Artificial Intelligence in the business landscape – insights to interactive/network approach

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Abstract

Artificial Intelligence (AI) in its current rendition is poised to transform or even disrupt business interactions, relationships and networks. Recent developments associated with AI, including robotics and cognitive agents have not just automated industrial processes but can now change most business activities. AI is discussed in terms of development into types of intelligent agents – weak and strong – and their role in business relationships, interactions and networks. A set of research insights focused on defining and exploring AI within the IMP approach are discussed – and are urgent, or this may be not completed by human actors.

Keywords: artificial intelligence, AI, interactions, relationships, networks

ARTIFICIAL INTELLIGENCE: THINKING VERSUS IMITATION

"That every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstracts and concepts, solve kinds of problems now reserved for humans, and improve themselves."

(Original (1955) definition of *"Artificial Intelligence"* in "A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence" (McCarthy et al. 2006))

McCarthy et al's 1955 view of Artificial Intelligence (AI) was embedded with established debate and research in whether computers could "think" like humans. As early as 1842-43 Ada Augusta, Countess of Lovelace highlighted that Babbage's Analytical Engine, conceptually "has no pretensions whatever to originate anything. It can do whatever we know how to order it to perform. It can follow analysis; but it has no power of anticipating any analytical relations or truths." (Augusta, 1842) – thus indirectly defining Artificial Intelligence beyond the capabilities of computing machines.

Turing (1950), posited that the question "Can machines think?" was "too meaningless to deserve discussion". Turing instead focused on the potential for digital computers to replicate, not human thought processes themselves, but rather the external manifestations of those processes. This is the premise of Turing's "imitation game," where a computer attempts to convince a human interrogator that it is, in fact, human rather than machine. Both Lovelace and Turing set a standard for AI that was both conceptually and technologically impossible in the early years of digital computing development – which in its purest form is still true as we approach the third decade of the 21st century.

Nevertheless, McCarthy et al (2006) proposed a research stream to translate digital computing toward a form of artificial intelligence. In the following 40 years after McCarthy

et al set up the first named AI research project advances in digital technology saw computers take over many routine and structured processes and activities.

Since the mid-1990's, sustained rapid combinatorial technology advances around Computer processing power (Moore's Law), Data transmission and bandwidth (Gilder's Law), digital networks and nature of digital innovation (Varian's Law) are setting up a digital platform with emerging capabilities in key AI functions and tasks including speech recognition, image classification, autonomous vehicles and machine translation (machine learning). Baldwin (2019), highlights a notion that while today's version of AI as being sufficiently advanced to be viewed as "Almost Intelligence" – not at the "Holy Grail" definition of AI, but sufficient to substantially replace not just industrial/manufacturing work but also many information-driven service jobs. Thus, it is worth to consider if AI is now at a level of development to transform or disrupt business landscape. It is the time to explore and debate B2B research insights for AI in business interactions, relationships and networks.

The aim of the paper is to warm up discussion on AI within the IMP Group by specifying some areas where changes are going to occur in the context of IMP approach to the business landscape. Potential changes may be so significant that they will require modification of the research optics to the foundations of B2B research frameworks, including the IMP approach. Therefore, at the beginning we pay attention to the differences in AI, indicating the important differences between weak and strong AI. Then we consider business situations of interactions with different types of AI. Finally, we draw conclusions on research for IMP group.

AI, AUTOMATION, AND MORE

Recent developments associated with "artificial intelligence" are assumed to be largely continuation of automation technology i.e. using machines and computers to replace human work in terms of tasks and industrial processes. A more radical view is that "globotics" (a combination of robotics, related digital technologies and globalization – Baldwin, 2019) is already and over the ten years will disrupt services and most business activities and processes more disruptively than for industrial processes.

AI in its present and emerging forms will assume an inevitable and radical role in business interactions. Scope, adoption, diffusion and translation of AI into business networks is difficult to predict. Our ambition in this paper is not to consider all possible directions and fields of development of AI (which is probably impossible), but to start the discussion on the issue so far omitted, which is the impact of AI implementation on the business landscape.

In this paper we focus on Artificial Intelligence as a tangible technology that is designed to sense, comprehend, act and learn, not a scientific concept. We position AI as referring to machines or IT systems that are capable of performing tasks that, if performed by a human, would be said to require intelligence (Scherer, 2016). Such AI may refer to a robot, a program running on a single computer, a program run on networked computers, or any other set of components that hosts an AI. Thus, in this paper, by AI, we mean intelligent agents - systems that perceive and operate in a given environment (Russell, Dewey and Tegmark, 2015).

INTELLIGENT AGENTS AND HUMANS

Intelligent agents (IAs) can be viewed through a selection of perspectives of types of AI that could inform IMP research in this context including human-AI comparison, IA development and human interactions with IA.

HUMAN-AI COMPARISON

In the first approach AI is understood as intelligence demonstrated by machines in contrast to the natural intelligence displayed by humans. This approach implies comparison between both intelligences and shows three stages of IAs. The first one is discrete systems, which perform selected functions. The second stage of IA is integration of distributed functions, but also improvement of the human-IA interface and inclusion of economic and social computing dimensions, together with creative ways to interact and collaborate with humans (Capgemini 2018). Implementation of such agents to business-to-business interactions is already tested, with examples of IBM Watson, Amazon LEX, IPsoft Amelia. The last stage is work on super AI systems that outperform people's capabilities. IAs at this stage is still a concept; there is a lack of agreement in forecasting as to when a breakthrough can be expected that results in their development (Bostrom 2016). That approach raises crucial epistemological and ontological questions on the sense of AI versus human comparison. Do we, as human, aim at creation of subjective or objective human-like Artificial Intelligence? Thus, do we aim at replacement or extension of human abilities by IAs?

FUNCTIONS OF IAS

AI development approach is focused on functions that can be performed by agents. Today, the leading introductory textbook on AI, Russell and Norvig (2016) presents eight different functional definitions of AI organized into four categories: thinking humanly, acting humanly, thinking rationally, and acting rationally. Capgemini Research Institute (2018) divides functions of IAs into three main groups:

1. *technology foundations:*
   - functions includes technologies that enable data processing, learning on this data and using that data to conduct some tasks and achieve goals;
   - covers machine learning, deep learning, and neural networks and swarm intelligence;
2. *natural language processing:*
   - technologies that enable machines to communicate with human-by-human natural language including chat or voice bots (eg. Siri), human speech recognition, natural language generation and semantic technology;
   - technologies that also support communication with humans but in a different way than by natural language;
3. *measurement of human expressions:*
   - covers measurement of human expressions, psychical states, emotions or even intents;
   - biometrics.

Contemporary IAs perform selected functions in above-mentioned areas. Advanced, multifunctional and flexible agents combine data processing with one of two latter categories that provide interaction mode that is acceptable by human. Such IAs can apply to many areas within management, marketing and sales. Systems of AI can now act autonomously and work towards acquisition of new customers, replacing help desk employees and solving customers' problems in a direct manner (Bughin et al., 2017).

Development of IA should be approached also from the angle of the level of automation performed by an agent. According to Parasuraman and colleagues (2000) model of types and levels of automation IA can support human in four roles: (1) information acquisition, (2) information analysis, (3) decision and action selection, (4) action implementation. At the

lowest level of automation humans manually control IA, at the highest level fully automated IA overtakes all the roles from humans.

A similar perspective is represented in Endsley's (1987) work on human use of expert systems. Comparing functions that human and IA can allocate, we can identify five levels of human - IA automation: manual (human decides and acts, no IA assistance), decision support (human decides and acts under IA suggestions), consensual IA (IA decides and acts with the concurrence of human), monitored IA (IA decides and acts unless the human stops it), to full automation (IA decides and acts with no human intervention).

HUMAN INTERACTIONS WITH IAS

Another approach to IAs arises from research approaches to interactions between human and artificial entities (human-computer, human-machine, human-systems, human-robot interactions) that focused on that phenomenon for decades (Wiener, 1988). The Computers Are Social Actors paradigm (Nass, Fogg and Moon, 1996; Nass, Steuer and Tauber, 1994) is crucial for that research stream, because it leads to assumption that people can treat IAs as real human actors thanks to interactions with them.

Literature on sense making process between human and machine provides evidence on many features of IAs (e.g. personality, response mechanism, the degree of bi-directionality) that can influence human approach to them (Mou and Xu, 2017). First level IA does not deliver the capability of self-adaptation that results from comprehension of human verbal and non-verbal communications and ability to answer in a proper way, while second level IA has such capability (Fanelli et al. 2010; Yin and Zhang 2014). Advanced systems will not suffer from the lack of intelligence for recognizing emotional cues related to human psychophysiological states. It is still the limited common-sense reasoning that currently is the Achilles heel of the AI technology - the ability to make presumptions about the type and essence of ordinary situations they encounter every day. These assumptions include judgments about the physical properties, purpose, intentions and behavior of people and objects, as well as possible outcomes of their actions and interactions (Davis and Marcus, 2015). However, advanced IAs should incorporate to its behavior humans' preferences for objects, events, or actions as such behavioral adaptations occur naturally during social interactions (Shih et al., 2017, Richter, 2018).

The appearance of IA can influence interaction with humans too (Goudey and Bonnin 2016). The simplest form of IA is virtual, but it can be materialized in form of machines, computers, toys, animatronic figures, humanoid robots or human-like robots (in terms of look). The most advanced systems are capable of speech, facial recognition, voice recognition, learning, mobility and have a body that allows for physical interaction with the environment (Belk 2016; Hortensius and Cross, 2018).

WEAK AND STRONG INTELLIGENT AGENTS

Three approaches presented above to differentiate IAs do not exploit all possibilities but suggest many variations of agents that should be considered. In this paper we refer to Searle's suggestion to distinguish weak and strong artificial intelligence, although we are aware that this concept is disputable and awaits better explanation. Weak IA performs selected functions, is pre-programmed, with low or moderate automation and is not able to incorporate to its behavior any effects of interactions with humans. Strong IA displays (or will display in a near future) social and emotional behavior when interacting with humans, are able to work autonomously, reasoning on their knowledge to make decisions, eventually instantiating those decisions into physical actions, are based on multiply functions. Advancements in development of such agents lead to define a new type of intelligent agents – cognitive agents.

They use perception, reasoning with and judgment of information or knowledge, have the ability to learn new knowledge from information and employ cognitive technology to interact with people on multiple related topics and react to the emotional content of a conversation (Lawniczak and Di Stefano 2010; Ibrahim, 2019).

Nevertheless, regardless of the complexity of IAs, they will increasingly interact in business landscapes. Thus we need to understand such agents, as well as human expectation, interpretation and reactions to it.

INTRODUCING IAS TO IMP BUSINESS LANDSCAPE

The possibilities of using IA to supplement tasks performed by people and to perform tasks assigned primarily to IA are large. Along with the growing interactive ability of IAs, one can assume that its implementation on a broad scale in business will significantly influence the nature and scope of cooperation between companies and will shape interdependencies. IAs should be reflected in the IMP research approach on three levels:

- *Interactive:* deals with actions and reactions between individual actors
- *Relational:* deals with bonds between organizations
- *Network*: refers to connections between numbers of interconnected organizations.

The role and place of IAs in business relations appears as a complex and multidimensional phenomenon that can be interpreted and understood differently. We assume that situations in which solely IAs create organizations are currently out of the reach of researchers (but also the possibility of human cognitive capability). Therefore, we exclude situations in which the inter-organizational relationships function between two IAs excluding people. We consider IAs in the business landscape by accepting the occurrence of human beings as a sine qua non condition. Therefore, we propose that the consequences of the introduction of IAs to be considered at the level of interaction, relationships and networks of actors with weak and strong IAs.

IAs in Business interactions

The basic concept describing the business-to-business sphere is the interaction that takes place between actors as an exchange mechanism, but also affects the entities involved in it. (Hakansson and Snehota, 2017). Based on Ford and colleagues (2010) definition business interaction is the process through which material, financial and human aspects of business and elements of business like actors, activities and resources are formed and transformed.

In the simplest terms, the introduction of IA to business interactions may involve using IA as a tool to support the work of interacting people. Such solutions are already used in customer analysis and relationships (e.g. Gordini and Veglio 2017), sales (Syam and Sharma 2018) and supply chains (Vendrell-Herrero et al. 2017). IA can support the communication of actors representing organizations or even replace them. This is the case when using the Virtual Assistant, specialized intelligent agents that integrate interactivity based on natural language processing with scheduling meetings for their users. The Virtual Assistant performs in normal business setting, using standard e-mail correspondence, they can handle multi-user situations, keep track of different time zones, follow up unanswered invitations and take in to the account user's personal preferences.

The use of IA by one of the actors in the exchange processes as part of business interactions can lead to a change in the way it is implemented. Weak agents will allow access to information derived from analysis of previously unavailable or difficult to access data about the market or the customer. Even weak IA can support decisions on the basis on a intelligent

algorithm (while the human judgment includes empathy and ethical reflection) what can affect the decision making process, because they will be able to prompt behaviors and actions tailored to the expectations of the other party. In this way, IAs can have a significant impact on interdependencies and interconnectedness.

On the other hand, strong AI can act like an actor in a business interaction leading autonomously exchange of goods, financial assets and information. Such a situation may lead to a change in the dimensions of exchange, because if the economic exchange changes (in the sense of time and space), then social exchange can be eliminated.

IAs IS BUSINESS RELATIONSHIPS

Interactions between business actors might lead to establishing a business-to-business relationship understood as a process, in which two companies or other types of organizations create strong and extensive social, economic, service and technical connections with the intention of lowering total costs and / or increasing value, thereby gaining mutual benefits (Anderson and Narus, 1990). For the occurrence of a relationship, it is necessary to establish mutual commitment, which can take the following forms: operational, information, social and investment (Dyer, 1997). The central idea is that establishing a relationship creates ties and interdependencies between the parties.

We assume that IA may take over the implementation of certain processes in the company related to the exchange with the environment. Cooperating in processes, which are the substance of a relationship, IA can develop workflows and relationships that combine resources and activities (Wilkinson, 2008). Such solutions can be expected, for instance, on ERP systems (although for now this concept in relation to ERP is in the state of infancy, however, they are expected to be developed soon). We can also find it in CRM systems, where machine learning based on big data from large amounts of micro companies collects activities directed to customers. Similarly, small customers increasingly interact with large players through Call Centers based on Interactive Voice Response intelligent agents.

In the case of weak IAs, relational processes can change, as IAs will automate many complex tasks. The consequence could be a change in the course of exchange, adaptation, routing and cooperation processes - they will accelerate, and the level of errors will also decrease. In contrast, strong IA will be able to read human emotions to optimize its decisions regarding processes. Therefore the emotional setting in which relationships develop will change. Managers use their knowledge of organizational history and culture, as well as empathy and ethical reflection. This is the essence of human judgment. IA decisions will be able to be separated from affective factors but simultaneously actors that are engaged in relationships with IAs will have to learn how to act with fully rational counterpart.

BUSINESS NETWORKS

Just as no entity operates in a vacuum, similarly no pair of entities is detached from the network of connections with other actors. This makes every enterprise dependent on others on the network with which it is directly and indirectly connected. This dependency creates uncertainty, including the organization's ability to acquire reliable and adequate resources to achieve its goals, such as maintaining its competitive position. Managing this uncertainty without losing organizational autonomy is a major problem for individual units in the network. Defining the network image and defining its role and position in it, networking influencing the position and role in the network, accomplish this and determining benefits derived from the current and assumed position and network role (Hakansson et al., 2009).

On the network level AI should be considered as a system that connects multiple technologies and machines, processes, agents and people. AI creates an environment for

interaction and relationships in this situation. With this situation we are already dealing on many social media platforms, where deep learning of weak IAs is used to suggest content and target messages. Individual participants of this network have no influence on the operation of such an algorithm; they must accept it as an environment in which they participate in the business network. As we move into the third decade of the 21st century, we assume that business networks are still dominated by human actors relating and interacting with strong IAs – but in future human and IAs will blur into mixed digital/human networks. By 2030, it may be possible to see globotic-dominated business networks (Baldwin, 2019) – although adoption and diffusion is likely to be ubiquitous similar to smartphones where applications, connections and outcomes were realized years after they started to dominate their contexts. Moreover it can be assumed that strong IA already has (or will soon have) the ability to manage and optimize business networks and to indicate which actors should interact with and establish common relationships (Harrari, 2016).

CONCLUSIONS

The AI adaptation in business landscape promises to transform not only the nature of work, but also the relationship among human beings and machines in organizations. We believe that intelligent agents will significantly modify how business relationships and networks will perform. Therefore it emerges as an issue requiring research attention and reflection of IMP community. The proposed work should enable the inclusion of IA in the IMP interaction model at the level of interaction, relationship and network, which we treat as a starting point for work to understand the consequences of IA's participation in business landscape. We suggest some research directions here, being aware of many other possibilities.

First, the observation of many areas of work on the development of AI leads to the conclusion that there is no one definition of IA. The division for weak and strong IA, even if too simplified, realizes great diversity of the world of IAs. Thus, for the analysis of the interactions, relationships and business networks in which IA appears, it is necessary to determine in advance how the analyzed solution will be understood (as a tool, an actor, a system or an environment). The differentiated functions and forms of IA also require determining whether IA is approached by researchers in accordance with features perceived and interpreted by those, who interact with IA or in accordance with objective (technical) features of IA. We assume that occurrence of IA could be considered in the following layouts of the business landscape:

- from the perspective of dyadic interactions:
    - as a tool (resource) supporting business interactions or/and
    - as an actor interacting with another actor (the level of interactions)
- from the perspective of network perspective of
    - as the subsystem of the enterprises linked to each other and shaping processes that create business relationships and or/and
    - as the environment in which business networks operate.

Each of these situations can shape business interactions, relationships and networks between actors, and the scale of this impact will depend on whether we are dealing with a weak or strong intelligent agents.

Second, there is a need to conceptualize IA in interactions – is it a tool or an actor. According to the Computer as Social Actors paradigm, will IA be treated as a participant of an interaction who can interact independently, more - can it be interpreted as a representative of an organization on a par with a human actor? Autonomy of IA seems to be crucial aspect here

as the level of control of IA by human can differ. It can define the identity of such entity in the eyes of others.
Second issue is to consider if implementation of AI leads to new form of interactions and relationships or network existence. As organizations are entering a landscape characterized by unprecedented interactions among managers and IA (Kolbjørnsrud, Amico and Thomas, 2017), the consequence of such interactions will be the development of specific relationships that we define as "technologically saturated". Relationships with IA might be less sensitive to affective and cognitive aspects. Will trust to IA have the same meaning as it has when referred to human actors or organizations built up by humans? Is human actor capable to involve into relationships with IA especially when IA decision-making process is unable to be understood? It is possible that measures previously used to determine the quality of relationships will not be able to capture the benefits and determinants of heavily AI-and-automation-based relationships. Is AI likely to have a negative impact – does it distance the parties from each other?

Thirdly, the introduction of IAs into interaction and business relations will have its consequences for understanding the interdependence of partners. As organizations can use AI functions to learn, model, and predict human and market behavior it can be the source of strength and thus the dominance of one actor in relation to others (in the network or relationship). At the same time, the question arises about the goals of strong IAs: will the once pre-programmed action change with the learning processes? In this situation, the issue of IA control by the entity remains crucial. In whose name will the IA work (its own, both sides of the relationship or the owner)?

Finally implementation of IA as the environment for business activities raises some questions about single actor ability to define or modify its position and role in business network. If IA will tend to optimize the structure of a network then only the decision to accept or not the proposed position and role, might be left to actors. It is not the science-fiction deliberation, it is what Uber algorithm already performs to match drivers and passengers.

Who – or what – is the real actor or agent here?

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