From social computing to digital transformation: the advent of the social machine

Da computação social à transformação digital: o advento da máquina social

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ABSTRACT
The internet and its innovations have made new paradigms appear, enabling the growth of systems, processes, methods, organizational and social mindsets, resulting in social and digital transformations. One of the paradigms is the emergence of Social Machines that integrate computational and social elements into the software, making the complexity of operations and services guided by thought and society be adapted to practice, causing problem-solving. The way software is developed, deployed, and used has changed over time, making software generations raise the level of relationship and previously unknown connectivity. This study aims to present the consequences of the transformations that occurred related to the revolutionary eras, whose question is to understand the digital relationships shown between man and machine, since the existence of social computing and digital transformation, where this relationship favors economic means. This research described concepts such as information systems, the Web, social computing, social machines, digital transformation, and entrepreneurship. The methodology used in this research was based on Design Science Research (DSR) which used a theoretical-conceptual methodological approach based on literature review, observing the evolution of relationships between man, machine, innovation, and business. The digital transformation process has to do with behavioral changes caused by the innovation of Information and Communication Technologies (ICTs) and business strategy. The advent of the Social Machine caused a process of paradigm revolution, culminating in both the digital transformation and the phygital transformation and the new way of the undertaking, even during the pandemic period, digital innovation was allied to the entrepreneur with the change of habits imposed by the restrictions created by Covid-19.

Keywords: social computing, social machines, digital transformation, phygital transformation, entrepreneurship.

RESUMO
A internet e suas inovações fizeram com que aparecessem novos paradigmas, possibilitando o crescimento de sistemas, processos, métodos, mentalidades organizacionais e sociais, acarretando em transformações sociais e digitais. Um dos paradigmas é o aparecimento de Máquinas Sociais que integram no software elementos computacionais e sociais, fazendo com que a complexidade de operações e serviços guiados pelo pensamento e sociedade pudessem ser adaptados à prática, ocasionando resolução de problemas. A maneira de como o software é desenvolvido, implantado e utilizado mudaram no decorrer dos tempos, fazendo com que as gerações de software elevassem o nível de relacionamento e conectividade que antes era desconhecido. O objetivo deste estudo é apresentar as consequências das transformações ocorridas relacionadas as eras revolucionárias, cuja a questão é entender as relações digitais presentes entre homem e máquina, desde a existência da computação social e a transformação digital, onde essa relação favorece os meios econômicos. Nesta pesquisa, conceitos como sistemas de informação, Web, computação social, máquinas sociais, transformação digital e o empreendedorismo foram descritos. A metodologia utilizada nesta pesquisa foi baseada na Design Science Research (DSR) que se utilizou uma abordagem metodológica teórico-conceitual fundamentada na revisão da literatura, observando a evolução de relações entre homem, máquina, inovação e negócios. O processo de transformação digital tem haver com mudanças comportamentais provocadas pela inovação das Tecnologias de Informação e Comunicação (TICs) e estratégia de negócio. O advento da Máquina Social ocasionou um processo de revolução de paradigmas, culminando tanto à transformação digital quanto à transformação Figital e a nova forma de empreender, inclusive durante o período pandêmico a inovação digital foi aliada do empreendedor com a mudança de hábitos impostos pelas restrições criadas pela Covid-19.

Palavras-chave: computação social, máquinas sociais, transformação digital, transformação figital, empreendedorismo.

1 INTRODUCTION

The internet has enabled the emergence of many technologies that support collaboration between humans and software. Such technologies allow the applications developed to demonstrate the power and potential that the Web has in facilitating the grouping of information and the integration between software. The internet has enabled the growth of systems that use computing concepts and are also guided by social processes. Consequently, new applications are rapidly emerging, and new computational models and paradigms are needed to deal with them. Thus, the effort to create technologies for the use of information distributed through social group interactions is social computing.

The implications of a Web that "connects intelligence" in terms of trust and governance are profound, especially within a set formed by the networked social community, as technologies mature so that organizational systems, processes, and mindsets must necessarily evolve with them. Thus, regardless of the pace at which technologies are changing, the human use of these technologies will determine the monitoring of changes in the structure of society and organizations. In these circumstances, there is the process of social and digital transformation. Social transformation represents the change in society, and its way of organization, and digital

transformation represents a change in mentality, whether people or companies keep up with technological advances.

As these media began to converge, new ways of developing software emerged, new forms of interaction, new communication mechanisms, new possibilities for collaborative content, further propagation of information in real-time.

With technological advances and the emergence of new means of communication, a way to describe information systems (IS) based on the Web was found, known as Social Machines (SMs). Social Machines are a paradigm for dealing with problems relevant to society, integrating computational and social processes into software, collaborating with the process of visualization, participation, and problem-solving. In them, work began on a practical way of dealing with the complexity of operations and services around us, based on changes in society's thinking and adaptation. The understanding of interpretation in which we use the term "Social Machine" is captured by Berners-Lee and Fischetti in their book Weaving the Web, which says:

> "Real life is and must be full of all kinds of social constraints - the very processes out of which society arises. Computers can help if we use them to create abstract Social Machines on the Web: processes in which people do creative work and the machine manages" (Berners-Lee & Fischetti, 2000).

Social Machine does not necessarily refer to social applications or social networks. In this context, the expression has a much broader meaning. A Social Machine, or Social Software, means that the software was conceived and built from the ground up to meet three goals:

• Publish its features relevant to your environment;

• Easily allow the formation of other social applications;

• Present science about its relationships (Relationship-aware) with other software, modifying its behavior when necessary.

The traditional concept of software has been changing in recent decades. Since the emergence of the first definition of a machine in the field of informatics described by Turing (1936), the software became part of people's lives, becoming popular with the inclusion of personal computers, the advancement of the internet, smartphones, and the internet of stuff. It can be said that software and the internet have changed the way we communicate, how business is done, and, later, how software is developed, deployed, and used.

Within these scenarios, the next generations of software will do more than connect people who unconsciously orchestrate processes and help us reach a level of relationship and connectivity that we previously thought was impossible.

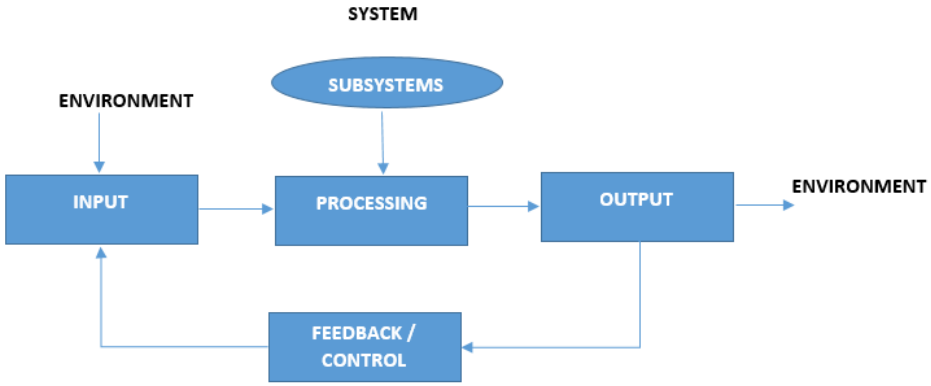
2 CONCEPTS AND APPLICATIONS

This section will describe concepts and applications of information systems, the Web, social computing, social machines, digital transformation, and entrepreneurship.

2.1 INFORMATION SYSTEMS

For Sommerville (2011), a System is a significant collection of interrelated components to achieve some goals. It is organized to perform a specific method, procedure, or control when processing information. However, the generic system concept presented in Figure 1 provides a more appropriate framework for describing these systems.

Figure 1. Generic representation of a System.



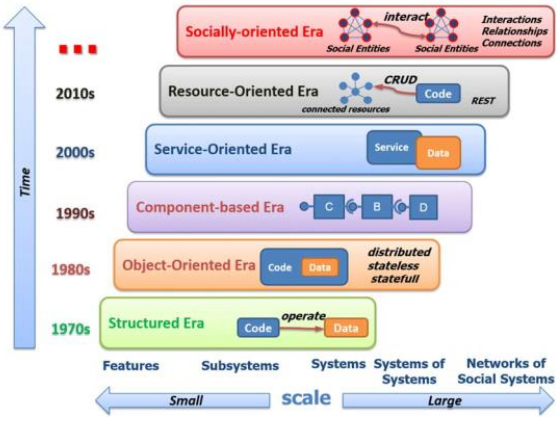
Source: authors

The input stage involves capturing and gathering elements that enter the system to be processed. The processing step involves transformation processes (subsystems) that convert input into the product. The output stage transfers elements produced by a transformation process to their final destination. Finished products, human services, and management information must be conveyed to your users. The Feedback/Control stage is data about the performance of a system; it involves monitoring and evaluating feedback to determine whether a plan is moving toward the achievement of its goal. Then, the control function makes the necessary adjustments to the input and processing components to ensure that adequate production is achieved (O'brien & Marakas, 2010).

Over the years, several areas have transformed, and it would be no different in the technological sphere of corporations. We had several eras in technology projects (structured, object-oriented, component-based, service-oriented, resource-oriented, social-oriented), represented in Figure 2. In it, the level of scale began to increase in resources. , reaching the subsystems, then systems, systems of systems (supersystems) and network of social systems where interactions, connections, and relationships began to be crucial, whether in technological systems (information

systems) themselves, as shown in Figure 3, as for the organizations themselves that use these means of computing, communication, and control in their structures, processes, and behaviors according to Figure 4.

Figure 2. Evolution of the software paradigm

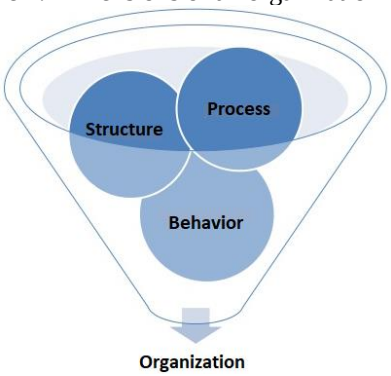


Source: Burégio (2014)

Figure 3. Dimensions of an IS

Source: Laudon & Laudon (2018)

Figure 4. Dimensions of an organization



Source: Gouveia (2011)

To have a complete understanding of information systems, it is necessary to understand their dimensions, which are: organization, management, and technology, according to Figure 3, since an information system creates value for the company, and organizational solution and direction to the challenges posed by the environment (Laudon & Laudon, 2018).

An organization coordinates work through its hierarchy and business processes. People, structures, business processes, politics, and culture are critical elements. The role of management is to make sense of the many situations faced by organizations, make decisions and formulate action plans to solve problems. On the other hand, technology is one of the tools that managers use to deal with change, whether these tools, platforms (hardware, software) are used by companies (Laudon & Laudon, 2018).

As shown in Figure 4, the dimensions of an organization are structure, processes, and

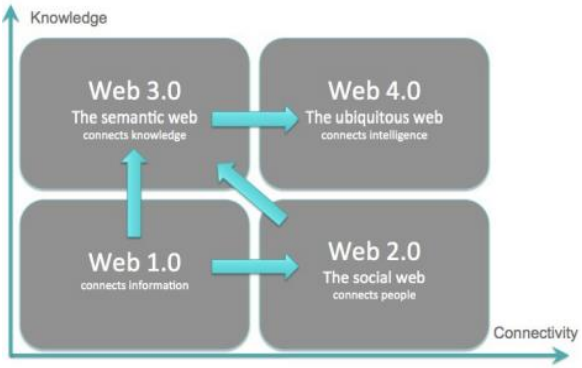
behavior. The structure refers to the relationships, the processes refer to the activities, and the behavior portrays the commitment (Gouveia, 2011).

2.2 THE WEB

The internet is a programmable, open platform whose applications and services are increasingly transforming industry and society (Meira et al., 2011). This service platform concept has increasingly transformed industry and society. Today the Web is an open and decentralized programmable platform, which has consequences for how the software will be developed. Although the way of developing software has changed as a result of the influence of the Web, where in the world social networks have reached more and more strength, in which computing means connecting something (Roush, 2005).

According to Davis (2009) and Intersticia[1] (2012), they described the evolution of the internet through the following phases, illustrated in Figure 5.

Figure 5. Evolution of the Internet, adapted from Davis (2009)



Source: Intersticia, 2012

For Intersticia (2012), the history of the Web evolution is:

• Web 1.0 aggregates information and is the first stage in interacting with the internet; introduced the formation of electronic pages navigable hyperlinks through a language known as HTML (Hypertext Markup Language).

• Web 2.0 brings people together and initiates socio-digital cooperation, that is, as new technologies developed, individuals were able to create, edit and share content.

• Web 3.0, called the Semantic Web, represents several meanings, starting with the aggregation of knowledge and carries together with the aggregated technologies such as the

[1] Intersticia was formed in 1996, initially as an agricultural company that operated a cotton and cattle estate in northern New South Wales. Over the next ten years, it grew into a consulting firm that: organized conferences for government agencies; consulted in new media in the Web 1.0 phase; managed associations; provided policy and policy advice to state and federal governments Government; participated in Government Councils and Advisory Committees, and created leadership programs. Now it's bringing it all together to meet the needs of people, groups, and teams within organizations as they face the challenges of the information society http://intersticia.com.au/wp-content/uploads/2014/12/SocialMachine.pdf.

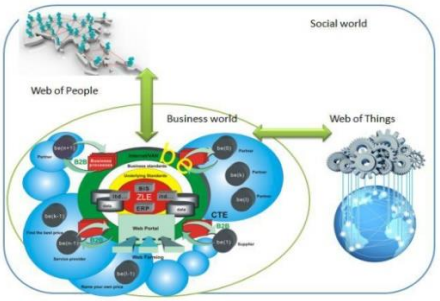
emerging intelligence of the machine, that is, it is the junction of the "intelligence" of artificial systems with the ubiquity of complete information in the service of helping individuals, facilitating the creation of new information, corresponding to difficulty in dealing with the inevitable "information overload."

• Web 4.0 brings together all the concepts of computing to become truly omnipresent in the daily lives of people and organizations, that is, to be present at the same time everywhere. This is what ubiquity represents, or rather, it is a fact of being or existing at the same time in all places, whether people or things[2]. As shown in Figure 6, a suitable software architecture for the Web that integrates people with artificial intelligence and the internet of things is needed, especially scalability, security, and interoperability.

Figure 6. Web of people, AI, and things

Source: Brito et al (2020)

Figure 7. B2B environment in the social age.



Source: Kajan (2017)

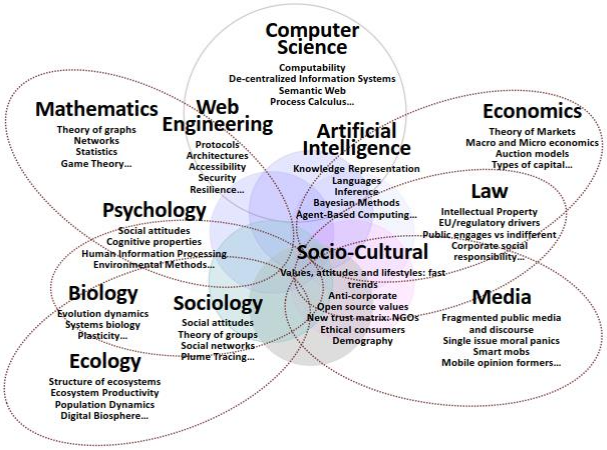
Figure 7 presents the view that in the social world, the integration of the Web with people, artificial intelligence, linked in the business world, and things are appropriately supported by software architectures and technologies, which can integrate them in an efficient, interoperable, scalable and secure.

Current research starts to detail Web 4.0 and is already beginning to mention Web 5.0. The first employs the strengthening of digital marketing and a more consumer-oriented internet. The use of artificial intelligence stands out, with algorithms capable of learning that track any step taken by the user on the internet. The second is considered a dynamic network because the idea is to bring feeling to our interactions with the network. In this way, the Web will be able to calculate emotions and "advise" due its artificial intelligence be called symbiosis, that is, the machine and the human being will have a relationship focused on an individual experience.

The authors Shadbolt et al. (2010) expose the scope and dimension of Web Science as being multidisciplinary and covering a series of interrelated fields, as shown in Figure 8.

[2]Things are everything that exists or can have existence in a real or abstract way. Available in: https://www.dicio.com.br/coisa/.

Figure 8. The Web-Science Components.



Source: Shadbolt et al. (2010) by Intersticia (2012).

The reality is that all these components or sciences are being used through web technologies to reach, handle, analyze, distribute and disseminate information and are increasingly interlinked to produce results.

2.3 SOCIAL COMPUTING

Social computing represents the combination of human social behavior and computation, developing computational methods and studying new types of social data to promote theoretical and empirical understanding of human social behavior (Weber et al., 2016).

The Web, due to its nature of communication, is particularly conducive to these types of systems known as socio-computational systems or Social Machines, which mean that everyday social interactions are increasingly mediated and modeled by algorithms and computational methods, bringing knowledge about human social behavior, as an example: friendship suggestions on social networks, product or service recommendations via E-commerce, content filtering through search engines (Weber et al., 2016). In this way, this makes socio-computational systems a new class of software systems in which functions are dynamically influenced by the social behavior of a large number of users (Weber et al., 2016).

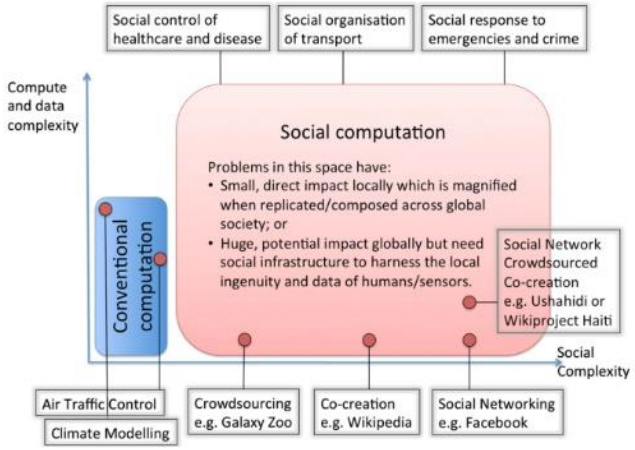
This computational capacity embedded in information sharing activities on the Web is called sociotechnical computing, which reflects explicitly conditional actions and the inherent potential that resides in information on the Web (Luczak-Roesch et al., 2015). These phenomena of information sharing activities are generally characterized by a socio-technical interaction that determines how applications and services on the Web are orchestrated for a specific purpose and how information is diffused.

For Rovatsos (2014), social computing is the large-scale collaboration of machines mediated

using digital interaction as a vision for future intelligent systems and a new challenge for multi-agent systems research. It means that massive advances in network connectivity and increased accessibility of computer hardware have recently led to a flood of web-based applications that mediate collective interaction between humans (Shadbolt et al., 2013). This, in turn, implies a growing interest in applications that embody a multi-perspective notion of hybrid human-machine intelligence, in which human capabilities and computational artifacts complement each other (Rovatsos, 2014).

Terms such as collective intelligence, collaboration (crowdsourcing), the wisdom of crowds (wisdom of crowds), and human computing are a set of human aspects used in social computing (Shadbolt et al., 2013). These social interactions, such as the World Wide Web, social networks, and smartphones (applications) arising from social computing, constituted socio-computational systems and generated socio-technical computing. These are Social Machines, as shown in Figure 9 below.

Figure 9. Dimensions of social computing.



Source: Shadbolt et al. (2019).

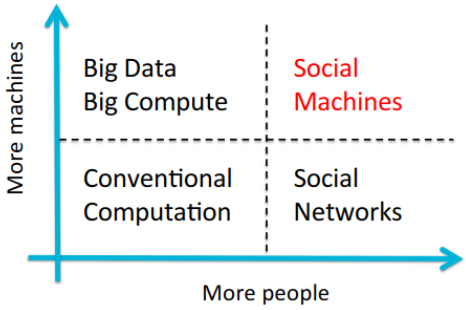
In this Figure 9, are presents dimensions of social computing along which growth occurred to make Social Machines possible. First, the complexity of conventional computing (both in terms of software and hardware) and the change in the amount of data represented along the vertical axis. Due to this increase, complex security and critical data issues can now be solved, from air traffic control to weather pattern modeling. Deep learning is becoming increasingly influential in real-time, and data-driven artificial intelligence is now a standard research tool (Shadbolt et al., 2019). Along the horizontal axis, we trace increases in social complexity as technology allows dispersed communities to form and cooperate to solve problems, as in labor-intensive scientific research, co-creation of content, as in Wikipedia, or social networks (Shadbolt et al., 2019).

2.4 SOCIAL MACHINES

The Social Machine emerged as a research area with potential for scientific investigation with different approaches (Lemos de Souza, 2020). This fact led to the need to review concepts, technologies, and standards that allow us to characterize and implement the theme (Lemos de Souza, 2020) because, in light of the research carried out, the social machine is an emerging paradigm that needs to be known even more (Lemos de Souza & Meira, 2021).

The "Machines" were programmed by programmers and operated by users. With this growing change of the Web and the numerous participation of machines and people, this limit was transformed into Social Machines. Following Figure 10, users and machines configure from the moment they interact with the content and each other.

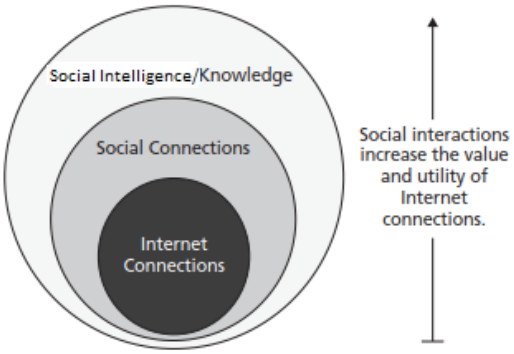
Figure 10. Crowdsourcing trajectory



Source: De Roure e Willcox (2015)

According to Hendler and Berners-Lee (2009), the Web was initially designed as an "information space" for both human and machine-to-machine communications, in nature, a Social Machine, which can be considered an extension of the Semantic Web, creating the process through which people perform creative tasks and machines perform data administration. The Semantic Web extends Berners-Lee's vision to the next stage, in which a "network intelligence" provides machines with the ability to understand and make sense of data and information, according to the scenario represented in Figure 11, about interaction social.

Figure 11. Social context transforms information into knowledge



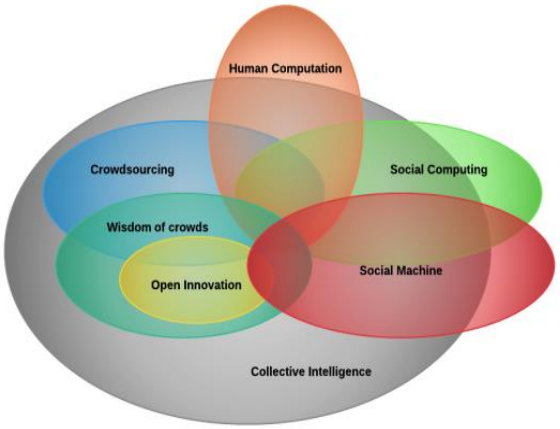
Source: Semmelhack (2013)

This vision is of an ecosystem not of humans and computers but Social Machines in constant evolution (Intersticia, 2012). Thus, regardless of the progress of technological development, it is the use of people through these technologies that will determine the follow-up of societal and organizational changes (Hendler & Berners-Lee, 2009).

As Social Machines become more refined, the elements will become dynamic and adaptable. The developers themselves will be able to directly instantiate and modify the computational coordination capabilities, if necessary, as Hendler and Berners-Lee (2009) put it, letting the "machine does the administration." This significant transition in thinking recognizes the reality of current sociotechnical systems.

Figure 12 describes the construction of Social Machines through classification in contribution, participation, and motivation. In this context, the number of terms refers to the way people interact with each other and with applications: human computing, social computing, Social Machine, collective intelligence, open innovation, collaboration, group of intellectuals, these terms are related, but they are not synonymous with Social Machines. They are elements that constitute human aspects described in Social Machines.

Figure 12. Social Machines and related areas

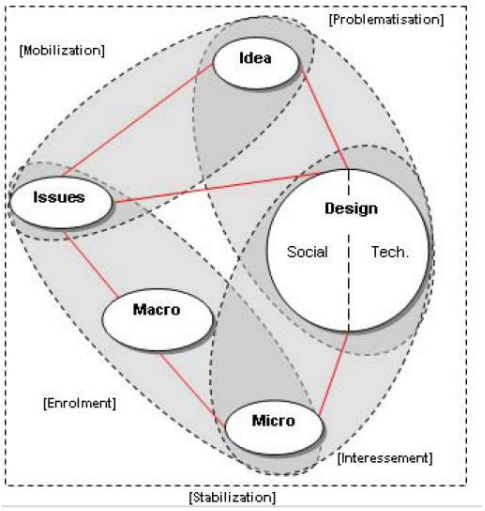


Source: Shadbolt (2013)

For Tinati and Carr (2012), this new area of expertise takes advantage of the set's power to

perform complex (difficult and time-consuming) tasks computationally. It is clear that the analysis of the relationship between technology and society, any job that requires legal involvement of humans and technologies is a form of Social Machine and, for this purpose, refers to the Web itself, as shown in Figure 13.

Figure 13. The processes on the Web



Source: Tinati, (2012)

In this way, expanding the combinatorial view to Social Machines is relevant, since an organization combines processes, technologies, and people and the Social Machine itself that emerges from a socio-technical system that portrays a combination of machines (technical computational elements), whether processes and technologies and the social, people and behavior (Souza, 2022). According to Shadbolt et al. (2019), Social Machines are created by technological components and human participation.

The Social Machine is an information system that relates to other systems, containing significant and restrictive elements in the relationship (Lemos de Souza & Meira, 2020). Apart from the expansion from the view of the types of existing relationships (Lemos de Souza & Meira, 2021), it also highlights the types of existing architectural styles and their characteristics (Lemos de Souza & Meira, 2020).

Given descriptions of the performance of Social Machines in organizations along with their behavior and evolution, a new theory can be generated in terms of perspectives on the performance of the Social Machine (Lemos de Souza, 2020) and other denominations such as the social micromachine as a subset of the machine that relates to the types of service architectures (Lemos de Souza & Meira, 2020).

2.5 DIGITAL TRANSFORMATION

Digital transformation is a process of mindset (change) of mentality, whether cultural or structural, companies and people go through to become more modern and keep up with the very impacting technological advances. This is still the requirement of a new world reality, whose processes for obtaining technical products and services obey the logic of the digital world that emphasizes rapid changes, instant responses, flexibility, and agility. The digital transformation itself implies using technology to implement the digital mindset, as the technological advance caused this transformation due to the new global context of the market and society (Oliveira, 2017).

If we thought about digital transformation as an algorithm (logical sequencing), we would first go through the adequacy of the technology, then through the understanding of this technology. The emergence of assertive results, ending with the emergence of new possibilities, from this evolution, hence yes, we could say that there is a digital transformation, but it is necessary to understand that it is a more complex phenomenon than just assuming that there is a simple cause and effect relationship. However, the digital transformation is a consequence of the changes that have taken place in society, not the cause. Therefore, if digital transformation could be simplified, it would be composed of new technologies, opportunities for improvement, and significant changes.

According to Rogers (2018), it describes some fundamental pillars to drive the transition in companies: customer, competition, data, innovation, value, business, health, education, consumption, etc.

Digital transformation brings benefits such as encouraging innovation, creativity, and multidisciplinary teams, breaking down communication barriers, reducing costs, encouraging self-management, and impacting entrepreneurship. The leading technologies used are cloud computing, social media, mobility, big data, the internet of things, artificial intelligence, agile methodologies, and design thinking (FIA, 2021) - Administration Institute Foundation.

2.6 ENTREPRENEURSHIP

According to Dornelas (2005), entrepreneurship is putting your ideas into practice, connecting processes, being a visionary, seeing opportunities where other people see difficulties, realizing dreams, adapting to economic crises or adversities that happen to appear, having the ability to identify problems, transforming human capital into a solution for society.

The authors Pereira and Bernardo (2016) state that entrepreneurship is an agile process that encompasses the generation of financial resources, led by people, where they assume calculated financial risks, spend time and commitment, channeling this effort and transforming opportunities into service provision or selling of products, meeting people's needs. The authors also claim that entrepreneurship converts ideas to facilitate collective life, commitment, dedication, effort,

awareness of the challenges imposed by everyday life, transforming opportunities for services or products to make a difference (Pereira & Bernardo, 2016). There are two types of entrepreneurship, opportunity entrepreneurship, in which there is an identification with a service or product to offer, where this activity is parallel to their primary occupation, as an additional income, and necessity entrepreneurship, which occurs when there is difficulty in getting to relocate in the job market in which entrepreneurship is a necessity to generate revenue (Pereira & Bernardo, 2016).

Digital entrepreneurship could bring several benefits to those who undertake where their services and products are in a virtual showcase that in Brazil, according to the National Household Sample Survey of 2019, carried out by the Brazilian Institute of Geography and Statistics presents that 82,7% of national households have internet access (Ministério das Comunicações, 2021).

Digital transformation has brought changes in buying a particular product or service, with the emergence of trading opportunities through digital platforms, so the entrepreneur must have knowledge and mastery of these new technologies to venture into the so-called e-commerce entrepreneurship (Gomes, 2003). In addition to the use of technology, it is necessary to improve processes and relationships with people, adapting to new business models (Yamamoto et al., 2021), generating a range of opportunities for the market whose foundation is the constant advancement of digital technology (Braga et al., 2021).

E-business can be considered a complete version of electronic marketing, as it is not limited to just acquiring a good or service, receiving help from business partners, and carrying out electronic marketing within a corporate conglomerate (Turban & King, 2004).

For Kraus et al. (2018), one of the categories listed in entrepreneurship were the products or services offered being transformed into digital formats, obtaining comprehensive visibility, reducing costs, and the possibility of increasing sales of products or services.

3 RESEARCH METHODOLOGY

To continue the development of this study, a theoretical-conceptual methodological approach based on a broad literature review was used. Based on the literature review, there is a need to adopt a research method centered on the evolution of a “Design Science”, highlighting its meaning and operationalization forms.

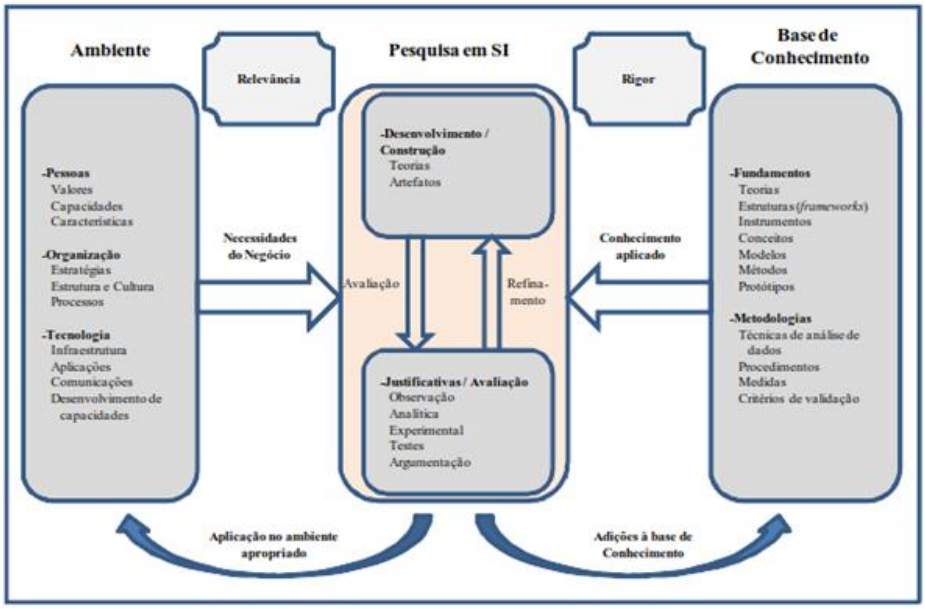
The methodology used in this work was based on Design Science Research (DSR) which is a method that operationalizes the research carried out under the Design Science paradigm.

For Vaishnavi, Kuechler, and Petter (2009), Design Science Research is a new point of view with a set of analytical techniques that allow the development of research in the most diverse areas. The DSR aims to study, research, and investigate (artificial) production and its academic and organizational behavior (Bayazit, 2004). It can be said that DSR is a research method to solve

problems (March & Storey, 2008). From the understanding of the problem, this method seeks to build and evaluate artifacts that allow transforming situations, changing their conditions, to better or desirable states (March & Storey, 2008). These artifacts constructed or assessed by the DSR are classified into: constructs, models, methods, instantiations (March & Smith, 1995), which may also result in an improvement of theories (Hevner & Chatterjee, 2010; Venable, 2006). Finally, a fundamental characteristic of research that uses DSR as a method is that it is oriented towards problem-solving, seeking a satisfactory solution for a given situation rather than an optimal solution.

Figure 14 presents Design Science Research and its relationship with two critical factors for research success: rigor and relevance.

Figure 14. Structure of Design Science in an Information Systems Environment.



Source: Hevner et al (2004).

As seen in Figure 14, the DSR must consider the relevance and rigor of the research. After all, it is the professionals of the organizations that will make use of the results of investigations and the knowledge generated to solve their practical problems and with a fundamental concern for the research to be valid and reliable, thus being able to contribute to the increase of the existing knowledge base in a specific area. Still referring to Figure 14, it relates to the environment where the problem is being observed, that is, where the event of interest to the researcher is located. This environment comprises people, organizations, and technologies (Hevner et al., 2004).

4 DISCUSSION AND RESULTS

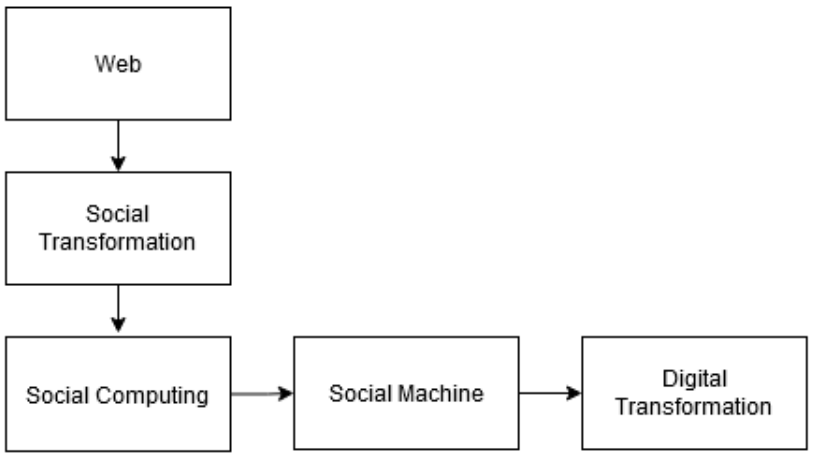
In this section, the thematic discussion and some terms used in the text are based on the

daily, bit-by-bit blog of professor, researcher, and scientist Silvio Meira[3].

There is always a transformation process in the face of historical facts, and digital transformation would be no different, although it is also linked to technology. Information and Communication Technologies (ICTs) and the economic, financial, industrial, credibility, and global crises serve to evolve and innovate. This innovation is transformation, permanent to continue competitiveness, in a context that can quickly change. Innovation is the sum of art and technology and must be part of any business strategy based on behavioral changes.

In this context, Figure 15 represents the process of evolution of behavior and products manufactured from the emergence of the Web to the digital transformation, as it adds factors such as crisis, risks, challenges, change, opportunities, innovation, evolution, among others, caused by ICTs, which resulted in the process of digital transformation in society and economy, which today affects institutions of all kinds.

Figure 15. Consequences of transformations.



Source: authors.

Describing Figure 15, the Web had its revolutions bringing as a consequence a paradigm shift in society that, together with social computing, brought emerging technology that was the social machine that helped in the process of organizational and social changes, as businesses are transforming into software as a service (SaaS) over multiple interfaces and networks (media and communication systems). So much so that many companies already provide their solutions on the web as a service, and the network is getting faster, more resilient, and has, every day, a better cost/benefit ratio, hence an increasing number of services that We need. In this way, without a doubt, the future is digital, interactive, extended, connected, networked, shared as a service.

Digital transformation is an evolution of how to do operations (create, leverage, and

[3] Blog dia a dia, bit a bit. https://silvio.meira.com/

integrate) and what to do (improve, extend and redefine) about a business value chain conjuncture that is problems and solutions, opportunities and results, creativity, innovation, entrepreneurship, competitiveness, investment, entrepreneurship and impact that can bring effects such as changes in agility, efficiency, transformations of experience, competitiveness and business model.

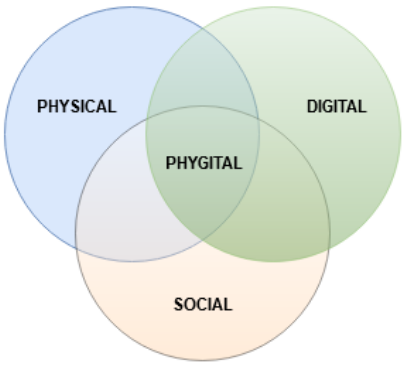
The pandemic caused by the Coronavirus (Covid-19) that started in December 2019 in Wuhan, China, brought with it immeasurable impacts, especially in terms of economic issues on a global scale, affecting various sectors of the economy. In this context, micro-entrepreneurs had to overcome themselves to seek ways out, especially during the lockdown period implemented in several places to contain the spread of the virus.

Briefly, digital transformation is based on digital innovation and strategic transformation that follows an orientation of digital business platforms that enable market ecosystems.

Faced with the pandemic, it could be seen that people and organizations were under pressure to evolve and transform in the face of disruptions that challenge their survival and demand innovation, incredibly strategic, to change behaviors and transform business models.

The combination of the analog (physical) and digital dimensions orchestrated by the social space results in the term Phygital represented in Figure 16.

Figure 16. Combination of physical, digital and social spaces.



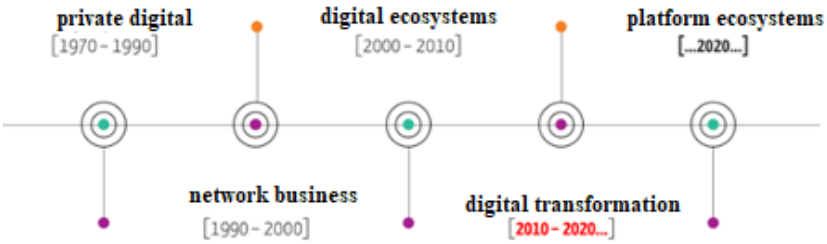
Source: authors based in Meira (2021).

This phygital space is being formed simultaneously as companies whose business models existed only in the physical dimension with some digital support.

The big revolution is that the transformation is phygital, as it is not purely digital, as shown in Figure 16.

Thus, we are in times of change of era, as shown in Figure 17, and there is a perception that time has become more scarce.

Figure 17. Revolutionary eras



Source: Meira (2021).

Digital acceleration is a behavior change that is linked to a change strategy. Therefore, phygital transformation is the composition of phygital innovation with strategic transformation.

According to research carried out in this article, connectivity has brought the entrepreneur the possibility of mitigating the crisis or even growth during economic chaos. This digital model of entrepreneurship benefited those who were offering a service or product and those who could not interact in person in a physical store or service provider such as a restaurant due to the restrictions imposed. Digital transformation was essential for the entrepreneur to overcome this moment of crisis.

5 FINAL CONSIDERATIONS

There is no doubt that we are living and going through a new process of revolution and that this process has to do with digital transformation. However, in the face of this research, we observe that in the same way that information technology is a space formed by three dimensions that deals with the transformation of information, the transmission of information and the control of information media, the convergence of physical, digital and social spaces takes place transformation and that to obtain a suitably pure digital transformation, other changes will still be needed. From the implementation of these daily changes, it was necessary to leverage dynamic solutions to circumvent and adapt to the new reality of the markets, where the internet has become an essential tool in helping the way to market mainly products and some services. The entrepreneur Attentive to this new demand, it experienced a period of growth in its business, boosted with digital transformation. These changes have to do with the creation of the Social Machine. The results of this emerging technology have caused paradigm-breaking processes that demand behavioral, innovative, strategic, model transformations and that are fully put into practice so that we can have a pure digital transformation.

As a suggestion of other relevant research, it is necessary to have other surveys of possible innovative technologies that have brought benefits to the process of digital transformation.

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