are a million of them – the algorithm still works the same and hence the costs are low whereas the roll-out is plentiful. But as the services are taking place mostly on platforms, cyber security and risk management becomes much more important. The risk of bankruptcy after a hacking attack has increased drastically, which became the focal point of many news stories in recent years. With the growing implementation of IoT-systems, cyber security issues are now key for the sustaining existence of businesses (Salam, 2020). As such, technical and social safety and stability become top concerns and they will likely be so in the future. On a similar thread, privacy and transparency concerns appear to be growing concerns for customers (Bandara et al., 2020; Stuart et al., 2019).

The digital developments lead to new opportunities, which will likely manifest in novel innovations in terms of products and services. This usually bears the potential to spur entrepreneurship (Sedera et al., 2022). Gupta and colleagues (2020) refer to the “digital sustainability matrix” and are convinced that digital innovations increase the potential and the motivation to enhance sustainability in all its facets. As small start-ups and large incumbents become more digital, there emerges the need for a cultural change. Since digitalization accelerates the speed of change, the more classic forms of leadership have proven to be in need of revision, whereas the pull for agile leadership is tangible (Burchardt & Maisch, 2019). The same appears to be the case for cross-functional teams as the interdisciplinarity becomes a hallmark of digital organizations (Burchardt & Maisch, 2019). Perhaps the most notable hallmark of the digital organization in terms of business modelling and entrepreneurship is the customer centricity. Digital platforms allow firms to become a lot more personal and customized, which means that the individual customers can and must become the focus of the business model and the organization (Peter, 2017). With the rise of AI, this is bound to increase in relevance. These results are summarized in Figure 5.

According to one expert, organizations will need to initiate a transformative digital change that will never truly end:

When you start an ISO-certification, then the process will be finished once the standard threshold is met. This is very different with digital transformation. Once you

start, it will never end. Even when you are on a good track, the organization must keep going because one needs to keep improving and adapting. There will always be new needs as there come new technologies. Organizationally, the standards will change towards the ideal of constant development and improvement.

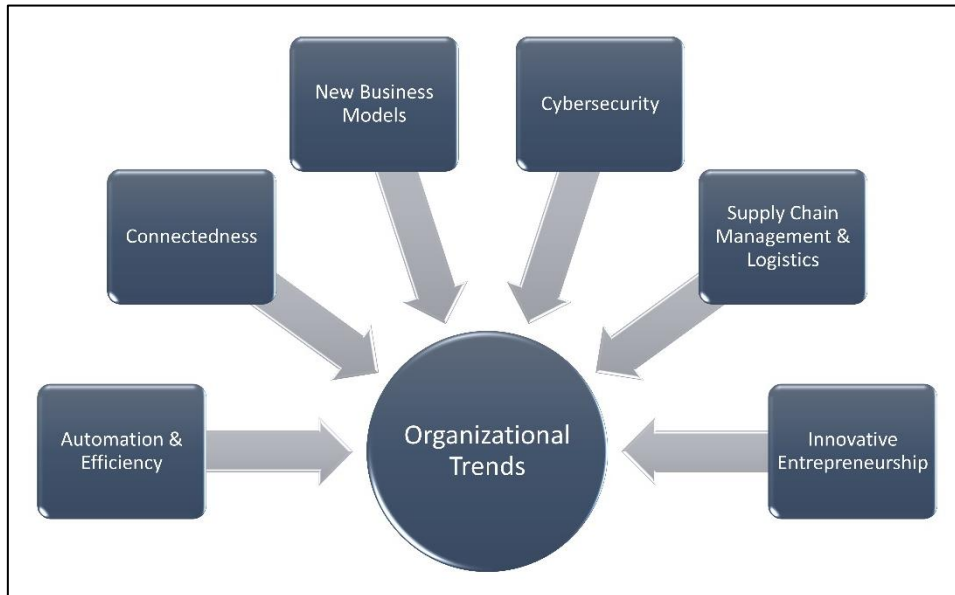


Figure 5. Future trends of digital transformation on organizations.

Work Trends

Although it is certainly interesting to see how organizations will change, since many of us spend hundreds to thousands of hours at our occupations, it is of paramount impact to both employees as well as employers how digitalization will affect our jobs. One feature that is visible already is that digital platforms lead to enhanced modes of collaboration. In line with this, a shift from product-oriented work to more service-oriented work will occur, which is generally referred to as *servitization* (Zhou & Song, 2021). With the shift to service-oriented business models and customization, the focus on user experience and user design inevitably increases. As such, products and work processes will revolve more around creating user-friendly experiences (Trischler & Westman Trischler, 2022).

Automatization enabled by AI will drastically augment productivity and efficiency, which means that employees might be spending their time less with repetitive work and more with tasks that have an added value to the machines (Benanav, 2020). The changes on the job models and the modes of work may be manifold as there will likely be different jobs than today. For example, a graphic designer might shift from doing manual graphic design to becoming a prompt engineer who needs to collaborate with an AI to construct an image. This may be done, at least in part, through natural language commands. The progress of Industry 4.0 and the implementation of IoT pushes the dominance of digital workspaces (Brahma et al., 2020). New machines and AI models come along with novel capabilities, provoking many people to fear for their jobs. Although there certainly will be a job

displacement, humans are very creative when it comes to what they want to do and so the jobs in general are likely to shift (Moradi & Levy, 2020), which – given the technical nature of the shift – leads to the need for further training and reskilling (Moradi & Levy, 2020). All of the interviewed experts seemed to agree that some of the jobs will make way for new ones if they cannot be remodeled and reskilled for the digital shift. One of the participants fathomed that perhaps there might be less jobs on the market than before, which might steer politicians in the way of favoring the idea of a universal basic income.

Remote work has been largely adopted during the corona pandemic, but due to its immersion will not likely go away (Cao et al., 2021; Hünefeld et al., 2021). It was shown that the digital tools and possibilities appear to increase our work flexibility. This might hold the potential to lead to higher work satisfaction because it can be tailored more strongly to the employee’s needs. There are, however, also downsides in the equation, like the risk that the constant availability may lead to more difficulties to “switch off” for work-life balance (Hünefeld et al., 2021). Although the gig economy is not a new phenomenon, chances are high that the flexibility and entrepreneurial spirit gained through digitalization will foster such gigs (Arora & Sharma, 2022). The work trends are summarized in Figure 6.

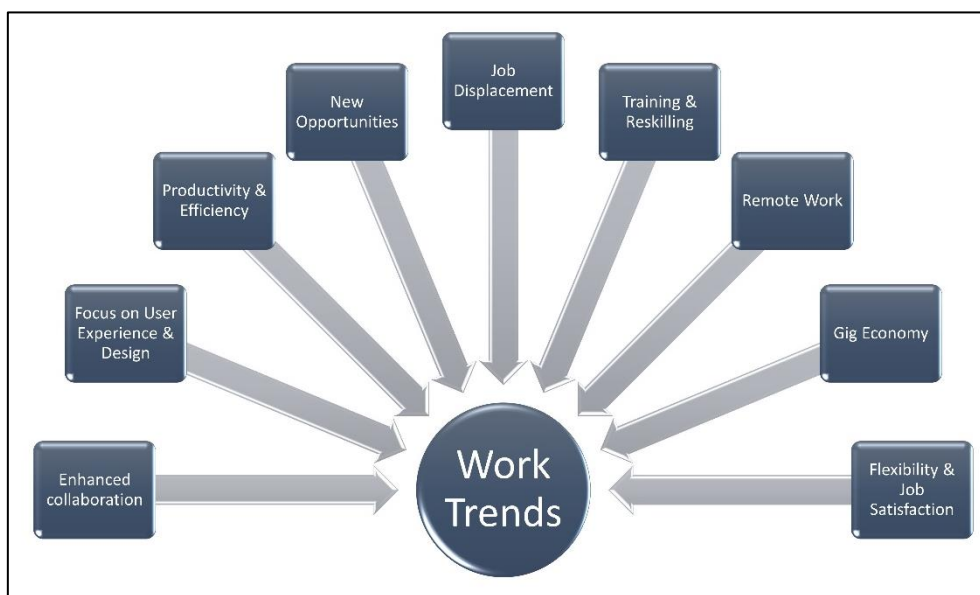


Figure 6. Future trends of digital transformation on work modalities and jobs.

Suggestions for Management, Organizations and Governing Bodies

The aforementioned impacts of digitalization on human psychology, society and business with their potential future trends allow for some practical recommendations. They are primarily viable and have been implemented in the business world and organizational management, but to a certain extent they are generalizable and can be projected onto other forms of governing bodies like political leadership. The recommendations are summarized in Figure 7, which take the form of a six-step-program: (i) start small, (ii) focus on practical (business) problems, (iii) foster a culture of experimentation and embrace collaboration, (iv) consider the impact on employees and other stakeholders, (v) address data quality, biases,

and ethical considerations, (vi) and stay up-to-date while prioritizing continual improvement. These steps are briefly outlined below.

Step 1: Start small

The digital world is changing so fast with many new developments occurring more rapidly than individuals might be able to stay on top of. Especially at the beginning of digital ventures or digital transformation processes, it may seem overwhelming. As such, the mantra “start small”, may come as a relaxant, which can help people to remain calm. There is no need to rush into digital projects, which might eventually produce a jungle of too many loose ends. Rather, leadership must keep the focus on what is primarily important for the organization and based on this, should formulate a clear digital strategy that provides direction for the whole enterprise. The digital strategy should be the basis on which a roadmap for implementation is deduced, so that the ideas are translated from the abstract realm of wishful ideas into the world of concrete milestones and projects. In the process, political and business leaders should embrace a digital mindset consisting of a “digital first” culture. This does not mean that everything that can be digitized should automatically become digital. Digital does not automatically mean better, since, for example, we as humans still need human contact and physical connectedness. However, the digital world provides new possibilities and opportunities, and it should be evaluated how this can be leveraged to provide additional value. Only the goals that add significant value when digitized should become a part of the digital strategy.

Step 2: Focus on concrete (business) problems

In line with the digital strategy, the focus should lie on practical problems. In the business world, these are clear business problems where a value proposition could be leveraged with higher returns due to digitalization efforts. For both politics and NPOs, these are problems that are faced by the citizens and the societal stakeholders (like marginalized people), this means that digital tools might be implemented to help exactly these groups. A key feature of this step is to have a customer-centric (or a citizen-centric) approach, meaning that at the end of the day, the digitalization efforts should be geared towards alleviating the problems of the focus group. For this, it is helpful to identify and prioritize use-cases so that the discussion and plans do not revolve around abstract and strategic ideas but primarily around concrete problem-solving. The process can be improved by leveraging data analytics. There is a wealth of data (Big Data) that can be used, and AI can be trained on such data, which eventually can help to improve or even automate decision-making.

Step 3: Foster a culture of experimentation and embrace collaboration

The digital landscape changes fast. Along the recent developments in AI have come about so rapidly that it appears like society has difficulty to keep up. This means that governments, organizations, and businesses do not fare well when sticking to concepts and management practices that might have worked 20 years ago. As such, employees should be motivated to experiment and try something new, if it aligns with the digital strategy and the provided roadmaps. Small-scale failures should not be rebuked but celebrated as the whole organization can learn from the mistakes with a “failing forward” mentality. In order to minimize the impact of failure and to make incremental progress, agile leadership

methodologies and iterative development approaches must be implemented. Together with the employment of creative capital, it can motivate a necessary culture for innovation, which in a rapidly changing environment is key to stay ahead. Organizations should leverage the emerging technologies such as data-driven decision-making, cloud computing, AI, and platforms. Especially when it comes to highly disruptive technologies like AI, people should be led to understand its potential and pitfalls through education, ethical guidelines, and implementation plans. Overall, digital platforms make it easier to collaborate, which should be viewed as an asset to promote teamwork since more people can be recruited to creatively and analytically contribute to a task.

Step 4: Consider the impact on employees and other stakeholders

Although leveraging technology sounds like a very technical endeavor, from a management perspective it is still first and foremost a human process. Technology can *enable* humans to do different things, to generate capital from novel business models, or to reach further people, but eventually it is a collection of tools for us to use. This may change some of our perceptions and behaviors, which is dependent upon the changing landscape due to digitalization. As such, it is of vital importance to keep the focus on the people, primarily the employees and subsequently also on the customers (or citizens) as well as other stakeholders. This means that one should never underestimate the psychological dimensions. For example, one should ask: “Do the digital tools help our employees with their work or are they causing techno-stress and depression?” Technology is only useful if it helps humans in their lives, otherwise it is counterproductive and at times even harmful.

Given the digital pressures in our time, it is important for leaders to both invest in digital talents (acquiring them) and in digital skills (training them) as this is bound to become a major resource in the future. With these skills in hand, it would be recommendable to build digital ecosystems where different players can become a part of our network. In the digital space, the ones who control the ecosystems and associated platforms hold the most definitory power on the social and market dynamics. To foster these directions, the top management and political executives have to develop a strong leadership team with the appropriate vision.

Step 5: Address data quality, biases, and ethical considerations

As AI becomes more prevalent, the data it is trained on, and the data used for general decision-making are key. High quality data are necessary for the best decisions and understanding the system architectures is important to critically evaluate the outputs. New possibilities also come along with new problems, which is why the ethical impact should be a constant concern of users. This should include the priority on ecological, social and economic sustainability. Since many digital processes occur online, they can become targets of hacking attacks and thus cybersecurity as well as data security must become a top concern of executives. Although it might be self-evident, laws and regulations are changing as society and technology adapt, hence organizations must address the dynamics of regulatory compliance.

Step 6: Stay up-to-date and focus on continuous improvement

A hallmark of digitalization is modernization and change, which means that the environment does not stay the same. As such, organizations (regardless of being political, social, or business-oriented in nature) have to constantly monitor the developments and adapt. There are many concepts that help with the idea of staying on top of constant change, like the Japanese philosophy of *Kaizen* that has been implemented in many firms to ensure constant improvement. At the same time, one's own impact needs to be monitored and tracked via Key Performance Indicators (KPIs).



Figure 7. A summary of the recommendations to management, organizations and governing bodies when dealing with the vast impacts of digital transformation on humans, society, and businesses.

Conclusion and Limitations

The triangulation approach

The present study was the first to introduce and test a triangulation of three methods that includes an LLM geared towards making sense of a given topic. The triangulation consisted

of AI ideation, literary refinement, and empirical enrichment. First, ideas were generated via AI and then, second, clarified and filtered through evidence from the body of literature. Third, empirical research (in this case, qualitative interviews) were used to make sense of the findings and to connect the dots. It seems like this approach works well in the context of psychology and social science, especially when dealing with complex and rapidly changing phenomena where it is difficult to get a clear picture of the many factors at play. The triangulation harnesses the novel capabilities of generative AI without falling into the trap of taking the output as authoritative since the outputs are compared carefully with the literature. At the same time, it can be connected to empirical research to create a holistic picture, which eventually helps to maximize the benefits from all three methods.

Psychological and social effects of digitalization

The effects of digital transformation on humans and society can be found on the level of human cognition, emotion, as well as social connections and constructs. The cognitive effects are seen in things like attentional control, cognitive overload, memory, and information retrieval, problem-solving, or reality monitoring. Influences on brain development were discussed. Emotional effects were found, for example, in perceived confidence and validation, empathy, Fear of missing out (FoMo), stress and anxiety, motivation, and the construction of a digital identity. Psychosocial effects were seen to be manifold, in things like language and communication, the relevance of online-communities, socialization, evolving norms and values, or in social isolation and connectedness. Future trends were discussed on the levels of society, organizations and work, which led to recommendations for organizations, management, and governing bodies (i.e. governments). The recommendations followed a six-step program consisting of starting small, the focus on clear (business) problems, a dynamic culture of experimentation, the consideration of people (employees and stakeholders), the focus on quality and ethics, as well as the need for improvement.

Limitations and future research

It is recommended to start future studies with AI ideation, which helps researchers to kickstart the strategizing process of the study design. With this, researchers cannot only save time, they can also make sure that they might not forget some relevant information and steps. However, it is important to never take AI as authoritative but only as an ideation tool in order to avoid falling prey to its weaknesses (like funneling, biases, hallucination).

The present study is one of the first to introduce this kind of triangulation approach with the systematic inclusion of AI to harness its potential. As such, future teams might add further recommendations on how such a triangulation would be useful and may even formulate more detailed protocols. The present demonstration should count as a first vision of how to implement the AI triangulatory idea.

The current digital transformation produces a rapidly changing landscape and any analysis about the dynamics can only be a snapshot in time. The assumed trends for the future can

be based upon the discussion using present-time data, but naturally never be fully accurate since only time will tell how things will unfold. Nevertheless, such a triangulation approach can help making sense of highly complex phenomena and try to pin them down. It may be used at several times to see how these dynamics change in time.

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