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FOREWORD

The International Journal on Optimization and Applications (IJOA) is an open access, double blind peer-reviewed online journal aiming at publishing high-quality research in all areas of : Applied mathematics, Engineering science, Artificial intelligence, Numerical Methods, Embedded Systems, Electric, Electronic engineering, Telecommunication Engineering... the IJOA begins its publication from 2021. This journal is enriched by very important special manuscripts that deal with problems using the latest methods of optimization. It aims to develop new ideas and collaborations, to be aware of the latest search trends in the optimization techniques and their applications in the various fields..

Finally, I would like to thank all participants who have contributed to the achievement of this journal and in particular the authors who have greatly enriched it with their performing articles.

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TABLE OF CONTENTS

Workplace well-being in the digital age: An exploratory study

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Abstract

Workplace well-being has been attracting the attention of the scientific community as well as practitioners for several years now. This topical subject is of paramount importance in the current context, marked by turbulence and the use of digital transformation of processes and the functioning of organizations, where we are becoming increasingly aware of the impact of "well-being" in the company on the behavior of employees at work, and consequently on the organizational performance.

A digital transformation can hardly succeed without taking up the human challenge: involve, motivate, ensure the rise in digital skills and lead the change, become the watchwords which technologies and digitalization must combine to succeed! This can only happen through involved, willing, passionate and above all fulfilled employees. This paper will focus on the importance of well-being at work in the era of digital transformation based on a literature review and an exploratory qualitative study, conducted with experts and middle managers. It aims to: (1) present the evolution of the well-being at work concept and its different dimensions; (2) highlight the theoretical and managerial implications through the study of the links that can exist between well-being at work and digital transformation; (3) demonstrate the interest of implementing programs aimed at promoting the well-being of employees in the digital era; and (4) understand the influence can have the psychological well-being employees on the digital transformation project success.

Through a literature review and an exploratory qualitative study conducted with experts and middle managers, we were able to highlight the importance of the PO fit (congruence between the person and the organization, particularly in terms of values) in the definition of well-being at work. The originality of this research paper lies in its managerial contribution, which explores the influence of the well-being of employees on the success of digital transformation projects as well as the role of middle management in driving change in the era of digitalization and the levers of success that enable it.

Keywords: Workplace well-being, Digital transformation, HRIS

I. INTRODUCTION

In the era of digital transformation of several functions in the companies, top management continues to invest in technology to increase the operational performance of its human capital. As a result, the question of the added value of the digitalization of processes and the use of technology is beginning to arouse the interest of employees, actors in these processes, who are observing their way of functioning and their well-being at work changing on

on several levels (psychological, economic, organizational, etc.).

The aim of this study is to (1) conduct an exploratory literature review based on previous research on well-being on the one hand, and digital transformation on the other; (2) examine through an exploratory qualitative study the influence that well-being at work can have on the digital transformation projects success in companies.

The digital transformation is a factor of change, which presents several technical, behavioral, and managerial challenges for the company. The emergence of modern technologies has influenced the various functions of the company, including the Human Ressources function (HR). In this context, the HR information systems market has undergone a considerable evolution centered on the democratization of data, connectivity between stakeholders, automation of activities and cybersecurity.

The findings of this paper should make an important contribution to the field of well-being at work and digital transformation by demonstrating a respond to both a theoretical and a managerial interest:

- For the scientific community: We aim - through this paper - to raise new questions related to the subject of well-being at work, thus allowing the extension and enrichment of the scientific literature in the fields of HRM Human Ressources Management), as the same as the digital transformation and change management.

- For practitioners: We aim to explore the role that employee well-being at work can play in the success of digital transformation projects.

II. EXPLORATORY LITERATURE REVIEW

In a constantly changing labor market, accentuated by major technological revolutions, companies are faced with economic and social hazards that directly and indirectly affect their social climate: burnout, psychosocial risks, the impact of work demands on employees' health and thus on their productivity levels, and finally the exponential costs related to psychological factors. These elements constitute major difficulties for the company which can only threaten its competitiveness. Consequently, the company has no choice but to guarantee a healthy and pleasant work environment, which integrates the health of its employees and their well-being. Dagenais-Desmarais et al (2010) distinguish five basic ingredients composing well-being at work: (1) willingness to commit to work; (2) recognition at work; (3) a sense of competence at work; (4) fulfillment in work; and (5) interpersonal fit at work. Dagenais-Desmarais et al (2010) also present concepts similar to well-being at work such as: mental health, psychological health, happiness at work, personal balance and well-being.

Ryff (1995) generally defines well-being as the set of six core dimensions (self-acceptance, personal growth and development, autonomy, positive social relationships, environmental mastery, and a defined purpose in life). Litchfield et al (2016) explain that the term well-being has the advantage of being the universal answer to the question "how are we doing?" As individuals, communities, or societies. Well-being is, therefore, an indicator of a person's satisfaction. Based on his individual perception of his health, happiness and personal purpose in life. Michel Guillemin (2018) and

Barel et al (2016) focus on a concept very close to well-being at work, namely happiness at work. For Michel Guillemin (2016), the concepts of happiness at work and health at work are similar and lead to a common goal: well-being at work. Indeed, happiness refers to "a state of complete satisfaction, of fullness", where the notion of health is defined as "a state of complete physical, mental and social well-being, and not only an absence of disease[1] ".

Wong et al (2020) assess the relationship between personal/work balance and organizational performance of employees. Through a meta-analysis that combines six factors: work motivation, attendance, recruitment, employee retention, organizational commitment, and productivity. The researchers found that there is a positive relationship between personal/professional balance at work and organizational performance. This relationship is particularly evident in work motivation, attendance, recruitment, and employee retention. This relationship is also affected by secondary factors such as: gender, industry, and organizational hierarchy. Samuel Mérineau et al (2020) distinguish between three sources of social support that directly contribute to employee well-being. Colleagues, supervisors, and the organization itself. Staw et al (1994) explain that positive emotions help employees achieve a favorable work outcome. They enhance their independence from other employees, facilitate the overgeneralization of good habits within the organization, and encourage their empathy towards their colleagues. Schneider et al (2019) argue that the instability of employees' work schedules can have harmful impacts on their mental health. Namely, sleep disorders, psychological distress, and job dissatisfaction. Consequently, the temporal dimension of work plays a significant role in well-being at work.

Regarding digital transformation, Hagbarg et al. (2016) defines it as "the integration of technology into everyday life; into all things that can be digitized." [2]The researchers see that digital transformation affects the different actors of the same organization. It impacts their daily life, changing their behavior and trying to incorporate new values through technology. Employees are confronted with a new language, which they must assimilate and communicate if they want to adapt to the new corporate reality. All the processes, trades, regulations and standards that create the cultural fabric of the organization are modified by the digitalization of the company. But not only that, the Digital Transformation influences the relationship of the internal actors of the company to their environment. In other words, the relationships with the various stakeholders. It also corresponds to a transformation of the competitive landscape, paving the way for the new expectations of the company's internal and external customers. This leads to the emergence of new business models, which create the difference between companies. It is therefore a remarkable asset, which should be taken into consideration during the various stages of the business strategy. Andy Main et al (2018) propose five steps to integrate digital transformation into the company's strategy: (1) Define the framework of one's digital strategy; (2) Orient

one's digital strategy to the interests of the company; (3) Identify the assets of one's digital strategy; (4) Have the courage to embrace the change due to digitalization; and (5) Imagine the end goal of one's digital strategy. According to Gicquel (2014), the company must work closely with information and documentation professionals and information systems departments, considered as valuable partners. Gicquel (2014) categorizes the key competencies needed for this project: (1) Documentary skills; (2) IT skills and (3) Management skills.

The HR function has grown within the company, hence the shift from a purely administrative logic to a HRM [1]that constitutes a strategic function at the organization level (Peretti, 2016). Hence the need to outsourcing and automate recurring administrative tasks through HRIS[2], thus focusing on the creation of global value. Storhaye (2013) lists three types of HRIS functionalities: (1) Basic functionalities. Advanced functionalities and (3) Front office and mobile functionalities. These functionalities make it easier for employees to access the previous functionalities and encourage their interactivity by presenting them with common communication spaces.

III. Methodology

Our work is part of a qualitative approach and follows an interpretivist paradigm which is an interdependent relationship between the researcher and the research subject. It is necessary when the meaning is not given by the observed values. Otherwise, it is necessary for the researcher to immerse him/herself in the field of research to understand the collective behavior from an individualistic point of view. In the context of our qualitative approach, the researcher can mobilize a multitude of data collection techniques: individual interviews; focus groups; non-participatory observation (Roche, 2009). For our part, we opted for semi-structured interviews. The construction of the interview guide goes through three stages: listing all the questions inspired by the documentary research (theoretical part), which will guide the semi-structured interview thereafter; grouping the questions under precise themes, to keep a methodological thread; integrating open-ended questions which will encourage the interviewee to express himself more freely on the interview topics. After having defined the field of the empirical study, we will describe a focus on the participants profile in the end of this paper (Appendix 1: Experts in change management, HRIS, well-being and middle managers who have accompanied digital transformation and/or well-being projects). Within this framework, we developed an interview guide consisting of 13 questions, structured around four axes: Digital transformation; Competencies accompanying digital transformation; Well-being a core of digitalization; Definition of well-being in the era of digitalization (Appendix 2).

To collect and assess the responses obtained from the experts, The data was recorded on a digital audio recorder and transcribed. The number of interviewees was set according to the principle of theoretical saturation.

IV. Findings and Discussion

In this section, we will present the main findings of the qualitative study conducted with our sample of experts and middle managers in the field of digital transformation, change management and well-being at work. The study was conducted with the objective of understanding the influence of well-being at work on the level of success of digital transformation projects in Moroccan context. We present these results according to four axes of analysis that follow a funnel approach.

Axis 1: Digital transformation, a trend, or a necessity

Although our interviewees are divided into two profiles, "Experts" and "Middle Manager", the question of the interest in digital transformation projects (on the technological and organizational level) in the Moroccan context finds a unanimous response; the experts explain that "Digital transformation has begun to grow with the outsourcing of support functions that the company is now able to manage remotely through digital tools in order to focus on the core of its business" Expert 1 (Expert Digital Transformation and Change Management).

In multinationals and complex organizations (matrix organizations) that operate in project mode, digitalization facilitates operational processes, saves time, and provides traceability and transparency of information. In the same register, the digital transformation is accentuated with the introduction of telecommuting on the one hand, and on the other hand, "the need to catch and align with competitors who reach a more advanced level of digitalization is a challenge to be taken up perpetually" Expert 2. We add to this, the need to respond to internal needs to better track and control the traceability of information to have a certain speed in decision making in an efficient way at lower costs.

By confronting this result with the research work already done on the question of digital transformation as a necessity or just a teenage trend in Moroccan organizations. Several recent studies have shown that "digital transformation is present as a necessity to adapt to external changes in the company and an opportunity to strengthen competitiveness and ensure its sustainability. It is a major challenge for companies that strive to be ahead of their competitors while transforming their threats into opportunities. (Victo & Babaci-Victor, 2017). Thus, in the oldest records on the subject, we found that "Processes are centralized, rigid, and are in line with the major IT projects of the 1990s (Expert systems, management software) that aimed at rationalization through standardization of activities (Muhlmann, 2001).

Axis 2: Competences accompanying the digital transformation

In the context of digital transformation, companies should ask themselves about the necessary skills accompanying this change on a technical, functional, managerial, and behavioral level (Gicquel, 2014). In this perspective, we asked the same question to our interviewees and the answers collected in this sense, are articulated around three bases:

-Technical skills base: Ability to develop and implement digital solutions

-Soft Skills: Ability to federate the team around a project, listening skills, communication skills, proximity, agility and organizational skills
-Managerial skills base: Team management, project management, change management

Indeed, the HRIS expert insisted on the development of soft skills as a condition for successful digitalization. ... In terms of skills, there are several dimensions to consider, first of all you need to have a base of technical skills to implement and maintain digital solutions over time, but reality has shown us that this is not enough to succeed in a digitization project, because if you do not manage to get the support of the project's stakeholders, you will surely fail at the time of implementation or post-implementation. Therefore you need to take the project to the highest level of the hierarchy and communicate around it through the implementation of a change management plan that includes in its actions a communication plan that will accompany the implementation of an HRIS".

From these results, our study revealed that to succeed in digital transformation, it is not enough to have only a willingness to implement digital solutions, but behind this willingness, the company has an interest in developing the skills that will carry this digital shift by focusing on soft skills as a core competency and similarly for technical skills as a basic foundation. In the same vein, the work of Main et al (2018) shows that "digital transformation is not only about the use of technology. But about the ability of the company-using technology-to be more competitive in the marketplace."

Axis 3: Workplace well-being in the core of digital transformation

The records collected in relation to the relationship between well-being at work and digital transformation are mixed. According to the experts and middle managers interviewed, there are two sides to the equation in Morocco. The first side, which is a major reality, concerns the introduction of digitalization in companies and HRIS as well as the digitalized way of working in order to improve the life of employees in the company and consequently this contributes to the improvement of well-being at work due to access to information, time saving among other reasons that we mentioned in the first axis. ... The HRIS allows us to save time and automate time-consuming and monotonous tasks, if we manage to free up time and make processes more fluid, the employee could eventually feel better at work" Expert 3.

In the same vein, middle management should play a key role in bringing about change and represent a relay of the digital transformation between general management and end users. In this context, the middle manager should have a certain autonomy, legitimacy, and recognition from his hierarchy to be able to fully play his role, get his teams to adhere to the change and give meaning to digitalization and its usefulness for improving working conditions in the long term. At this stage, middle managers and experts agree on the perceptions they have observed in their experiences regarding employee support for digitalization projects. They distinguish two cases. In the first case, employees claim that their freedom is infringed upon, and their skills are being

questioned because of the difficulties encountered in using the modern digital tool, as they develop a psychological block because of their attachment to old habits and they feel threatened and think that technology will replace their usefulness at work and their remuneration will drop accordingly. These behaviors are present in older employees who show a strong resistance to change in the context of digitalization projects. The second scenario consists of accepting change and adhering to digitalization projects by default and by curiosity. This perception is omnipresent among young executives who are used to manipulating digital tools and seek to discover the functional utility of each element.

For example, top management is interested in the implementation of an HRIS in order to improve the return on investment, while end users are interested in the functional usefulness that the tool offers. Young people accept the new change and adhere to the digitalization project, and in some companies, they even demand the need for its implementation, given that their social life is facilitated by digital technology. Contrary to the second category of generation X employees who show a strong resistance to change due to technical and cultural constraints" Expert 3.

"... the resistance at the beginning of any change process is phenomenal and almost generalized in the public sector, but this behavior changes gradually, when we improve internal communication and motivate the employees while also involving the social partners". Middle Manager 1 (Public Sector)

What is curious in these findings is that digital transformation, whether it is in the context of HRIS implementation or in organizational change with the accentuation of the digitalized work mode, is a double-edged sword with respect to employees' well-being at work, and the reluctance to this change varies according to the age of the employees, their background, and their technical skills.

In this sense, we have found several studies that confirm the influence of well-being on the success of digital transformation projects. In this regard, we recall the work of several researchers (e.g. Davis et al, 1989) who provide empirical evidence that "the beliefs of individuals and their attitudes towards an information system, influence their intentions to use it. And vice versa. We can predict employee use of HRIS before we implement it in an organization. But these predictions are not always correct and definitive, especially if use is mandated by management" (Brown et al, 2002).

In the same vein, the study by Maier et al (2012) demonstrates the impact of the direct relationship between job satisfaction, turnover, HRIS implementation and its impact on work behavior. HRIS is perceived as useful, easy to use and effective by employees with high job satisfaction.
And this, even in a context of mandatory use. On the other hand, if the HRIS is perceived by employees as a threat that will jeopardize their work, the level of satisfaction declines.
If we come back to the role of middle management, the results of our qualitative study show that the middle manager must

fully play his role of ambassador to carry and accompany the digital transformation. In this context, we find that the well-being at work of this population is also essential for the success of the latter, because the middle manager needs more autonomy and recognition...so that they can have legitimacy regarding their teams and be able to help them accept the change.

More previous studies have confirmed this observation. Indeed, if the role of middle managers is part of the classic trend in supporting transformations (Alber, 2015; Martin, 2013), other types of relays seem more original. A study at Phonetel, shows that "digital ambassadors", play the role, in addition to their main function (which may or may not be related to digitalization and may or may not be added to the responsibility of management), of helping employees to become familiar with digital tools or to better master them (Benedetto-Meyer, M. & Boboc, 2019).

Axis 4: Definition of well-being at work in the era of digitalization

With the digital maturity and the mass introduction of technology in the life of employees in the workplace, the representation of well-being at work could not keep the same dimensions. We retain different propositions from our experts and middle managers interviewed in the framework of this study, following the question we asked them:

With hindsight, and following your various experiences in supporting companies in digital transformation and/or well-being at work, how do you define well-being at work?

Definition 1: "I would say that it is difficult to define the concept of well-being at work, knowing that human beings are complex and complicated. But if I should try to give a rough definition that has matured from my own experience: Well-being will depend for someone on the salary aspect, for another it will depend on the social climate, for another it will depend on the absence of quarrels and political problems within the work. therefore, if the company takes care to reconcile these dimensions (equal salary, ergonomic factors, good social climate, reasonable working hours, social peace), it will contribute to the well-being of its employees" Middle Manager 2

Definition 2: "There is no single definition of well-being at work, the definition differs from one person to another according to his or her personal and professional experience. For me, I can define it because of the following dimensions: feeling fulfilled in what one does on a daily basis, having autonomy, having visibility on one's career path, being in an environment marked by respect as a value, and finally having flexibility. (Expert 3).

Definition 3: "Well-being at work is an inner state that is provided through a climate of trust between the company and the employee and that allows the employee to adhere to the values of the company, to feel part of the team and to contribute to the results of the company" (Expert 2).

Definition 4: "...The concept of well-being at work is not a new concept, well-being has surfaced, because ill-being has taken space in the professional environment. It is only

from this moment that we started to be interested in the well-being at work that the company could have it and develop it by defining a common base of the collective intelligence which emanates from the individual emotional intelligence, because the feelings and the emotions have their place in the working space. In this context, the adhesion of the collaborators to the company culture plays a primordial role, it must be shared between the actors and lead to the same finality of the company especially in environments marked by a perpetual change of the technology, the organization, the operating mode and the processes which result from it. (Expert1).

Through the analysis of the different definitions proposed by the researchers on the first hand, and on the other hand, the consolidation and analysis of the definitions proposed by our interviewees from their professional experience. **We suggest a new dimension that reinforces the components already present in the current literature, in this respect we introduce the cultural dimension as a new component incorporated by "adherence to the values"** of the company, this notion was raised by most of the interviewees in the context of our qualitative study. By comparing the results obtained in terms of definition, we recommend that the definition proposed by the researchers Dagenais-Desmarais et al (2010) is the closest to our reality which emanates from the Moroccan context. Indeed, they are particularly interested in psychological well-being at work and propose a definition based on five key ingredients previously mentioned in this paper and which are (1) willingness to commit to work: positive contribution to the company's efforts and success; (2) recognition at work; (3) interpersonal adequacy at work, which consists of fostering and maintaining positive interactions with one's professional entourage; (4) fulfillment in work; and (5) feeling competent at work.

V. CONCLUSION

By questioning the digital transformation not in its technological effects nor in its technical components, but through the perceptions and uses of the stakeholders and actors who support it, implement it, and use it through the HRIS and the various digital solutions. We wanted to emphasize the direct and indirect links that can exist between well-being at work and digital transformation with the help of answers from experts in the field who have experience, hindsight, and a global vision of the coexistence of this relationship in the Moroccan context. The originality of this work lies in its managerial contribution which explores the direct and indirect link between the two variables on the one hand, and on the other hand, it explains the role of middle management in the conduct of change in the era of digitalization and the levers of success that allow it. Thus, our study makes a theoretical contribution through the introduction of the cultural dimension (adherence to the company's values) in the definition of well-being at work. However, our study has certain methodological limitations due to the small sample of experts, justified by the principle of saturation in the context of an exploratory qualitative study. In the same vein, the results obtained through this study need to be confirmed by an in-depth study or by a quantitative study questioning the various actors in the digital transformation.

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APPENDICES:

APPENDIX 1: THE STUDY SAMPLE

Experts	Profiles	Companies / Reference organizations	Supported projects (Well-being at work and/or digital transformation)
Expert 1	• Expert in change management • Former Director of Support and Digitalization • Ex Project Delivery Manager • Certified Coach Therapist (Humanistic Psychology)	• ATOS France/Morocco • 3M France • ENGIE/GDF SUEZ • LA POSTE/France	• Implementation of Information Systems, SAP • Outsourcing • Support for change management
Expert 2	• HR Business Partner • Ex HR Consultant • Certified Coach Therapist (Humanistic Psychology)	• A digital services company	• Digitalized happiness at work device • Digitalized social climate device • Change management for the organization in remote mode "Telecommuting
Expert 3	• HRIS expert • E-learning consultant	• Consulting firm (Clients: hotel chains in Morocco, banks, ...)	• Implementation of HRIS • Implementation of e-learning platforms
Middle Manager 1	• Recruitment Manager • Manager of training and management • Management of proximity	• Renault Morocco • Lear Corporation • Eaton Corporation	• Implementation and post-implementation study of the efficiency of the HR Access software package for personnel data management.
Middle Manager 2	• Head of HR department (4000 agents perimeter) • HR Supervisor Regional Perimeter (18000 agents)	• Ministry of National Education and Vocational Training	• Implementation of the MASSAR platform (integrated IS for managing school and pedagogical affairs) • Implementation of the MASIRH program as the HRIS of the National Education and Vocational Training.

Appendix 2: Interview Guide Questions

1) Could you present us your professional background?

2) In the context of your professional career, can you tell us about the digital transformation projects in which you have participated or accompanied?

3) Why do you think private and public companies are more interested in digital transformation?

4) In your opinion, what are the behavioral and managerial skills necessary for the success of digital transformation projects in companies?

5) Do you think that the proficiency and development of these skills depend on the well-being of the employees, the working conditions and their professional fulfillment? Can you tell us about similar cases in Morocco?

6) Can we consider the HRIS as a digital transformation [10] project? If so, why is it interesting for employees at all levels of the hierarchy?

7) What is the perception of employees regarding the HRIS implementation process (or other digitalization projects) during all its phases? How do they react to this change?

8) Follow-up question: To what extent could the implementation of an HRIS (or other digitalization projects) have an impact on well-being at work?

9) On the human and relational level linked to well-being at work, what are the mistakes to avoid in the implementation of a digital transformation project such as the HRIS for example?

10) Follow-up question: With hindsight, and following your different experiences in supporting companies in digital transformation and/or well-being at work, how would you define well-being at work?

11) To what extent could improving well-being at work contribute to the success of digital transformation projects?

12) What do you need to do to get your employees to adhere to your digital transformation projects? In other words, how do you motivate them?

A survey on IoT technologies and their applicability

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Abstract—Society is undergoing a new industrial revolution which marks the inception of the industry of things. Due to its highly changing nature, we require to take a step back from time to time to analyze the current environment. The objective of this study is the evaluation of the status quo with the goal of gaining insight in regard to developing standards, cloud providers, the impact of this emerging industry and its effects on other domains. This article considers prominent solutions affecting various spheres such as economy, medicine, agriculture etc., how they influence said areas and technical aspects of the product. The results present an incipient maturation of the technological approach, while the adoption factor has a slower ascension due to infrastructure costs and inertia of the targeted industries. This survey highlights the complexity of an IoT environment and compares the features implemented by platforms pertaining to multiple categories. The analyzed solutions provide a rich and distinctive feature set, but it seems there is no absolute winner.

Index Terms—IJOA, Journal, Optimization

I. Introduction

Starting with monitoring a Coke vending machine at Carnegie Mellon University in 1990, as mentioned in [1], Internet of Things (IoT) has come a long way in the past decades. With an evergrowing number of connected devices the IoT market also requires adapting to its consumers. Hence, many IoT solutions are surfacing every day with the purpose of enriching the context of our decisions. From society, to industry and home use, every domain greatly benefits from IoT integrations.

Nonetheless, all of these solutions require their own infrastructure which provides device management, deployment administration, monitoring etc. While there are multiple kinds of IoT platforms, this report will focus on cloud platforms used as IoT platforms, industrial internet of things (IIoT [2]) platforms as alternatives and open-source options.

The remainder of this paper is organized as follows. The next chapter presents the motivation for choosing the analyzed platforms. Chapters III, IV and V contain the review of the cloud centric solutions, the other trending iot platforms and, respectively, the open-source solutions. The feature summary of the IoT platforms is reported in chapter VI. Conclusions of the paper and future-work directions are provided in chapter VII.

II. Trending solutions for IoT deployment

Due to the widespread usage and the familiarity of the developers, cloud platforms represent a great contender for the list of analyzed solutions in this paper. Since the cloud environment has reached maturity, it makes sense to use the developed standards and apply them to the emergent IoT market. Taking a look at some key players of the cloud environment, Amazon, Microsoft, Google, IBM, their focus on this niche, becoming segment in the last years, is obvious.

Nonetheless, the previous list is built on the assumption that the IoT environment is related to the cloud one. But this hypothesis could be wrong since the number of devices, and the sheer amount of data, might require a whole new paradigm. Ideas that support this theory range from novel technical approaches, such as edge [3] and fog [4] computing, to new business concepts, such as a marketplace for IoT data [5]. Of course, this new perception also raises problems along the likes of data governance, data sovereignty etc. However, this discussion is out of the scope of this paper and was meant to exemplify the different use-cases IoT might impose.

Considering the previous arguments, this survey also includes IoT platforms developed from the ground up, as their approach might be more suitable for the integration of the features mentioned above. The issue with selecting such platforms is the fact that some of them are built as in-house products, not available to the public use.

On the other side of the fence, there is the open-source community, which is just as excited about the new nature of the Internet. Hence, various task forces [6], consortiums [7], [8] and even government funded projects [9] are also working on developing protocols, standards and platforms.

All in all, this paper will analyze products pertaining to all these categories, from the stable cloud developers, to the proprietary solutions developed alongside IoT products and last, but not least, the efforts of the open-source community.

III. Cloud centric IoT platforms

AWS offers 10 services in their Internet of Things category and as an IoT platform its domain seems to be a general one: it offers both services to satisfy a home user, an IoT startup or an industrial site. Their supported protocols range from LoRaWAN [10], HTTPS, to MQTT and MQTT over WebSocket Secure (WSS), encompassing a wide range of use-cases. Besides the security offered by these communication protocols, they also provide a special service tasked with overseeing the best security practices in regard to IoT devices. Another important feature is modelling Things: for an easier process of integrating the same kind of device from different vendors, it could be modelled in a generic way that expresses the basic functionality. With AWS's IoT Things Graph [11], users can develop their own models or use existing ones. Furthermore, this facilitates the creation of flows between different models of Things. Hardware support is provided via FreeRTOS [12],

an operating system for microcontrollers that facilitates IoT development, but also through a custom tailored portal for monitoring industrial equipment. Deployment management on the edge is achievable by using AWS's IoT Greengrass [13] through their proprietary agent. Aside agents, integration can also be done through various SDKs ranging from C++, Python, JavaScript, Java to Embedded C and Mobile SDKs. Event processing can be tackled through numerous Amazon services, but another aspect is detecting the state of Things through those events. This can be achieved by either creating detection models for them, or even using machine learning algorithms to further enhance the responsiveness of the solution. Users can access monitoring and analytics data through a diverse set of services and informative dashboards. The access to all these resources can be controlled through the use of IAM roles allowing for fine-grained regulations. Last, but not least, to accelerate development, AWS also offers a marketplace for IoT solutions. All in all, AWS's IoT platform is very versatile, fitting a wide-range of use-cases, while also offering implied scalability through their experience as a cloud platform.

Microsoft Azure offers 24 services in their Internet of Things category, but many of them aren't specific to IoT. Nonetheless, their presence in said list is an indication of the flexibility of the platform offered by Microsoft. Projects developed here can also scale from tens of devices to millions by using some of the well-established protocols such as MQTT, AMQP and HTTPS. They also grant WebSocket support for the first two which ensures higher resilience in regards to transmitting information. The security offered by the Microsoft platform starts from silicone: they provision certified microcontrollers which embed accredited chips safe-guarded by a custom tailored operating system. And in the case of edge computing, they also provide a specialized service which facilitates the management of any computational processes. Building on top of that, they administer authentication for IoT devices and a security overview of the connected equipments. To properly model the functionality of a Thing, a user can use the Azure Digital Twins [14] service which allows for the creation of a digital model of the physical appliance. Deployment management can be easily performed due to the vast range of supported operating systems, list which ranges from Linux to Azure RTOS [15] - Microsoft's custom RTOS. The event management process isn't handled by a specialized IoT software, which hurts the user experience, yet it's still a very scalable and durable data processing functionality. Azure facilitates integration through a plethora of SDKs, covering the most popular programming environments: .NET, C, Java, Node.js, Python and iOS. All these capabilities are easily accessed through their IoT Hub, offering a bird's eye view of the ecosystem, and if a detailed view is required, the monitoring system satisfies any debugging needs. This central point also manages the authorization functionality, through IAM roles which can be manually assigned to their resources. The marketplace is a great place to search for certified devices and, if you are looking for pre-built solutions, Microsoft offers IoT accelerators, which should suite the needs of any

application or at least provide a base implementation. In conclusion, Microsoft Azure offers a comprehensive toolset for any IoT project, but their functionalities should be better emphasized for a richer user experience.

GCP's offer of IoT services is more succinct, providing only the Google Cloud IoT API [16], which registers and manages IoT devices that connect to the Google Cloud Platform. They offer basic protocols for communication such as MQTT and HTTP which are relayed through their respective bridges. Security is enforced through the use of JSON Web Tokens signed with the certificates used for provisioning the devices. Thing description is achieved by adding metadata to a device, but no other enrichment is possible. While explicit hardware support isn't specified, GCP provides their own application-specific integrated circuit (ASIC) called Edge TPU [17] which incorporates AI capabilities. Deployment management appears to be a very raw feature, through pushing device configuration via the hub. To process the events sent by the devices, one can use any of the managed services offered by the GCP platform for data processing. With regard to monitoring, a crude overview of the appliances' activity can be analyzed, while further analytics should be configured by the user through the usage of other GCP services. Authorization can be configured at service level, but more fine grained capabilities aren't available. The marketplace offers a handful of solutions when querying for "iot" and no accelerators or pre-built solutions could be found. Google's IoT platform relies heavily on the usage of pre-existing services, while their user experience seems to provide just the building blocks required for designing an IoT environment.

IBM also offers their own IoT platform through IBM Watson IoT [18]. Unfortunately for the purpose of this survey, the platform couldn't be accessed, so the following analysis is based solely on their presentational documents. Their communication protocols list is pretty basic, including MQTT and Java Message Service (JMS) [19], but they offer extensions through custom protocol plugins. Data access and storage is secured through the use of certificates, API keys and authentication tokens. Device management has a base implementation for modelling, but no further details regarding grouping Things, defining them or reusing Thing definitions could be found. Sensors can be updated through commands, but there doesn't seem to exist a custom tailored solution for deployment management. Event streams can be processed through other IBM cloud services, allowing the use of machine learning algorithms for a more thorough analysis. Regarding developer integration, their SDKs are built for C, Java, Node.js and Python. Monitoring and analytics are offered either through custom made dashboards or informational reports. Authorization can be handled by using either pre-defined roles or custom made ones. There doesn't seem to be a solutions marketplace, but their website presents a wide array of plublicly recognized solutions built using IBM Watson. Unfortunately, due to the fact that the platform wasn't accessible for this analysis, we cannot describe a comprehensive outlook of its features. Nonetheless, the documentation presents a

well-rounded IoT solution, which accompanied by the various AI services offered can maximize the potential of the data collected.

IV. OTHER TRENDING IoT PLATFORMS

Researching platforms focused solely on IoT can prove difficult. The first reason would be the popularity of the cloud centric platforms and secondly the level of trust: the field of IoT hasn't matured enough to prove the need of an entirely separate kind of platform. However, looking back at its roots of monitoring machines, it makes perfect sense to analyze the IoT platforms used in factories, supply chains etc. Following that train of thought, this paper analyzes the industrial IoT (IIoT) platforms provided by PTC ThingWorx, Siemens MindSphere, Bosch IoT Suite and some interesting alternatives.

At the time of writing this article, PTC ThingWorx offers 5 services, but the greatest difference is the fact that this platform is provided as on-premise: the consumer would install these applications on his hardware and has to manage their availability. Since their domain is focused on IIoT, their protocols range from HTTPS, SMS, SMTP, POP3 to a plethora of protocols integrated as extensions available from their marketplace, and also standard industrial protocols. Their solution embeds security procedures for device management, and a very rich device modelling functionality: a user can define Thing templates, shapes and groups, to ensure the proper modelling of the running environment. Hardware support is heavily emphasized by supporting over 150 industrial protocol drivers which outlines the consideration put in the industrial side of IoT. Deployment management seems to have basic support only via configuration updates and event management is crudely implemented through an alerts system. The SDK area encompasses the following programming languages: C, Java, .NET. While this range is a bit more limited, the Java SDK supports Android development and further interactions can be achieved through the use of the APIs. A monitoring dashboard is available, which presents both a history of device events and also any available logs. These can be further analyzed via statistics, for a better comprehension of the current state. Access control is managed through permissions, which offer fine-grained control over the access a user can possess, while any outliers are present in the audit log. The PTC marketplace administers both extensions to the provided applications and also pre-built solutions ready to bootstrap any IIoT project. Finally, while this IoT platform provides a very rich user experience for an educated user, its features can be a bit overwhelming. Furthermore, the fact that it's presented as an on-premise solution can be a drawback for a consumer which has no pre-existing hardware available, but this can be overcome through the use of cloud platforms. These cloud platforms can be further utilized with the deployed solution through various integrators which facilitate reaching the full potential of the gathered data.

Siemens' platform, MindSphere, is more industrial centric, but they still support popular communication protocols such as HTTPS and MQTT, besides the wide range of lower level protocols. Their security methods aren't explicitly stated, but they claim to support industry standards and device authentication is facilitated through unique identification numbers and security tokens. Their devices can be modelled through either vendor specific designs or generic representations of Things; the vendor specific designs are further supported through their integrations with various microcontrollers and devices. Deployment management doesn't seem to be available in the trial version surveyed here. Users can handle device events by creating flows through an user interface, which contributes to the user experience. Other event processing capabilities don't seem to be available for this review. Integration with the platform is facilitated through Java, C++ and Web SDKs. The devices can be monitored and analyzed either through the MindSphere Fleet Manager [20] or through the Visual Analyzer [21], services which facilitate the use of the data exported by the devices. User and role management are only available for the applications developed on the platform; the environment allows to configure external applications integration with the data available. Siemens also presents a solution marketplace which contains both proprietary solutions and also custom made ones. Siemens' MindSphere packs a rich feature-set, but the user-experience has its shortcomings and without it a potential customer could miss on their extensive functionalities. Yet this downside is alleviated by their extensive range of supported industrial equipment.

Bosch offers its IoT services both as suites and also for standalone use. Besides, the classic communication protocols MQTT, HTTP and AMQP, they also support protocols specifically aimed at IoT such as LoraWAN and CoAP [22]. Security is implemented through the use of certificate authentication and authorization on a per-device basis. The platform relies on open source projects for some of its functionalities, such as Thing management; devices can be described through various models, ranging from generic functionalitites to vendor specific, all available through the Vorto Repository [23]. Hardware support is granted by their IoT Edge [24] services which serves as both a gateway for non-IP IoT devices and also as a computational hub, allowing for event management through flows, analytics and AI enrichment. Furthermore, consumers can remotely command firmware updates and update their deployments. Their SDKs range is narrow but carefully honed: they provide Java plugins for the Eclipse IDE, which expedites the development process. Monitoring is displayed at various service levels, but if more advanced analytics are required, Bosch has developed a custom tailored managed service with the sole purpose of getting the most out of the data collected by the devices. User and role management don't seem to be available for the trial provided, but the option to select and group devices seems to indicate to its existence. Overall, Bosch's IoT platform is very well developed, with an extensive feature-set, refined through a blend of proprietary and open-source projects. Furthermore, there are available integrations with both AWS and Azure. The controversial point is their user experience. On one hand, they offer their services as suites: one looks to be honed for a smaller number of devices,

while the other seems to be targeted to an industrial-level of number of devices. On the other hand, the service dashboards are disjointed, and at a first glance it can be tedious to jump from one application to the other.

Cisco, the networking infrastructure leader, is also establishing a foothold in the IoT market. Due to their background as providers of out of the box solutions, this intent is also observed in the matter at hand; their services rely on proprietary software and hardware which allows access to more advanced functionalities, but has the potential to lead to vendor lock-in. Their solution for IoT is called IOx and is described as an application environment that encompasses specific devices and gateways, secured communication via a proprietary operating system and further integrated services. They seem to be less descriptive about specific communication protocols supported, but they mention managing the data through standard protocols such as RPC and PubSub. Through the provided demo, the IoT Operations Dashboard [25] can be accessed, which boasts multiple essential features. Here a user can have a bird's eye view of their devices' location and alerts, while also being able to add new devices. A new device can either use an existing, or a newly created Asset Type [26], which embeds both metadata and also groups multiple sensors in said type. This facilitates the management of the existing devices, but the downside is represented by the sensor catalog, which, at least in the demo version, only offers a handful of Cisco certified sensors. Worth mentioning is their, now at end-of-life, Cisco Kinetic [27] platform, described as an IoT data fabric, which utilized Edge & Fog Processing Modules [28] and also Data Control Modules [29]. Cisco's proficiency is highlighted again by their approach to managing fleets of devices: Cisco IoT Field Network Director [30]. It is described as a complete networking solution capable of monitoring, managing and deploying millions of devices. Developers can integrate with Cisco's IoT services by building IOx Applications [31], described in YAML [32] format and packed as Docker images. Their examples are based on Python and support for other programming languages isn't specified. The authorization angle seems to be tackled through the IOx environment, but specifics regarding granularity aren't obvious. They don't seem to provide a marketplace for pre-built solutions or accelerators, but product descriptions hint at integrations with various cloud platforms. As mentioned at the start of its description, Cisco doesn't offer a platform, it offers an environment. While their solutions apparently require a hard commitment on the part of the consumer, their time proven experience certainly stands the ground for their IoT services.

Orange, the telecommunication corporation, also launched its own IoT platform called Live Objects. They both provide Internet protocols for communication such as MQTT and HTTPS, while also leveraging their infrastructure for CoAP, LoraWAN and SMS. Besides the inherent security of the communication protocols, they also implement API keys and certificates for authentication. Device management is provided through basic metadata of the device, but it also uses the connectivity capabilities of the appliance to further control the actions the platform can apply. Hardware supported is presented through the implementation of specific communication protocols. Depending on the connectivity of the device, various functionalities are offered: command, configuration or resource. The Things send their data through streams, which further allow for the enrichment or analysis of the events. The state of the devices can be monitored in customizable dashboards and in case of failures, various alerting rules can be implemented. Authorization is implemented through the use of roles backed by pre-defined labels which control the resources to be accessed. Unfortunately there are no marketplace solutions or other extensions to expedite the development process. Overall, the Live Objects platform may seem simple, but with simplicity comes ease of use, and their features have the potential to support the quick development of an IoT solution.

V. OPEN SOURCE IoT PLATFORMS

While the industrial giants provide extensive IoT solutions, the open-source community also jumped on the track of this new industry. Ranging from IoT platforms for home use, to production ready IoT platforms, their capabilities shouldn't be overlooked. For the purpose of this paper, the most prominent projects were selected based on their GitHub activity which was used as an indicator of the platform's success.

ThingsBoard is an open-source IoT platform with an extensive feature set. Their supported protocols range from the standard HTTPS and MQTT to OPC-UA [33]. Device authentication can be achieved through access tokens, basic credentials and certificates. Things can be described through custom labels, can have device profiles to automate various actions and they can also be grouped to enrich the user experience. Specific hardware support doesn't seem to be available, besides the plethora of integrations with industrial protocols. Deployment and over the air upgrades aren't supported out of the box, but there are plugins that satisfy this requirement. Rule Engine [34] is ThingsBoard's framework for event processing. Using visual flows, a consumer can greatly enhance the interactivity of the data produced by the devices. No explicit SDKs are offered, as they claim that the simplicity of the API doesn't require it. Nonetheless, a list is available containing community client-side libraries for MQTT and C implementations for CoAP. To monitor the connected devices, a user can utilize the telemetry feature and expose said data using custom made widgets or dashboards. The authorization functionality doesn't seem to be very complex, but solves the access problem in a simple way: tenant users can fully-manage devices and they can create dashboards for customers to visualize their data. There isn't a ThingsBoard marketplace per-se, but the solution offers integration with many cloud providers and also has the contribution of the open-source community. The billing plan is split between the Community Edition which is free and the Professional Edition which boasts some extra features which elevate the user experience. In conclusion, ThingsBoard is a viable option as an IoT Platform,

being capable to support the needs of both home users and also enterprises.

OpenRemote is another open-source IoT platform. While it has a lower number of contributors, the overall features presented can satisfy the requirements of an IoT project, and the technologies it's based on are in trend with the current software environment, which reflects the effort put in keeping this project up to standards. The list of supported communication protocols contains the standard HTTPS and MQTT and also future or custom integrations. The security of the system is backed by Keycloak [35], but the process of device provisioning only offers username/password authentication. However, devices can be modelled through an extensive list of provided Assets [36]. Specific hardware support and deployment management is left up to the user, which can implement these functionalities through custom agents. There are no SDKs available, but the main programming language is Java, so a developer could build his own tools if required. Monitoring of devices is offered through the use of a geo-located map which highlights the state of the managed Things. Event management is handled through three options: When-Then [37], Groovy [38] or Flow [39] rules. These allow establishing interactions between the devices present based on a wide array of conditions. The analytics feature is satisfied through the use of custom dashboards, which can be used to analyze the historical usage or state of the assets. Authorization and access management have a basic implementation, allowing the creation of read/write users, but the underlying security system provides the potential for future improvements. OpenRemote has a few gaps to close to achieve production ready state, but its current set of features satisfies the requirements of a home IoT solution.

VI. FEATURE SUMMARY OF IoT PLATFORMS

This survey analyzes a wide range of IoT platforms and takes note of the commonly required features. A wide array of communication protocols and/or a variety of SDKs allows for a quicker integration process. Every integrated device needs to be authenticated, through a process named provisioning. This functionality was heavily researched as referenced in [40], hence it becomes a requirement for any enterprise level platform. Once the data flow is established, a user could declare himself satisfied with the status quo. However, as the devices grow in number, the need to give meaning to the data arises. An ideal IoT platform should be able to describe a Thing through its functionality; this way, the event processing system can take specific actions and further enhance the interaction between devices and user. Once the system has grown, the user should still be able to notice any problems in the environment. He should be able to monitor and analyze statistics regarding his devices' usage and in case of issues, he should be able to update any of the malfunctioning Things. Of course, from the perspective of the platform, all these actions must be audited and controlled through an extensive authorization system.

All the IoT platforms present in this paper were compared regarding the features described above, and the outcome of this comparison is presented in Table I.

TABLE I
IoT PLATFORMS COMPARISON

Feature	Cloud centric				Alternatives					Open-source	
	AWS	Azure	GCP	IBM	ThingWorx	MindSphere	Bosch	Cisco	Live Objects	ThingsBoard	OpenRemote
Extensive communication protocols	✓	✓	×	×	✓	✓	✓	✓	✓	✓	✓
Secure provisioning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
Thing modelling	✓	✓	×	✓	✓	✓	✓	×	×	✓	✓
Hardware oriented features	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	×
Deployment management	✓	✓	×	×	×	×	✓	✓	×	×	×
Event management	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓
SDKs	✓	✓	✓	✓	✓	✓	×	×	×	×	×
Monitoring	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Analytics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Authorization mechanisms	✓	✓	✓	✓	✓	✓	×	✓	✓	×	×
Accelerators	✓	✓	×	×	×	✓	✓	×	×	×	×

VII. CONCLUSIONS

Since the IoT industry is growing at an accelerated rate, both existing enterprises and start-ups try to capitalize on its potential, which always leads to the question: "Where to deploy the IoT solution?".

Due to the sheer number of IoT platforms (300 in 2018 as mentioned in [41]), only a slice of them were analyzed. This survey was conducted by accessing either trial versions of the platforms, where possible, and/or through the analysis of their publicly available descriptions. Analyzing platforms from different subcategories, a set of common features emerged, which were used for the comparison of said products. While some of these characteristics are more important than others, such as security, some of them cannot be easily gauged. The survey at hand follows a broad use-case of utilization for these environments, so changing this angle of perspective might put the result of this paper in a different light. For example, a consumer interested in implementing an IoT solution for farming equipment won't be affected by the fact that a platform doesn't support the HTTP protocol, as long as there exists hardware support for his devices.

Hence, the answer to the initial question cannot be easily obtained. While some of the cloud centric platforms seem to cover all the features evaluated, their user experience could prove too complicated to handle. On the other hand,

if the solution in question is more focused on IIoT, maybe the platforms providing extensive hardware support might fit better; or, if the scope of the task at hand is smaller, such as a home project, an open-source option might be favored.

As such, for future work, these platforms could be reviewed through the perspective of representative use-cases: an enterprise solution for smart-homes, a solution for healthcare equipment or the management of a large-scale farm.

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Digital governance: Towards a successful digital transformation of Moroccan universities

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Abstract

This work is concerned with the issue of digital governance of Moroccan universities, by focusing on some experiences that have dealt with the subject of the digital transformation of universities, for example the MISSION, RECET and AGENT project.

After the presentation of the experience of the MISSION project, we focus on the usefulness of setting up a digital workspace, the formalization of procedures and the definition of key performance indicators as support tools for improving the digital governance of universities. The conclusion sheds light on the successful digital transformation of Moroccan universities, which must not be done without the establishment of a specific framework of analysis and an appropriate organizational structure.

Keywords— Digital transformation, digital governance, academical, information system, digital workspace, KPI.

I. Introduction

The digitization of society is now a reality; no sector is left out of this transformation, including universities, which include new information formats, new modes of communication and more demanding users.

In this new context, information governance processes form a critical bridge between the systems inherited from the past and the agile platforms of the future. [1].

In 1987, Nobel laureate in economics Robert Solow pointed out that the massive introduction of computers into the economy, contrary to expectations, did not translate into a statistical increase in productivity [2]. To recap, technological developments and the implementation of new tools would not be enough to achieve the strategic objectives of an organizational being.

An information system (IS) is an organized set of resources that collect, store, process and distribute information, it is a socio-technical system made up of two sub-systems, social and technical:

- The social subsystem is made up of the organizational structure and people linked to the IS.

- The technical subsystem is made up of the technologies (hardware, software and telecommunications equipment) and business processes (business blocks) concerned by the IS.

In the technical subsystem, we consider the IT or computer system, which is the set of hardware and software assets of the organization intended to automate the processing of information. This is the visible part that everyone thinks of when it comes to IT projects.

In this work, we consider the following three axes:

- Organizational structure.

- Computer system.

- The Business process.

To ensure the development of the information system, we need to evaluate the existing system in universities.

Generally, the dimensions to be considered in the evaluation of the operation of an information system are the following: the quality of the processes used in an organization, the quality of the artefacts generated during the development, the quality of the data and, finally , the quality perceived by the end user [3] [4].

In the first section of this document, we will focus on harnessing the benefits of the MISSION project [5]. Its main objective was the   implementation of a national operational information   system   service

for Moroccan universities. Subsequently, we will deal with the point of support for improving the governance of universities by setting up a digital workspace, which must be based on a clear formulation of procedures and a determination of Key Performance Indicators (KPIs). In this sense, I will describe the experience of Hassan First University in the "Scientific Research" business process.

To conclude, we will propose questions whose answers can help improve the digital governance of universities.

II. TEMPUS MISSION 2012-2015 PROJECT EXPERIENCE

A. Project overview

Hassan First University launched in 2012 a project for the implementation of a national operational information system service (MISSION), this project, cofunded by the European Commission under the reference [530495-TEMPUS-1 - 2012-1-MA-TEMPUS-SMGR], aimed at modernizing the governance of 14 Moroccan universities (currently 12 after the merger of 2 universities). More specifically, the MISSION project aimed to provide each Moroccan university with an SSIO Operational Information System Service using an Integrated Management Software (An open-source ERP) and managing 4 business process (students affairs, Finance, Heritage and HRM) plus the "Scientific Research" business process.

It should be noted that alongside the improvement of governance, the Information System Service has planned to help the development of the University's missions in terms of teaching and research.

We usually distinguish:

- Operational processes (realization);
- Support processes (support or resources);
- Steering processes (management or decision-making);
- Measurement (outcome evaluation) processes.

Operational processes are at the heart of the business of organizations: Management of student registrations for example. The support processes symbolize the activity of mobilizing the means necessary to carry out operational processes: For example, support for training. The management processes reflect the activity of the information design allowing the activity to be managed: For example, monitoring the management of registrations. The measurement processes allowing the control of the differences between the results and the defined objectives. These measures allow continuous improvement of the processes.

The first deliverable of the project was the development of a master plan for the university information system distinguishing between the business processes of the University Presidency (strategic management) and institutions (operational management).

The motivations that encouraged the adoption of a master plan are:

- Maintain the link between genaral strategy and IS strategy.

- Prioritize IT investments according to the value brought.
- Find the balance between transparency and operational efficiency.

B. Discussion :

The fallout from the implementation of the information system should be felt on the way in which the business process are managed and on the administrative staff. But the non-exploitation of the benefits of the project hampered the improvement of the quality of information and its management. The governance aspect is therefore at the heart of the problem [6].

Digital governance concerns the development and initiation of projects related to digital activities on the one hand, and the management of information systems and the use of digital technology at the University on the other. It must be based on a digital device, a Digital Workspace, this aspect will be dealt with in the next section.

III. DIGITAL WORKSPACE

An digital workspace is a global digital information and communication system that must support personal and professional activity within a work community, which makes it possible, among other things, to:

- Modernize the services offered to users of digital services.
- Familiarize users with the uses of technologies, which not only allow them to learn better but also to better understand the knowledge society in which they will have to take place.
- Make it possible for everyone to demand alternative forms of teaching and learning.

A. The existing Digital Workspace: Case of Hassan First University

Hassan First University provides its students with an digital workspace synchronizing with the APOGEE information system (Application for the Organization and Management of Student Education) to provide students with a detailed view of their university course. This space is not used much, for the main reason is that each institution seeks to provide its students with specific tools.

Another point to consider is that the University's digital workspace targets students only, without considering other electronic services and resources, except news in sync with the web server.

This tool was used during the spring semester of the 2017/2018 academic year. Below are screenshots from the current digital workspace at Hassan First University.

After accessing their profile, the "my file" menu offers the student the possibility of consulting their marital status, addresses, registrations and grades and results: http://ent.uh1.ac.ma/uPortal/login.

B. Why an digital workspace in universitie ?

An digital workspace can be seen as a personalized device offering any authenticated user:

- A device that promotes, (re) creates social ties
  - between students

- o between students and teachers
- o between teachers
- o within and with the administration

- A system in line with current uses of information and communication within the scientific community.

- A system in line with current uses for the production of digital resources and services.

- A system in line with the individual and collective practices of the "internet generation": social networks, Facebook, twitter, YouTube…

C. The issues to consider

The deployment of an digital workspace within a teaching and research community must be based on the prior modernization of the information and communication system. This is a condition for the good governance of the services offered to users, their quality and the revitalization of collective intelligence [7]. The issues to consider are:

- Generalize the use of ICT / ICT.

- Respond to the current needs of the various stakeholders of the University: Students, teachers, staff and new audiences of the university.

- Anticipate the new needs of university stakeholders.

- Improve public service.

D. Proposed technical approach

Taking into account the experiences of Moroccan universities using the UPortal tool. These universities have customized the default environment to suit their needs. For example: Ibn Tofail University in Kenitra, Abdelmalek Essaadi University in Tetouan and Hassan II University in Casablanca.

The approach proposed in this section is developed on the basis of my knowledge in the field, my parallel training, my internships and my experiences. It does not require additional investments, but rather an appropriate organization, which aims at a portal operating autonomously and then gradually connecting it to the various components of the information system: LDAP directory, CAS authentication server and Apache server.

Before detailing our functional approach, below is a diagram giving an overview of the technical approach presented at the Marrakech meeting of the AGENT project (support for the improvement of university governance by setting up an digital workspace), organized from 05 to 07 December 2013.
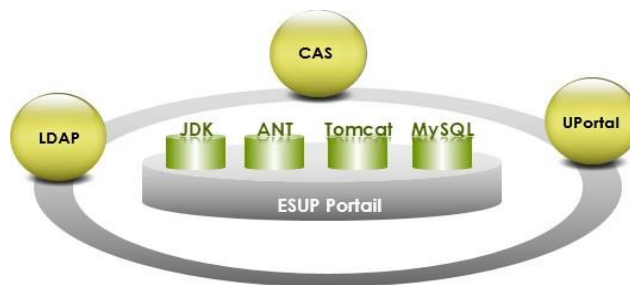

Fig. 1 The ESUP-Portal solution

The main features of Esup-Portal are:

- Support for different Database Management System (DBMS), uPortal can be linked with different databases: Mysql database, oracle, SQL Server, postgre SQL… etc.

- Direct access to the DBMS (JDBC) or by pool (Tomcat).

- Support for different authentication mechanisms, it can use different directories such as Active Directory, open LDAP or other.

- uPortal user accounts and self-creation of accounts.

- uPortal user attributes and mapping to other sources.

- uPortal groups and permissions, specify for each use the utilities needed for the installed applications.

- Channels and Portlets, to categorize and organize portal content.

E. Functional approach

Taking into account the above, the design and support of the organizational changes targeted by the establishment of an digital workpace, involves:

- Identify and act on the key success factors: information system, communication, intranet, resources, skills, ..

- Identify the actors, organizational proposal to be implemented:

  - o Organization for the dissemination, installation, operation, maintenance and evolution of IT developments.

  - o Organization for the supply and animation of content and services.

- Emergence of new "professions".

- Training actions.

- Administrative organization of the system.

Beforehand, we define the functional scope of the Digital Work Environments:

- Identify and study the services currently offered to the various stakeholders.

- Identify the needs for new services.

- Specify the services to be integrated directly and which will be accessible through the digital workspace.

- Define access modes and profiles: authentication,

user authorizations, location, type of terminal, availability…

The prerequisites to consider in setting up the digital workspace are:

- A project team and a project manager.

- Secure network architecture and administration (including the intranet).

- IT equipment and services for management.
  - The base of an ERP / ERP integrated management software package is installed
  - The LDAP staff directory is up to date.
  - The messaging system is open to all members of the establishment.
  - Connectors for third-party applications (eg: APOGEE, Moodle, shared calendars, storage, etc.) are available.
  - Authentication (CAS) is in use.
  - The web content management platform is in place (CMS).

- Administrative and educational governance is organized and roles and tasks are established

- Unified, secure access to the range of services and resources of its working community.

- The rights and modalities of contribution to the production of content are fixed

- Users are informed and trained in the proper use of the digital work environment.

- The resources are available as soon as the digital workspace is put into service.

So the functional architecture will be as follows:
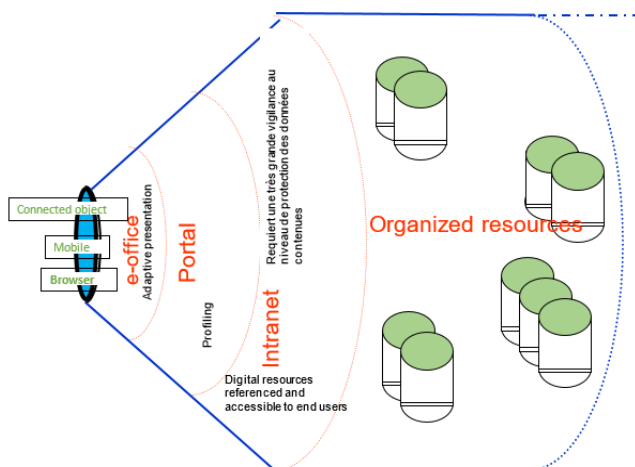
Fig. 2 Proposed functional approach for digital workspace

My proposal inspired by the experience of the University of Bordeaux Montaigne.

A successful Digital Space must be based on a Digital Master Plan clearly framing the strategic objectives and the means to be put in place to achieve them. For the development of a master plan respecting the strategic orientations of the university, we must formalize the work procedures, in order to better understand our activity [8], without forgetting the key performance indicators (KPI) as decision-support tools [9].

IV. FORMALIZATION OF PROCEDURES AND KEY PERFORMANCE INDICATORS

A. *Formalization of procedures*

The formalization of procedures will allow us to think about our own mode of operation and, more precisely, the improvement of processes to have better visibility and readability.

To formalize is also to schematize our daily actions using flowcharts, the main objective of which is to describe graphically and understandably by all the operating diagrams of the processes [10].

A single document covering the entire procedure: an introductory part, a flowchart (activity diagram), the procedure in detail (in editorial form) with the necessary documents.

Secondly, the writer (s) will ensure that a summary of the procedure is inserted, which can sometimes span several pages depending on its complexity.

We will find there in a summary frame:

- The objective (s) of the procedure (eg the administrative and financial set-up of a research project)

- The launch of the procedure.

- The closure of the procedure.

B. *Key performance indicators: Case of the business process "Scientific Research"*

Performance in an organization everything that, and only what, contributes to achieving strategic objectives, several notions can be linked to performance:

- Effectiveness: Carrying out an action

- Efficiency: Be concerned with obtaining the expected results at a lower cost

- Adequacy measure: Between the strategic objectives initially defined and the results actually achieved.

Performance - target achievement - is therefore closely linked to the notion of strategic management. In practice, this means making available to the management of the organization a limited number of various indicators grouped together in the form of a "dashboard", with the intention of helping its managers in their decision-making. strategic decisions.

The indicators are in the form of accounting and financial data, physical data characteristic of the activity (amount in MDH dedicated to research activities in a university for example), ratios (financial ratios, returns, etc.) or even qualitative information (synthetic opinions of students on the evolution of

research structures within a university, for example).

A comparative study was carried out in 2016 by the university, between the indicator guide for the research component developed within the university, the user guide for the RECET self-assessment benchmark (Strengthening of Competences in Institutional Assessment) [11] in the field of research And the questionnaire of the board of Accounts relating to university research and to which the university must respond. A study that I presented during the 5th edition of the Open Source Days, February 23 & 24, 2016, National School of Applied Sciences-Khouribga.

The question asked: Do the indicators currently defined ensure the coverage of all the university's evaluation criteria in the research component?

Concerning the correspondence of indicators defined in the university guide compared to the questionnaire of the Court of Auditors and RECET:

Evidence covered by indicators is 12%.

If we are interested in the indicators relating to the research component, they are divided into four sets:

- Research capacity indicators.
- Indicators of production of research activities.
- Capacity indicators for innovation and technology transfer.
- Production indicators in terms of innovation and technology transfer.

C. Discussion

In this section, I have presented the usefulness of formalizing procedures as a tool to help improve processes and understand the way of working. Among the good reasons for formalization:

- The time spent will be a benefit.
- Trust does not exclude follow-up.

The definition of key performance indicators will help to steer and measure the effectiveness and efficiency of an organization's processes.

IV. CONCLUSION

A successful digital transformation must not be done without the establishment of a specific analysis framework, and an appropriate organizational structure helping to optimal decision-making, that is to say an improvement of digital governance.

Improving digital governance requires the establishment of a Digital Workspace. A successful Digital Space must be based on a Digital Master Plan clearly framing the strategic objectives and the means to be put in place to achieve them. For the implementation of the Digital Master Plan, we must carry out a diagnosis of the current IS perimeter by answering the following 4 main questions:

- What are the strategic goals for digital?
- What are the preferred activities for the university with the most digital needs?
- What are the priority projects?
- What is the situation of the digital existence?

Afterwards, we will design and re-engineer the process mapping and target processes.

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CONSUMER ENGAGEMENT IN VALUE CO-CREATION: PROPOSAL OF AN EXPLANATORY MODEL

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*Abstract-*Value co-creation has been a key issue in marketing research for the past twenty years. Behavioral observation reveals a reality where consumers are active and wish to participate in the company's activities by sharing and creating knowledge. Companies, in turn, have understood the value of taking advantage of such resources to achieve their objectives. We propose a model that highlights the motivations of consumer engagement in value co-creation activities. To this end, we present a literature review and use self-determination theory as a theoretical framework.

Keywords-value co-creation, consumer engagement, self-determination theory, motivations, model

I. INTRODUCTION

Historically, only companies that know how to adapt to the new realities of their markets have survived. The development of new technologies has been accompanied by a multitude of new behaviors on the part of consumers and companies.

For example, Decathlon invites sportsmen to take part in its product development projects through a dedicated platform. Likewise, Ikea or LEGO offer customers to participate at different levels of co-creation and to mutually benefit from engagement platforms that promote the exchange and pooling of resources and skills. The consumer is now considered as a partner and the link with the company is conceived as a relationship of sharing and co-creating.

Two approaches account for the co-creation phenomenon in marketing. The evolutionary approach of Prahalad and Ramaswamy (2000), which highlights the evolution of the consumer and the desire to take power, and the approach of Vargo and Lusch (2008), who believe that the consumer has always been a co-creator of value through consumption and the meaning he or she gives to it.

Our work aims to enrich the literature through understanding the motivations that drive consumers to engage in value co-creation activities.

II. VALUE CO-CREATION: THE CENTRAL ROLE OF THE CONSUMER

A. The evolutionary logic of the consumer's role

For a long time, the consumer was considered as the means for the company to make profits in exchange for the value created. However, the consumer has gradually freed himself from this relationship of dependence. Consumers today are even looking for freedom and "power". Several researchers have examined this notion (Wathieu et al. 2002), which has led to the emergence of a stream of marketing research aimed at providing consumers with more tools, freedom and resources in order to improve their sense of autonomy and meet their need for power. This evolutionary logic was initiated by Prahalad and Ramaswamy who developed their theory around the evolution of the consumer's role (Prahalad and Ramaswamy, 2000; 2004 a; 2004 b). S/He goes from being a passive consumer to a partner who co-creates value with the company.

Moreover, consumers are seen as "more active, more participative, more resistant, more activist, more playful, more social and more community-oriented" (Cova and Carrère, 2002). They are in search of recognition and for this they don't hesitate to mobilize the resources made possible by the Internet to enter into relationships, to interact and to make their voices heard (Cova, 2008).

Whether initiated by companies, consumers or other stakeholders, the evolutionary approach is interested in how these actors collaborate to co-create value, in the processes that allow them to exchange knowledge and skills (Parahalad and Ramaswamy, 2004a) and in the mechanisms that promote the shift from a transactional perspective to a collaborative one (Leclercq et al., 2016).

B. Service-dominant logic

The second approach, called the service-dominant logic, (SDL) (Vargo & Lusch, 2004; 2008; Lusch & Vargo, 2014a; 2014b) complements the evolutionary approach. It purports that the consumer has always co-created value and that it is

the researchers who have come to adopt a new view of their role.

This approach suggests that companies are always delivering service (Vargo and Lusch, 2011) and that products are a set of value propositions (Cova, 2008) which makes them services that require the mobilization of consumer resources to extract value and derive satisfaction. This is in line with the idea that the consumer has always had the possibility of appropriating the object of consumption and diverting it from its initial use, according to his/her needs and desires (De Certeau, 1980; 1990 cited in Hamdi-Kidar (2013)). The consumer gives meaning, his or her own meaning, to the lived consumption experience (Holt, 1995).

The LSD approach focuses on the exchanges of resources between actors and how these exchanges lead to the co-creation of value (Maglio and Spohrer, 2008; Read et al., 2009). Thus, during the process of value co-creation, each of the actors takes on two roles in turn, the provider and the recipient. The former offers resources and the latter integrates them in order to reciprocally create value (Lusch and Vargo, 2011).

Interaction between actors plays a key role in facilitating resource exchange (Grönroos, 2008) and takes place through online or offline engagement platforms (Ramaswamy and Gouillart, 2010). Furthermore, interactions and resource integration are an opportunity for actors to gain skills and knowledge generating engagement in co-creation activities (Payne et al., 2008).

C. Value co-creation as an approach

Co-creation from the perspective of Prahalad and Ramaswamy (2004) is defined as "an active, creative and social process, based on collaboration between producers and users, initiated by the firm to generate value for customers." Lusch and Vargo (2011) propose to understand it as "an exchange between suppliers who offer resources and recipients who integrate these external resources to create value through consumption". According to Payne et al. (2008), this exchange implies the engagement of actors in interactions through a platform allowing them to provide, receive and create resources.

Leclercq et al. (2016), in their literature review, define value co-creation as "A joint process during which value is created reciprocally for each of the actors (individuals, organizations or networks). These actors engage in the process by interacting and exchanging their resources. The interactions take place on an engagement platform where each actor shares its own resources, integrates resources proposed by other actors, and potentially develops new resources through a learning process.

Engagement in a value co-creation process is the result of drivers identified as motivations, it also causes consequences for the different actors involved (Leclercq et al., 2016).

Engagement in the value co-creation process originates in motivations of various forms. The literature identifies the following criteria: altruistic versus non-altruistic motivations, intrinsic versus extrinsic motivations and personal versus social motivations.

Furthermore, consumer value co-creation can occur at different points along a continuum (Firat and Venkatesh, 1995; Vargo and Lusch, 2008). Indeed, the literature on co-

creation agrees on common characteristics regardless of the moment of participation, namely; the willingness of the consumer to participate with firms, the firm evolves and wishes to leverage consumers and finally consumers and firms agree to collaborate.

The literature identifies two levels of intervention, upstream and downstream. In both of these forms of co-creation, exchange platforms are necessary to promote the meeting between actors. Whether online or offline, these platforms offer the possibility of discovering new uses and trends through the sharing of one's own resources, the integration of other actors' resources and the development of new ones in a learning dynamic (Sawhney et al., 2005; Leclercq et al. 2016). The stakeholders of value co-creation considered in marketing are often companies and consumers without being exhaustive. Indeed, these stakeholders can also be suppliers, competitors or even public institutions involved in the process (Prahalad and Ramaswamy, 2004a; Vargo and Lusch, 2011).

The value created through the co-creation process can take the form of knowledge, skills, or relationships (Arnould et al. 2006). In a context of value creation through consumption or use, actors mobilize and activate operating resources defined as a set of knowledge, know-how, expertise and capacities, as well as operating or material resources such as infrastructures that facilitate this process (Vargo and Lusch, 2008). Depending on the nature of the resources mobilized, the literature identifies several profiles of co-creative consumers, such as lead users (Von Hippel, 1986; Vernette et al., 2013), emerging users (Hoffman et al., 2010), "market experts" (Feick and Price, 1987) or "boundary spanners" (Bullinger et al., 2010).

Leclercq et al (2016) explain that the relationships between actors in a value co-creation process are characterized by several factors. The interaction which can be in the form of a single participation or a succession of participations (Frow et al., 2015), the interactional structure which sets the number of participants, their interactions, and the interaction environment. Thus, interactions can follow a dyadic or network logic (Parahalad and Ramaswamy, 2004a). The mode of coordination that represents the rules of operation and the sense of hierarchy (Aitken and Campelo, 2011) and the relational dynamics taking the forms of competition, competition, or cooperation (Bullinger et al., 2010) are two other factors.

As mentioned above, value co-creation implies several consequences for the different stakeholders. For the company, value co-creation generates gains in terms of innovativeness and creativity (Hoyer et al., 2010) and consequently better performance. It also leads to a better response to consumers' needs, to the creation of involvement with the offer (Nambisan and Baron, 2007) and to a reduction in the risk of failure (Bogers et al., 2010). Moreover, through value co-creation, companies develop and strengthen their relationships with the actors involved (Roser et al., 2013). For so-called "passive" consumers, the co-creation of the offer by participants considered similar to themselves provides a perception of quality that positively impacts consumer loyalty, purchase intentions and willingness to pay (Fuchs et al., 2013; Schreier et al., 2012; Thompson and Malaviya, 2013). Finally, for other contributors, value co-creation positively impacts satisfaction, loyalty, purchase intention, propensity to pay, recommendations, and continuity of engagement (Atakan et

al., 2014; Bacile et al., 2014; Franke and Schreier, 2008; Füller et al., 2011).

III. VALUE CO-CREATION ENGAGEMENT

A. Engagement definition

The conceptualization of engagement is distinguished by two major phases (Brodie et al., 2011). The first includes concepts that relate to social science, management, and business practices (Brodie et al, 2011). Academic work has focused on civic engagement, social engagement, nation engagement, student engagement, and employee/stakeholder engagement (Brodie et al., 2011). The second phase relates to the marketing literature (Brodie et al., 2011). There, the concept of engagement is conceptualized as "who is committed to what" (Angeles Oviedo-Garcia et al., 2014). Thus, the subject of engagement can refer to a customer, consumer, or user and the object, perhaps a company, brand, product, company activity, or media (Hollebeek, 2011).

Many marketing researchers propose multidimensional definitions referring to cognitive (experience), emotional or affective (feeling), conative or behavioral (participation), and social (interaction and sharing of experience or content) dimensions (Islam & Rahman, 2016).

Patterson et al. (2006) define customer engagement as "the degree of physical, cognitive, and emotional presence in a relationship with a service company", Higgins and Scholer (2009) understand consumer engagement as "a state of being involved, occupied, fully absorbed, or captivated in something, sustained attention". Brodie et al. (2011) identify customer engagement as "a psychological state that occurs as a result of interactive and co-creative customer experiences with a focused agent or object in service relationships." Vivek et al. (2014) focus on the behavioral dimension and define engagement as "the level of customer (or potential customer) interaction or connections with the company brand or offering or activities, often involving other customers in the social network created around the brand, offering or activity." Storbacka et al. (2016) refer to actor engagement and define it as "the willingness of both actors to engage, and the activity of engaging, in an interactive process of resource integration within a service ecosystem." Finally, in their literature review Leclercq et al. (2016) see consumer engagement as "a degree of connection between actors. A multidimensional iterative process including cognitive, affective and behavioral aspects".

B. Engagement in co-creation activity

Higgins and Scholer's (2009) definition of consumer engagement as "a state of being involved, occupied, completely absorbed, or captivated in something, sustained attention" has a universal character and suggests that engagement in value co-creation concerns all fields. In the context of work research, Saks (2006) focuses on employee engagement and defines it as "a degree to which an individual is attentive and absorbed in the performance of their roles. We note that engagement is linked to the accomplishment of a task or performance and that it occurs in the context of interactions between value-creating actors, dictated by the different roles played by the employee. For these reasons we find this definition to be interesting for our work.

Van Doorn et al. (2010) posit that consumer behavioral engagement (CEB) can be defined as "behavioral manifestations toward a brand or firm, beyond purchase, resulting from motivational factors." These manifestations of a positive or negative nature include word-of-mouth activity, referrals, helping other customers, blogging, writing reviews, and engaging in legal actions. According to Van Doorn et al. (2010), the factors that most impact consumer engagement behavior are attitudinal factors (satisfaction, brand dedication, trust, brand attachment, and perceptions of performance) and consumer goals (maximizing consumer benefits or maximizing relational benefits or resources of time, effort, and money). The most known consequences related to consumers are cognitive, affective, and conative effects. Satisfaction, trust and dedication fall into this latter category. However, as mentioned earlier, these concepts can also be antecedents to engagement in a situation where customers are already consumers (Hollebeek, 2011). Value co-creation and loyalty are also seen as consumer-related consequences of engagement.

Furthermore, Leclercq et al (2016) define value co-creation as a joint process during which value is created reciprocally for each actor. Value co-creation is thus understood as a process of exchange and joint creation of resources between actors. Lusch and Vargo (2011) consider co-creation as an exchange between providers who offer resources and recipients who integrate these external resources to create value through consumption. Exchange implies the involvement of actors in interactions through an engagement platform allowing them to transmit and receive resources and even create new ones through learning (Payne et al. 2008).

Leclercq et al (2016) point out that this process of value co-creation is the result of drivers identified in the literature as actors' motivations and that it has consequences for each of them.

According to Lusch and Vargo (2006) "co-creation involves the participation of the customer in the creation of the offer. It is done through the sharing of inventiveness, co-design, or the shared production of related goods". Thus, co-creation occurs when the customer participates through spontaneous and discretionary behaviors that make the customer-brand experience unique.

Finally, the concept of engagement is conceptualized in marketing as "who is engaged in what" (Hollebeek, 2011). Thus the "who" or subject can be the customer or consumer and the "what" or focal object can be a product, brand, company, activity, or media (Hollebeek, 2011). In our research context, the attribute will be engagement, the subject will be the consumer, and the object will be value co-creation.

To the definitions by Saks (2006) and Higgins and Scholer (2009), we add the definition proposed by Thion (2018): "consumer engagement in value co-creation is a psychological state, a degree by which the consumer is absorbed and attentive in the performance of value co-creating interactions." This definition, largely inspired by the two previous ones, completes them and highlights the three constituent elements of the consumer engagement in value co-creation construct.

IV. DÉTERMINANTS OF VALUE CO-CREATION

A. Drivers of engagement in value co-creation

Using motivation to explain behavior is somehow asking why individuals act the way they act or behave the way they behave (Fenouillet, 2017). In the field of marketing, Higgins

and Scholer (2009) believe that individuals are motivated by goals that are either ephemeral or fundamental. Motivation is being moved to do something - "to be moved to do something" (Ryan & Deci, 2000).

According to the dominant service logic (DSL), "value can only be created with, and determined by, the user," (Lusch and Vargo, 2006). Other research also suggests that customers participate only if they can anticipate benefits from the relationship (Ennew and Binks 1999). Similarly, Ryan and Deci (2000) and Higgins and Scholer (2009) suggest that individuals need to be motivated to engage in activities. Later, Van Doorn et al. (2011) consider that consumer engagement behavior results from motivations. This research is corroborated by Leclercq et al. (2016) who highlight the role of motivation as drivers in the value co-creation process.

Numerous classifications of motivation have been proposed by researchers, with two main categories identified: intrinsic motivations and extrinsic motivations. On this basis, Amabile (1993) believes that individuals are intrinsically motivated when they seek pleasure, interest, satisfaction of curiosity, self-expression, or personal challenge in a task and extrinsically motivated when they engage in an activity in order to obtain a purpose distinct from the activity itself.

Our work aims to determine the impact of different forms of motivation on consumer engagement in value co-creation. Self-determination theory focuses on how motivation affects choices (Deci and Ryan, 2008); namely the "what" and "why" of actions. In our case, this is engagement in the co-creation task. Furthermore, in addition to distinguishing between intrinsic and extrinsic motivation, this theory specifies the different forms of extrinsic motivation. Finally, as this theory has been the subject of empirical work in several fields, it can still be applied to several contexts as suggested by Deci and Ryan (2008).

Researchers believe that individuals need to perceive themselves as the origin of their actions. They identify three fundamental psychological needs: autonomy, competence and social connection. Motivation related to these needs will emerge in several forms, including intrinsic motivation and extrinsic motivation. The former occurs when an individual takes part in an activity voluntarily out of pleasure or interest in that activity itself. The second occurs when an individual's participation in an activity allows him or her to achieve a specific outcome that is separable from the activity itself (Ryan and Deci 2000). In the classical theory of cognitive evaluation (Deci and Ryan 1971, 1985), the concept of self-determination is important, intrinsic motivation is aroused by needs that everyone develops to a greater or lesser extent, those of feeling competent and self-determined and free to choose from the options offered. Situational and environmental factors can play a decisive role in strengthening or weakening intrinsic motivation, depending on whether the individual perceives them as constraints or as supports for his or her autonomy.

Self-determination theory suggests that extrinsic motivation can vary between autonomy and control on a continuum (Gagné & Deci, 2005). An action dictated by an external factor such as a reward or constraint is externally regulated. Motivation is introjected when the control of an individual's behavior comes from an internal factor such as the ego or public self-awareness. Extrinsic motivation will be identified when goals are fully accepted as self, but behavior remains instrumental (Ryan & Deci, 2000). Extrinsic motivation will be integrated when an individual's goals are fully accepted as consistent with their own values and identity. According to Bendapudi and Leone (2003), the willingness to engage in co-creation requires a high degree of involvement with the product. According to Etgar (2008), customers must not only use their knowledge, share their creative ideas, and make changes to product concepts, but also be willing to invest a significant amount of their time. Faced with the monetary and non-monetary implications of co-creation, individuals proceed to compare the costs and benefits they will gain from engaging in co-creation activities (Hoyer et al., 2010) and only voluntarily engage when the outcome is rewarding (Füller, 2010). According to Vivek et al. (2012), customers' motivation to engage is related to their goals, resources, and expectations in terms of outcomes or perceived value co-creation (Hollebeek, 2011a).

This includes a range of motivations beyond monetary ones (Zwass, 2010) and social, technical, and psychological factors all play a role (Füller, Matzler, & Hoppe, 2008).

According to Jaakkola and Alexander (2014), some drivers of co-creation may come from its intrinsic value. From the consumer's perspective, Behavioral engagement may be driven by the benefits derived from the behavior itself (Gummerus et al., 2012). The customer interaction experience itself can be a source of value and thus a motive for engagement. In a virtual community context, Nambisan and Baron (2007) indicated that consumer participation in product support activities is primarily motivated by belief in the benefits of engaging in such activities and not just by civic or normative considerations.

In the same context, enjoyment is also a primary driver of engagement in creative activities. Individuals may seek pleasurable experiences and take part in virtual co-creation projects because they consider it an intrinsically rewarding and cognitively stimulating activity (Füller, Matzler, Hutter, & Hautz, 2012).

Hoyer et al. (2010) discuss psychological reasons for consumers to participate in the co-creation process (the feeling of self-expression and the sheer pleasure of contributing in terms of creativity). Extrinsic benefits may also be behind engagement in co-creation, such as social benefits, increased knowledge, and economic benefits (Füller, 2006). Social incentives such as reputation within a desired group (Casaló et al., 2010), recognition of expertise (Hoyer et al., 2010), and strengthened connections with others involved (Nambisan & Baron, 2009) can foster consumer engagement (Dholakia, Blazevic, Wiertz, & Algesheimer, 2009).

In sum, the benefits that the customer expects from participation may be cognitive gains (learning), social integration (increased sense of belonging or gain of social identity), personal integration (gain of reputation, status, or self-efficacy), and hedonic (stimulating experience) (Nambisan & Baron, 2007, 2009).

According to Füller (2010), most users are motivated by a combination of intrinsic motives (enjoyment and altruism), internalized extrinsic motives (learning, reputation), and wholly extrinsic motives (payment or career prospects).

Lusch et al (2006) identify six key factors that contribute to the involvement or level of participation of the customer in the co-production of the service offering. Expertise, control,

"physical capital", risk-taking, psychological benefit and economic benefit have been identified. These are therefore intrinsic and extrinsic factors.

Dahl and Moreau (2007), in turn, identified three motivational factors: autonomy (the pleasure of freedom of choice, which enhances intrinsic motivation, sense of belonging and creativity), competence (the satisfaction gained from the success of the project) and task interest (one of the main drivers of engagement in creative activities). Füller et al (2011) build on these factors and add a fourth: sense of community. Individuals engaging in co-creative activities are not only interested in the content but also in the interactions with others and the possibility of building a network of relationships based on shared interests.

Finally, Roberts et al. (2014) synthesized the findings of different researchers to show that motivations differ across forms of co-creation. Thus, innovation independent of the company is based on egocentric and intrinsic motives (increasing personal skills and abilities in addition to the desire to improve the product), innovation within a community of users is based on altruistic motives and is therefore both intrinsic and extrinsic (social exchange, intrinsic need for recognition and acceptance by peers), whereas innovation in direct collaboration with the company is based on opportunism and the expectation of rewarding results and is therefore extrinsic.

To summarize, the literature identifies two main types of motivation: intrinsic motivation and extrinsic motivation, which can be considered as two independent constructs or as a continuum that allows for the internalization of extrinsic motivation.

Some studies have shown the positive influence of extrinsic factors on intrinsic motivation, while others have warned that extrinsic factors can undermine intrinsic motivation in certain cases.

B. The explanatory model of consumer engagement

In this research we try to understand the determinants of consumer engagement in a value co-creation activity. We wish to highlight the role of motivations in the engagement in a co-creation activity.

Our problem statement is formulated as follows: What is the role of consumer motivation in the engagement in value co-creation?

Our research hypotheses are structured as follows:

H1: The stronger the consumer's intrinsic motivation, the stronger his engagement in value co-creation.

H2a: The stronger the consumer's integrated extrinsic motivation, the stronger his engagement in value co-creation.

H2b: The stronger the consumer's identified extrinsic motivation, the stronger his engagement in value co-creation will be.

H2c: The stronger the consumer's introjected extrinsic motivation, the stronger his engagement in value co-creation will be.

H2d: The stronger the consumer's externally regulated extrinsic motivation, the stronger his engagement in value co-creation will be.

H3a: The stronger the consumer's integrated extrinsic motivation, the stronger the intrinsic motivation will be.

H3b: The stronger the consumer's identified extrinsic motivation, the stronger the intrinsic motivation.

H3c: The stronger the consumer's introjected extrinsic motivation, the weaker the intrinsic motivation will be.

H3d: The stronger the consumer's externally regulated extrinsic motivation, the weaker the intrinsic motivation will be.
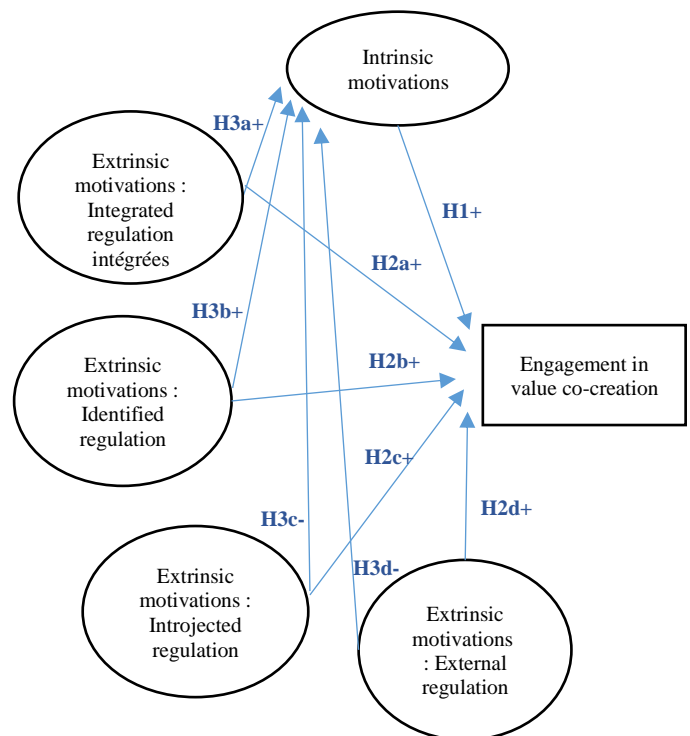
Our research model is as follows:

Figure 1: Explanatory model of consumer engagement in value co-creation (ourselves)

V. Conclusion

Our literature review shows that value co-creation is a concept that can take several forms and that the process can be triggered by the company or by the consumer. We have adopted the Vargo and Lusch (2002) point of view, which considers that the consumer is always a co-creator of value through use. Self-determination theory proposes to explain consumer engagement in value co-creation processes through the types of motivation and their intrinsic or extrinsic origin (Ryan and Deci, 2000). We learn that intrinsic motivation increases engagement and on the motivation continuum, the more extrinsic motivation is internalized the stronger the consumer engagement. The proposed research model accounts for the assumed links between the different types of motivation and engagement in value co-creation. In the logical continuation of a hypothetical-deductive research protocol, the confrontation of the model with reality will allow us to test its explanatory power and eventually identify the factors that could moderate the effects of such motivations.

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Traditional banks' strategies against FinTech:
The case of Morocco

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Abstract —

This work aims to study the different strategies of banks facing the fintech revolution based on an empirical study among some Moroccan banks, the results of this study show that Moroccan banks are mostly aware of the opportunities and threats of these new players. As a result, several strategies are possible.

Keywords—FinTech, banks, strategies, digital, Morocco.

I. INTRODUCTION

Since the financial crisis of 2007, the principles of finance have been challenged by the change in regulations in the banking sector and the intensive use of digital technologies that began in the 1950s with credit cards. Indeed, Blockchain introduces the notion of trusted third party, big data allows for better risk management, and crowdfunding platforms redefine financial intermediation. As a result, new players designated by FinTechs[1] are emerging and the distribution methods of traditional banking and financial services are changing. Also, customers are adopting an unprecedented behavior and forcing traditional banks to be more transparent. Faced with the rise of FinTechs, traditional banks are responding by mobilizing monitoring systems and implementing cooperation strategies with these FinTechs. Various forms of cooperation have been envisaged depending on the issues pursued by these banks and the integration effort they wish to ensure.

In Morocco, a new banking law, Law 103-12, has been in force since 2014. It is far better known for its introduction of participatory banking than for what it brings to FinTech. Indeed, this law introduces two concepts that are essential for the development of Fintech in Morocco. The concept of the Establishment and payment agent which will put an end to the monopoly situation of the banks of the services and means of payment. In addition, Bank Al-Maghrib published two circulars concerning payment institutions and payment services allowing its implementation. Furthermore, according to a study entitled "Digitalizing Africa: The rise of Fintech

Companies," conducted by PwC in Morocco in partnership with Casablanca Finance City on the evolution of FinTech in Africa, Morocco seems to be well prepared to accompany the development of these FinTechs despite an ecosystem that is slowly evolving.

In view of given this situation, a question deserves to be asked: What are the strategies of Moroccan banks in the face of the FinTech revolution? The objective of this article is to answer this question by examining and analyzing the reaction of banks to FinTech.

To answer this research question, our paper will be organized in two parts. The first one presents the factors that overwhelm banks today and make them fragile in front of fintechs as well as a review of the strategies implemented by banks to counter fintechs. The second part will be devoted to an empirical study whose data are derived from a questionnaire intended for professionals in Moroccan banks.

II. BANKS FACING FINTECHS: A REVIEW OF DIFFERENT STRATEGIES

A. *The three factors that make banks vulnerable to fintechs*

a. *Prudential regulation*

Banks are at the heart of the financing of economies, mainly where financial intermediation is more advanced. In order to maintain the stability of the banking sector and reduce the risk of bank failure, regulators intervene through laws and mainly prudential regulations to protect both savers and borrowers. However, while the 2008 financial crisis confirmed the need to adapt prudential regulations, financial institutions denounced the excessive cost of the new Basel regulations, a cost that would inevitably weigh on the activity of banks, and consequently on economic activity [1].

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[1] The Financial Stability Board (FSB) defines FinTech as "Technology-based financial innovation that could lead to new business models, applications, processes or products that have a material impact on markets, financial institutions and the delivery of financial services."

Despite these benefits, which lie in allowing banks to have sufficient and quality capital, contribute to reducing the severity and scale of financial crises as well as improving the resilience of the banking system in case of a crisis. These additional capital requirements for banks in terms of solvency regulation and liquidity risk contracting the supply of credit, a key variable in the financing of economies, so the strengthening of bank capital means an increase in regulatory capital holdings to the detriment of the bank's resources.

Protected a long time ago by specific and complex regulations, the banks are now prisoners of this new regulation. Indeed, all these new rules weigh heavily on the banking sector and do not allow it to react with the flexibility and agility it needs to adapt to innovation: These are not only prudential requirements, but also requirements related to the organization of the institution, not to mention the heavy compliance rules, all of which do not allow institutions to respond effectively to the new expectations of customers. [2]

However, fintechs are exempt from regulation and have a more flexible status, as their activities do not cover all banking services.

b. The traditional mode of organization

The second constraining factor for banks is the way they are organized. Indeed, the traditional players are structured vertically, and all their action revolves around the product, its design, its production, its marketing and its sale to customers. In addition, the calculation of margins and the analysis of profiles are made according to the products [2].

With the arrival of the Internet and the democratization of its use, this mode of organization has profoundly changed. In fact, this mode of organization becomes inefficient and very difficult to manage. On the other hand, the new digital players, and more specifically the fintech players, organize themselves horizontally, and according to the customer. Therefore, a product or service can only be sold to a customer if it meets the customer's need [3]. Fintechs analyze customer behavior and leverage their agility to offer and deliver products that perfectly meet the needs of consumers. In the end, the fintechs' organizational mode is more adaptable, more agile, and more resistant to shocks and complexities.

c. Distribution via Agencies

The distribution mode via bank branches will be impacted in the coming years by this disruptive technological upheaval [4]. En effet, ce mode de distribution a vécu longtemps sans aucun changement. In addition, branch network maintenance costs, as well as IT costs, are the highest cost category for banks, while customers use of the branch network is becoming increasingly infrequent.

In summary, the heavy structure associated with the existence of a very old and overabundant distribution mode and a vertical and inefficient organization mode that is more difficult to manage, as well as a regulation that has become very demanding and constraining, make banks less agile and inert in the face of technological innovation and unfit for revolutions and facilitate the emergence of new players.

B. banks' strategies towards fintech

With the rise of fintechs, traditional banks are responding by mobilizing monitoring devices and by implementing several strategies and forms of collaboration. We review these different strategies and their benefits.

a. The Investment Strategy

With a diversified and aggressive investment strategy, banks can quickly position themselves on the services offered by FinTechs, and thus catch up. According to a survey conducted by Statista in February 2015, 20% of banks are choosing to compete with fintechs through an investment strategy and 10% through acquisitions.

According to the KPMG 2020 report, FinTech continues to attract investors from around the world. Indeed, since 2014, investors and acquirers have had a sustainable interest and continue to engage with fintechs[5]. This involvement and movement of funds concern all types of investments, stages of growth of the company: venture capital, development capital, mergers and acquisitions.

Banks recognize that digital transformation is a critical competitive factor and therefore investing in FinTech is a strategy to gain direct access to the new technologies they need to meet their customers' needs.

b. The collaboration strategy

Besides the investment logic, cooperation between banks and fintechs remains the most common strategy. According to the Global Banking Report, in 2017, 91% of banks and 75% of fintechs said they were willing to cooperate. This collaboration may take the form of commercial and distribution partnerships that allow the partners to open up new horizons and segments in this strategy, each actor brings to the other what he can do better. On the one hand, fintechs with their platform bring agility and the ability to process huge amounts of data in a very short period of time and, on the other hand, banks bring customer trust, huge potential of economy of scale and better risk management.

c. The Coalition

A coalition model is emerging to enable the various actors to protect their interests. Indeed, alliances, both joint and opposing, between banks and fintechs have been emerging in recent years as demonstrated by many of initiatives such as R3, a consortium of 45 banks that is designing standardized solutions based on distributed ledger technologies similarly, UBS's Fintech Innovation Lab in London gives banks the opportunity to explore the potential of blockchain and catch up with fintech in terms of innovation. It allows for partnerships with banks and testing within the Ethereum protocol.

The objective is to collectively develop norms and standards around these new disruptive technologies and to identify new use cases.

d. Incubation and acceleration

Several banks have chosen to adopt this strategy as another approach to collaboration with fintechs. Indeed, according to a survey by Efma-Infosys Financial Innovation, 43% of banks participate in incubation programs, it is impossible to treat them all in an exhaustive way, here are some examples among

others In France, Crédit Agricole is launching CA Store, a platform open to developers to create applications for the bank's customers, and Le Village, an incubator for young start-ups in all areas of the tech industry. For example, BNP Paribas has created a FinTech accelerator in collaboration with L'Atelier, which brings together banking professions and fintechs to address business issues. Finally, Barclays launched a dedicated fintech accelerator program in London in 2014, in partnership with Techstars.

In the end, whether they choose to ally themselves or oppose the banks, Fintech has become unavoidable. Taking an increasingly important position in the banking sector, Fintechs have become so dominant that they are succeeding in supplanting banks in their field, as a precursor to PayPal.

II. THE STRATEGIES OF MOROCCAN BANKS FACING THE FINTECH REVOLUTION

After examining the different strategies of banks internationally in the face of the fintech revolution. We will focus this section on the Moroccan context and see how Moroccan banks will react to fintechs.

A. Methodology

In order to collect the necessary data to conduct a qualitative study, this approach was chosen, as it is the most appropriate way to answer the problematic of this article in the Moroccan context. We chose to set up an online questionnaire via GOOGLE FORMS which we distributed in two different ways: by email and by diffusion on the networks (Facebook and Linkdln). There are several advantages to submitting a questionnaire online. It is relatively simple to administer and facilitates the collection, analysis and interpretation of the information collected.

In this questionnaire, we have opted only for so-called structured questions. In this type of question, the author of the questionnaire determines a series of valid answers, but also the answer format.

B. Presentation of the Sample

The objective of this research is to study the strategies and reaction of Moroccan banks to fintechs. To achieve our objective, we will use a qualitative approach. This choice is dictated, on the one hand, by the nature of the research question and, on the other hand, by the lack of statistical data on the subject.

Due to limited resources and the inability to specify a sampling frame, we opted for a purposive sampling method to select respondents. The objective is to get answers from people working in the banking sector who are concerned by Fintech. Finally, our sample of respondents is essentially made up of the personnel of 3 participative windows and 13 Moroccan banks with universal character.

C. Results and data analysis

We begin our analysis of the results obtained with a brief description of the profile of the respondents to the questionnaire. Of the 45 who responded, 31.1% were women, or 14 people, and 68.9% were men, or 31 people.

*Figure 1: distribution of respondents by gender*
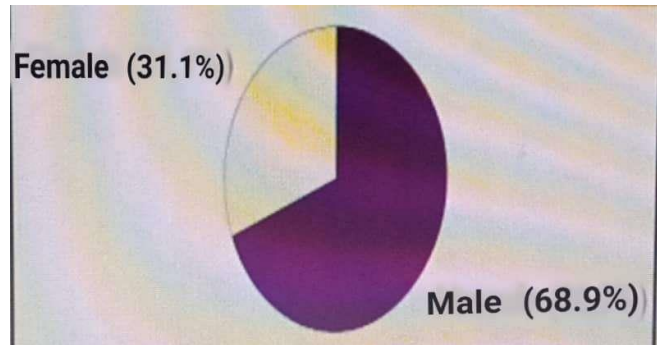
Source: survey data

Regarding the age groups, the two best represented are the 25–34 years and the 35–44 years with 53.3% and 24.4% or 24 and 11 respondents each. Then, we find the least represented are 65 years or more (0%) and the under 25 years with 4.4% or two people. Then we find the 45–54 year-olds and the 55–64 year olds with 11.1% and 6.7% or 5 and 3 respondents each.

We received responses from all participatory banks and six conventional banks and a single dar Al aman participatory window from Société Générale. In addition, the most represented banks are BCP and CAM with 28.9% and 26.7% respectively or 13 and 12 respondents for each. For the most represented participatory banks are Al akhdar bank and Assafa bank with 6.7% or the same number of respondents 3 for each.

Figure 2: Banks participating in the survey
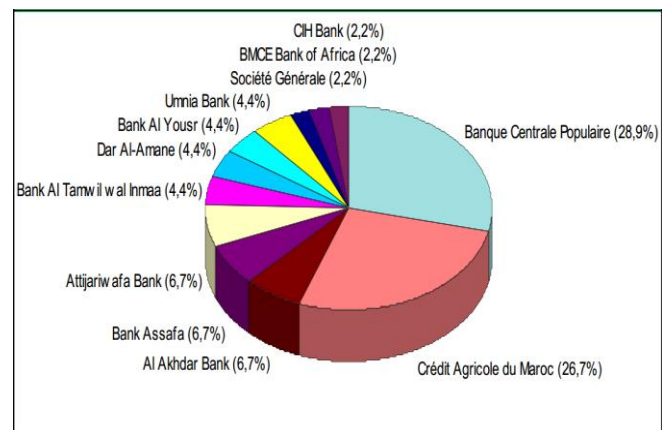
Source: Survey data

Regarding the strengths of fintechs, the answers are surprising, most respondents recognized these strengths. Indeed, 40% of respondents strongly agree that customers will opt for fintech services because they are simple, fast and efficient and 31% also strongly agree that fintechs are less demanding in terms of guarantees. At the end, 28.9% strongly agree that the services offered by fintechs are cheaper than those offered by banks.

In addition, we are looking at the extent to which Moroccan banks are ready to react to the repercussions of FinTech. The results show that 55.6% or 25 respondents consider their bank to be unprepared for the repercussions of fintechs and only 2.2% of respondents said their bank is extremely prepared. In addition, 73.3% of respondents indicated that their bank would invest in fintechs if there are

good opportunities and 26.7% say their bank looks forward to fintechs enthusiastically.
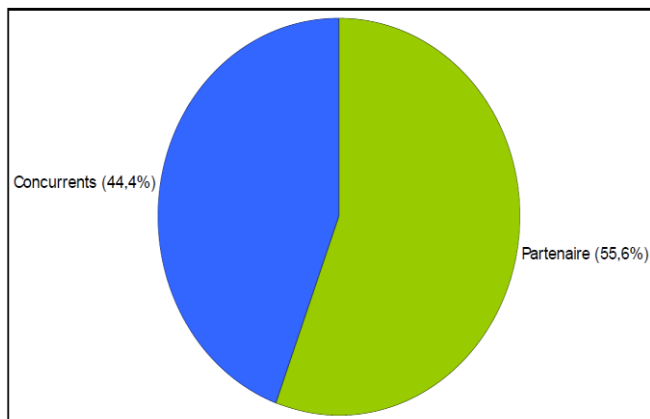
Figure 3: the current state of Moroccan banks in the face of fintechs
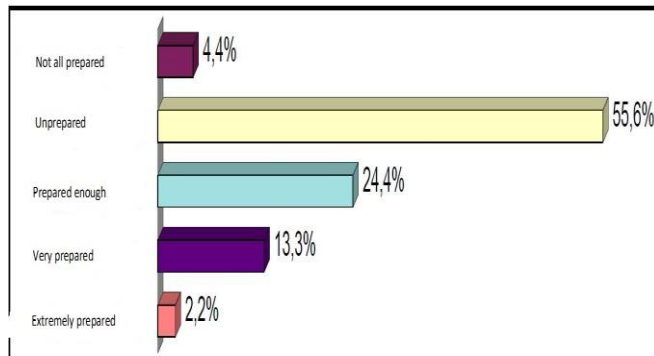
Source: Survey data

In addition, we want to know the nature of the relationship of Moroccan banks with fintechs.

Figure 4: The perception of fintechs

Source: Survey data

In this sense, 55.6% of respondents confirmed that it will perceive fintechs as partners, while 44.4% will perceive it as competitors.

Regarding the current state of Moroccan banks towards fintechs, 28.9% of bankers surveyed indicate that their bank monitors fintechs in order to respond competitively and 24.4% indicate that their bank will engage in a partnership with fintechs. In addition, 17.8% say that their bank will proceed with the purchase of the services offered by fintechs and only 15.6% who say they will not deal with fintechs.

C. Discussion of the Results

The results of the analysis of this questionnaire show that the majority of Moroccan banks are aware of the opportunities and threats of these new players. Indeed, most respondents say that the rise of FinTech within the banking sector allows them to develop products and services, accelerate financial inclusion, improve customer retention and reduce infrastructure costs. As a result, 55.6% of respondents confirm that their bank sees fintechs as partners. In this sense, Moroccan financial institutions are increasingly interested in Fintech, as evidenced by several events and initiatives such as the "Fintech challenge" of the Banque Centrale Populaire, the "Smart Up Hackathon" of Attijari Wafa Bank and the

partnership between Société Générale and CEED for the "Open Tech Challenge."

Nevertheless, a share of respondents indicates that the rise of fintechs threatens traditional players. These threats are increased price competition, loss of market share, information security (threat of privacy) and increased customer churn. It is for this reason that 44.4% of respondents say their bank perceives fintechs as competitors.

It can therefore be concluded that Moroccan banks can be segmented into two groups. On the one hand, the group that perceives fintechs as partners and seeks to seize the opportunities offered by them and, on the other hand, the group that considers fintechs as competitors and seeks to avoid their threats.

We can deduce that Moroccan banks will adopt strategies according to their perceptions of fintechs. Thus, 73.3% of the participants in our survey say that their banks will invest in fintechs if there are good opportunities, then the strategy that comes in second place is the partnership with fintechs and the strategy of acquisition and purchase of services offered by fintechs comes last. With these strategies, Moroccan banks align well with banks globally. Thus, according to the World Fintech Report of 2017, 38% of banks plan to invest directly in start-ups that develop banking/finance services 90 and 18.6% evokes a possible takeover. While 29.6% rely on the creation of accelerators and 34% collaborate with training organizations.

CONCLUSION

Whatever the strategy adopted, these two actors bring valuable assets. Fintechs are technology-driven, testing new solutions and exploring what is technically possible, without being tied to existing systems. Applying innovative concepts, they generate a very large number of ideas in a very agile way.

In addition, FinTech entrepreneurs innately use social media technologies to support their work, from idea-seeking to consumers contact after launch. Banks generally have a risk aversion and act much more slowly due to their regulatory limitations and responsibilities. Their banking capabilities allow them to open accounts, keep money, extend credit, and offer other regulated products and services.

In addition, they can add their industry, legal, regulatory, compliance and risk management expertise and give FinTech access to their own customer base. Overall, they can reduce the barriers to entry for fintechs in the financial services sector.

Together, fintechs and banks are creating an ecosystem that enables them to better meet customer needs and close the gap between the services offered by traditional banks and customer demands.

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Digitalization and quality control in a construction site: case of Moroccan companies

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Abstract— **The goal of this article is to shed light on the influence of digitalization on the construction and building sector, as well as how integrating digital technologies into construction enterprises' activities can improve a variety of performance indicators. We are constantly striving to improve our sales, better satisfying the demands of our clients, and, mostly important, meet deadlines.**

The organization manages to optimize time in all stages of construction thanks to the digitalization of construction processes, including the quality control process, which is the topic of our research. We provide a mobile-based digital solution for monitoring and processing non-conformities, which can be used to verify for compliance with protocols and track progress until final delivery. The digital technology allows businesses to save a significant amount of time when completing projects.

Keywords— *Digitization, construction, indicator, non-conformity, platform*

I. INTRODUCTION

The construction sector is an important economic pillar in Morocco, and it encompasses all building- related industries (the building, the seconds of work and the architectural batches).

The field of the building and civil engineering is the second potential creator of employment in Morocco after agriculture, representing a turnover of more than 59 MDH (1) and employing 10% of the active population of Morocco, thanks to multiple projects of instruction as well as the country's commitment to socio-economic programs of fight against the insalubrious habitat (2)

Moroccan enterprises are improving their management deficiencies and moving toward digital solutions to modify their technologies in order to be more equipped for national and international competition, as the construction sector is typically resistant to change. However, the digital transformation that this industry has undergone in recent decades meets the Moroccan company's challenges.

II. DIGITALIZATION

Companies have seen substantial changes with the advent of digitalization, which have had a significant impact on their competitiveness, investments, and the development of their employees' abilities. These changes are widespread, involving everything from individual job duties to the development of new collective models, new forms of interactions, the digitization of old processes, and new technical solutions that provide superior value to customers. As a result, digitization alters our society in several ways, presenting businesses with numerous new opportunities and problems as well.

In this regard, what is the difference between digital and digital transformation?

Digitization includes the implementation of new networks and connected devices that transform analog into digital without changing the actors involved, however when the business model of the company is affected by implementing a new process with new digital technologies (software,

application, tool ...) that change the daily lives of employees we talk about digitalization.

III. THE CONSTRUCTION INDUSTRY AND DIGITALIZATION

Nowadays, digitalization has shifted the construction industry toward digital technologies that touch all activities, beginning with support, payment management (PPM), supply chain management (PSCM), and accounting, all of which are done utilizing blockchain technology (3), In order to integrate the design, construction, and operation of buildings in a construction project, practice manuals have been developed as a reference to support the deployment of BIM software using 3D printing, production robots, and BIM software, the latter of which is about to become mandatory (4). (5).

And, like other services, quality must evolve through leveraging digitization.

By building a model for monitoring the compliance of a construction project with a regulatory framework, the compliance monitoring process might be automated, allowing for more effective monitoring (7).

And in this piece, we'll look at another revolution that the construction industry's quality control process has undergone as a result of the interplay of all other services and Big Data (6).

A. The influence of digitalization: a case study in quality assurance

In this section we will present a digital tool that has lightened the process of quality control of works.

From the studies through the delivery, this mobile application placed on a tablet or smart phone simplifies the management of controls and the rectification of non-conformities.

The objective is to standardize the controls used during execution and then validate them digitally, without the use of paper.

To do so, the contractor and the company meet to design a control plan and incorporate it into the computer tool, which has three levels of use.

As a result of utilizing the tool

Detection of non-conformities

The quality team integrates the FQs that have been designed in a specific way into the tool before starting the construction site, then the work managers fill in the forms during the execution and the quality team validates them.

Drivers no longer need to bring printed CFs to the field, fill them out manually, and then produce Excel reports. Everything is now done on-site with a tablet or smartphone, and reports are automatically generated and distributed to all staff.

Finition	3 / 3
Reprendre Bande	3 / 3
Angle À Reprendre	3 / 3
Fixation A Déplacer	3 / 3
Boucher Trou	3 / 3
Finition Enduit	3 / 3
Pose Ba13	3 / 3
Manque Une Bande	3 / 3
Bande Armée	3 / 3

Fig. 1 Exemple FCQ

Treatment of non-conformities

The tool will notify the quality management of any identified non-conformities; the quality manager will discuss the non-conformity, show it with pictures, and even provide solutions and a treatment deadline.

After the non-conformity has been corrected, the team leader notes on the tool that it has been treated as such, and the quality manager can close it if the remedy is complying.
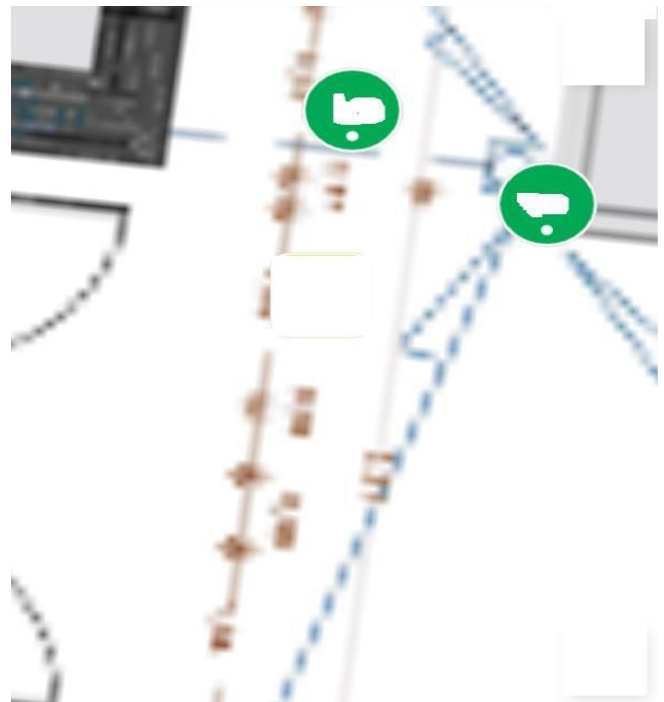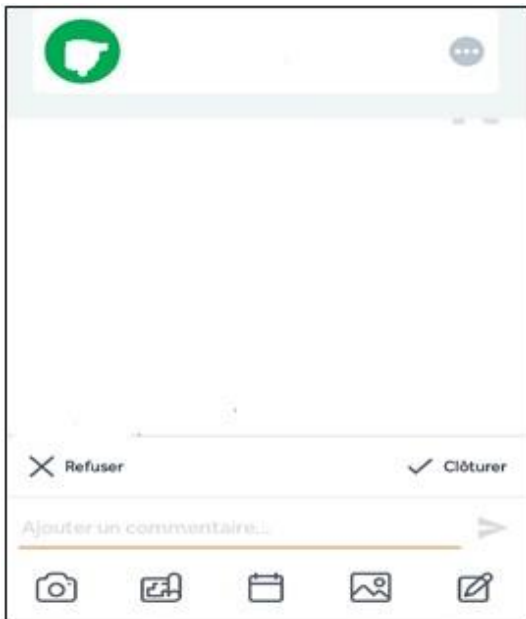

Fig. 2 non-conformities detected on a plan

Fig. 3canevas of non-conformity

The lifting of reservations

The project team prepares its OPR by following up on its reservations in real time. During easy trips to the construction site, collaborators can create reservations on the tool with the relevant information, and after lifting these reservations, the person in charge closes them on the spot.

The geolocation of the blocking sites made it possible to lift 70% of the reservations in half the time it would have taken to remove 100% of the reservations on a construction site without this digital tool.

The volume of reserves to be processed no longer poses a time constraint.
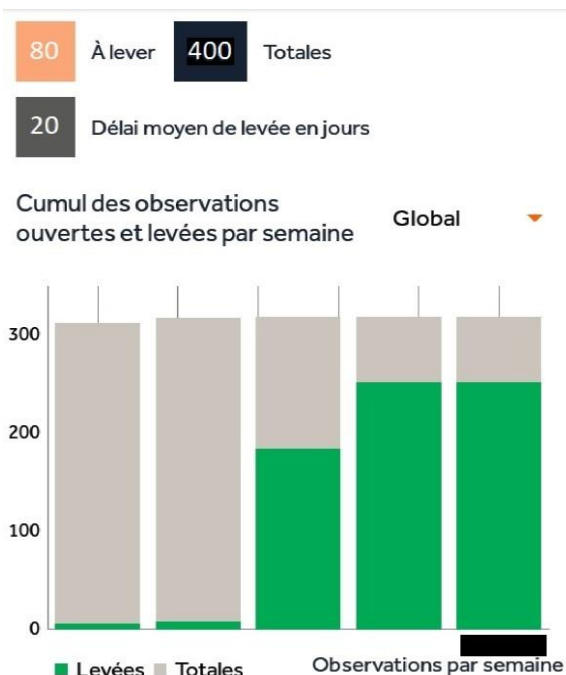
Fig. 4Statistics of reservations

IV. CONCLUSION

In summary, the digital tool demonstrated allowed first and foremost for the mobility of documents and plans, secondly, for the quick treatment of non-conformities (as soon as the non-conformity is detected, it is communicated directly to the tool for treatment), and thirdly for the reduction of delivery time due to the simple reception.

The construction industry's shift to digitalization has simplified operations, but digitalization-focused programs may not be effective on a bigger scale, leaving small enterprises unable (or unwilling) to participate (5).

To encourage all businesses to digitalize their processes, easier and less expensive technologies must be developed.

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A review on Business-to-Business Data Sharing technical solutions

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Abstract— **Interest in data sharing techniques and tools has been growing consistently over the years, given their goal is to facilitate the cross-sector collaboration of businesses. Automatic mechanisms for data exchange along the economic supply/demand chain are a necessity to ensure the proper development of Business-to-Business (B2B) processes. In this research, an overview over the data sharing techniques and applicability in the enterprise ecosystem is provided. Subsequently, a review of the most representative B2B data sharing software solutions is presented in terms of promised features and technological traits. Their analysis is concluded with a comparison in terms of technical and business requirements, characterized by relevant metrics. The aim is to clarify the advantages and disadvantages of using each alternative in the development of B2B processes and increase awareness towards their particular focuses and properties. Even if the approached tools contribute to the successful development of B2B data sharing processes, shortcomings are identified in terms of security, privacy, data modelling and data governance techniques. As a result, further research is needed to improve such systems into a generally applicable software solution.**

Keywords—**B2B Data Sharing, Data Confidentiality, Enterprise Tools for Data Sharing**

I. IMPORTANCE OF BUSINESS-TO-BUSINESS (B2B) DATA SHARING IN THE ENTERPRISE ENVIRONMENT

Considering the intense digitalization process the nowadays society has been subjected to over the years, traditional Business-to-Business (B2B) processes [1] evolved. In theory, we can describe a traditional B2B process as a series of events and steps which occur when one business attempts to purchase and sell products from or to another business, in order to complete the product manufacture process [2]. However, in practice, the products exchanged in the B2B process slowly transitioned from physical raw goods to digital information, given its value to offer insight over a business's end users opinions and desires [3]. Nowadays, any company engaged with Business-to-Consumer (B2C) needs to have an overview over the demand of its products reported to its supply capacity in order to survive the competition of other alternative businesses in the industry [4]. As a result, data sharing has become a key activity in the everlasting initiative of each business to improve its processes and products, with the goal of nurturing new opportunities. In this context, the activity of exchanging data between companies can be defined as "making data available to or accessing data from other companies for business purposes" [5] either by monetizing it or by offering it for free in a mutually beneficial trade with a business partner.

The advantages of performing B2B data sharing go beyond the improvement of B2C transactions, on which most business users usually focus. Data sharing is also necessary in order to innovate current Business-to-Government [6] processes and B2B relationships, taking into consideration the complete perspective of the economic supply/demand chain which can be built using multiple aggregated data sources [7]. Companies which take part in B2B processes with their suppliers and their buyers will be able to identify difficulties in potential and existing business initiatives from multiple perspectives. Subsequently, business representatives will understand the challenges faced by their partners during their partnerships and will be able to take mutually beneficial decisions.

Most companies which want to engage in B2B data sharing processes need to estimate the effort of integrating new mechanisms and technologies, in order to assess the feasibility of the whole process. In the B2B perspectives report [5], European Commission representatives outline some categories of techniques and strategies taken into consideration by businesses for the data exchange process, as shown in Table I.

TABLE I
B2B DATA SHARING TECHNIQUES AND REVENUE GAINING STRATEGIES

Data Sharing Technique	Revenue Gaining Strategy
Data monetization	a strategy preferred by companies choosing to share part of their data in order to increase their business profit; Gartner's report on "Magic Quadrant for Analytics and Business Intelligence Platforms" [8] shows several companies consider data sharing for revenue a significant aspect of their business plan - Microsoft and Tableau are leaders, Oracle and Salesforce are visionaries, while IBM and Alibaba Cloud fall into the Niche Players category; MicroStrategy and Looker seem to seek to make constant improvements to the existing processes, which brings the current B2B techniques gradually closer to an ideal shape;
Public data marketplaces	rely on public trusted entities that connect both data sellers and data buyers in one environment; usually, the

	companies developing and maintaining such platforms for businesses engaging in data sharing perceive a transaction fee for all exchanges
Industrial data platforms	a secure and private environment which is restricted to group of companies exchanging data for free voluntarily in order to facilitate new product and services development; companies developing this type of data sharing solution monetize it using a SaaS model [9] – the platform is deployed in a custom manner for each business partner in accordance to a licensing plan
Technical enablers	businesses which specialize in creating data sharing flows custom for companies; they do not offer a general-purpose product, but rather build custom integration and data modelling mechanisms depending on each partner's needs
Open data policy	companies choose to share some of their data in an open manner with other businesses; the value of the process is given by the resulting analytics which help businesses make long-term profitable decisions based on the needs of their consumer users and business partners

As stated in [10], achieving a performant business model requires designing reliable and cost efficient B2B data sharing processes. Reliability of a B2B data sharing process is given by technical and legal considerations a company must be compliant with in its evolutionary journey.

According to [5], the first challenges which appear in the B2B data sharing process are caused by the interoperability and standardization issues, along with the stale or insufficient quality of data. These issues result in operational barriers in the automatic data processing and analysis step.

Another important difficulty all businesses need to address is the cost associated to the storage, security and curation of the available data. Any software tool chosen by a company to fulfill its data sharing process needs to offer the option to only remove stale versions of the data, while continuing to offer metainformation about its former existence. This feature also ensures another concern of companies in regards to data sharing is avoided - denial or unforeseen termination of access to the datasets metadata by the data supplier is not possible.

However, the ability to assert ownership rights and define the legal extent to which shared data can be used, remains one of the top requirements of a company when choosing a data sharing solution. This request is ensured by designing proper data governance mechanisms [11] in the B2B data sharing platforms, while providing business customers with guidance and methodologies to follow. Furthermore, a solution offering a systemic approach to data sharing should be able to address concerns regarding potential loss of business competitiveness or exposure of trade secrets. This is possible by developing mechanisms to monitor and control the extent of usage for shared data.

Given the recent increase in user private data breaches [12], businesses are also concerned about ensuring compliance with data confidentiality regulations. As a result, B2B data sharing solutions should integrate methods to curate datasets prepared for sharing, in order to protect the privacy of users from whom the information was collected. Moreover, shared datasets should be subjected to clear license agreements. Both aspects help businesses avoid

litigation costs, which are usually implied when a business-to-consumer or business-to-business contract is breached.

Finally, costs associated to the skills development among employees within the company to analyze the available data is also an important aspect for businesses. This requirement can be ensured by the B2B data sharing software suppliers by providing an easy-to-use development environment, while ensuring all the necessary dependencies are included. It should be well-documented, offer paid support option to its business users and should be sustained by the community as well.

Given all the challenges involved, the majority of companies deciding to include data monetization as part of their business plan [13] reach the conclusion that developing and maintaining their own B2B data sharing solution is a very costly long-term investment [5]. As a result, some businesses decided to monetize the data sharing process by designing and deploying tools for companies wishing to improve their revenues by analyzing and aggregating data exchanged with their partners worldwide. In the following section, we present the features and drawbacks of each state-of-the-art B2B data sharing products. They are reviewed relative to the technical and business requirements companies engaging in data monetization have [5].

II. B2B DATA SHARING SOFTWARE ALTERNATIVES

A. B2B Data Sharing Solutions Review

Nowadays, data monetization can represent a significant source of income for businesses in any industry, given the existence of various technical solutions which facilitate B2B data sharing. In this section, the most promising public data marketplaces, technical enablers and industrial data platforms are presented, alongside with an overview of their significant features.

An outstanding provider in the public B2B data sharing marketplace sector is DataPace [14]. The proposed solution has the goal to support data collection from IoT sensors and trading activities performed by businesses with the resulted datasets. The data acquirement transactions are executed by businesses in a secure environment, which relies on a global-scale decentralized architecture, sustained by the Hyperledger Fabric blockchain technology [15]. Following this technological approach, businesses have the ability to easily quantify the value of data – through DataPace tokens - and to build smart contracts in order to ensure the integrity of data throughout transactions. The underlying blockchain uses businesses involved in trades and validators as stakeholders. In this context, the validator has the role to validate the blocks of transactions emitted by other stakeholders through the network. The fault tolerance of the network is ensured by the PBFT algorithm [16], in case certain nodes manifest malicious behavior. Smart contracts defined in the platform by companies are the base element in the data sharing process, since they define the terms of the data exchange. As a result, businesses improve the financial and technical security of their transactions, while reducing the costs implied by a conventional legal commitment. A significant disadvantage of using DataPace is the lack of built-in privacy assuring mechanisms. Each business must define its smart

contracts responsibly, in order to ensure there is no breach of data confidentiality regulations in the on-going B2B processes. Data governance features are not included in the current version of DataPace, which may lead to data ownership doubts and lack of control over the usage of the shared data. Redundancy of the datasets and the need to build custom integrations for each of them are also notable downsides. This is caused by the absence of a comprehensive data annotation strategy, which leads to interoperability and reusability issues. The usage of the solution is limited to the data collected by the platform linked IoT sensors, which greatly reduces its applicability in various B2B contexts.

One of the most promising public data marketplace solutions so far is Omnisient [17], a platform focused on security and privacy enhancing data exchange mechanisms to connect data producers and consumers. Omnisient offers two main products: a secure AI data exchange platform, which makes B2B data exchange safe and an anonymous campaign engine (entitled ACE), whose purpose is to allow companies to reach new potential customers without actually accessing or exchanging their personal information. The data sharing platform tries to overcome the challenge of data privacy regulations compliance, which businesses need to ensure, in order to gain consumer's trust and engage in data sharing for marketing purposes. The platform integrates the ACE engine, which helps brands grow their customer base by getting in touch with data partners. From a technological point of view, the platform is delivered to the customer as a client desktop application, which anonymizes the data at source before loading it into the administration and monitoring platform to allow other companies to execute queries and perform analytics. The architecture of this platform is based on the P2P model, with producers offering data to consumers through self-hosted APIs - thus the system is scalable and extensible. Data anonymization is performed by applying tokenization techniques [18]- the link between the original data and the tokens is kept in a vault outside the production environment - and reverse engineering of tokens to gain access to personal customer information should not be possible. Based on the uniquely generated tokens, identity matching of customers across datasets of different businesses is done. This allows businesses to conduct analysis and derive trends and opportunities over all data sources available. Datasets made available by businesses in the platform are structured according to the FAIR principles [19]. This technical feature should ensure data interoperability and the proper means to build comprehensive data governance mechanisms [20], although no concluding information is presented in this direction. A major downside of the solution Omnisient offers is that it only presents an enterprise version, with no paid support for companies offered and no community support. The lack of methods to formalize legal agreements between companies is another downside encountered, therefore no legal action can be performed in case one of the data partners breaches the trust of the other in terms of data usage.

Another remarkable solution for data sharing, access and reuse is offered by Opendatasoft [21]. Its product follows the industrial data platform solution, while including traits of the open data policy [22]. The resulting system is offered as a cloud-hosted on-demand product, since its target audience is represented by businesses with non-technical users. The Opendatasoft platform allows creating datasets from data resources in various locations, having different formats. The source data is restructured according to a data schema provided by the user to a generic extractor component. In order to enhance interoperability, metadata properties are extracted and structured using DCAT [23] and INSPIRE [24] vocabularies. Other transformations on data are done using processors defined in the platform by the user. The obtained data and metadata are given a unique record identifier, which is later used for indexing and the search engine integrated in the platform's APIs. Once a dataset is published, automatic data republish rules can be configured, in order to ensure data does not become stale. Another feature of the platform is its integrated marketplace, which allows businesses to browse datasets made available by others in an open manner or according to an invitation to collaborate, based on granted write access. Datasets or catalogs of datasets can be downloaded in multiple formats - such as CSV, RDF - and can be filtered and sorted based on user provided metadata. Information and content of the datasets can be either visualized and modelled in maps and charts using ElasticSearch [25] plugins or by accessing a custom API following the REST paradigm. Even though data reuse in datasets is not automatically identified, the user has the option to link its dataset to other data resources which were used in its creation. As a result, reuse of a dataset will be visible to other users in the platform and through the API returning datasets metadata in a Linked Data Format [26]. In terms of security, an access control mechanism is provided - a user can either make data available to everyone or provide write or publish access rights to individual businesses or users. To ensure datasets consistency and remediate unintended changes, a change monitoring mechanism is provided with a built-in feature to revert datasets to previous versions. Scalability of the presented SaaS platform [9] is ensured by its API driven architecture, where each main service offered by the platform is packaged in a standalone component, scaled horizontally and vertically depending on the number of users, datasets and API calls. A downside of this solution is the lack of privacy enforcing mechanisms, which should ensure shared data is shared without any infringement on current user privacy regulations, such as GDPR [27] [28] and CCPA [29]. Improvements should be made in the direction of data ownership and control of use provided to users. Access rights provided for datasets cannot be defined on time frames, which requires human intervention to ensure they are compliant with the legal agreements established between businesses.

Even if data monetization is a key focus for all data sharing solutions presented so far, Leapyear's [30] technical enabler distinguishes itself through its focus on data confidentiality, built on differential privacy techniques [31]. Their product provides tools for reporting, analytics and machine learning, which can be used by companies across a variety of datasets processed through the LeapYear's systems. LeapYear provides the technology to ensure data confidentiality, to extract its analytic value and preserve the scalability of the datasets in time. As a result, companies

engaged in B2B data sharing can stay compliant to all the data privacy regulations applied in business sectors such as retail banking, capital markets, pharmaceutics and healthcare. However, LeapYear does not offer a complete B2B data sharing solution, since the resulting datasets are not made available in a data marketplace for the clients to manage, exchange and reuse. As a way to eliminate this downside, LeapYear provides their business clients with the option to commercialize the privacy-preserving datasets through a partner's banking platform. The platform facilitates the data distribution and marketing process. It also processes the monetary transactions performed between data buyers and producers and ensures proper data usage by the buyers. Nonetheless, businesses also have the option to create custom integrations with data markets or other companies, since datasets processed by LeapYear are available through an API gateway.

Another trending technical enabler, creating custom flows for the data sharing needs of each business, is Epimorphics [32], which includes a set of instruments to manage linked data [26]. This solution provides support for its business customers in their custom data modelling process, as well as in the engineering of applications based on the resulting linked datasets. From an architectural point of view, the data management platform is designed on three layers: a component for load balancing and routing of requests, the application containing characteristic business flows and the data storage unit. The access to the linked datasets of each business can be done through API and user interface endpoints hosted on RDF servers, while the load balancing component scales their number. At the application level, a data management service is defined. Its purpose is to ensure the successful transition of datasets from unstructured to structured. The data modelling process is different for each business, depending on their needs and data quality. As a result, Epimorphics builds custom adapters for datasets, in order to ensure their client's data becomes compliant with FAIR principles [19]. In contrast to the business models of public data marketplaces and industrial data platform, Epimorphics representatives monetize the support they offer to companies in the initiative to process their data for integration in B2B flows. However, this reduces the opportunities of businesses to form new partnerships or easily find suitable external datasets for integration. Since user privacy is an important concern for companies involved in data sharing processes, the lack of privacy centered data curation represents a major disadvantage of using Epimorphics. Data exchange activities performed without any anonymization or deidentification technique result in legal complications for both involved parties according to confidentiality laws. Even though business clients are able to provide data access to their partners through an OAuth2 [33] secured API, proper data usage and assertion of ownership cannot be guaranteed. A proper approach to solve this issue relies on developing a set of features which allow businesses to govern their data.

A suitable solution for the frequently encountered problems of the B2B data sharing processes, relative to the data governance principles, is DataShareFair [10], an open source public data marketplace offering key features of an industrial data platform model. In the design of this platform, the Privacy-By-Design principles [28] were followed in the architecture modelling. In addition, the features of the system were developed using the researcher's own blockchain solution centered on data confidentiality mechanisms. This platform is decentralized, following the P2P architectural model - each company runs its own instance of DataShareFair, which is composed of two components: a resource management module and a data sharing module. The resource management module contains a Web interface for business representatives to access data sharing and management features. Each user action performed in this data marketplace platform triggers the execution of the suitable smart contract. The available smart contracts contain the business logic to manage and exchange data between companies. They are easy to use and maintain, given the ability to version and adjust them relative to the change in business requirements. Execution of a smart contract is done on the node of the initiating business, while the generated transactions are broadcasted to all the nodes in the network. To ensure the security and integrity of the shared data and its underlying model, all transactions are validated using a consensus algorithm before their commit in the blockchain. References to each business's data and metadata is kept in the blockchain, in order to be able to administer and monitor the changes in the shared data and extracted metadata over time. Aspects regarding reusability, accessibility, findability and interoperability are approached by developing in DataShareFair a set of methodologies based on the FAIR principles [19], used to model the data shared through the platform. The data sharing module allows businesses to directly connect and exchange FAIR data and metadata, without any intermediaries to identify and locate the requested datasets. This is possible by offering a FAIR Data Point for each business, which allows assertion of ownership and control of use over the data through encryption, reversible only on validation of the defined access policies through a smart contract. As a result, formalization of legal agreements is possible in DataShareFair through direct and group data sharing based on dataset specific access policies defined in the marketplace. Data governance mechanisms included in the platform are built on top of the FAIR compliant metadata modelling, controlled through the blockchain mechanisms.

Another promising public data marketplace is iGrant.io [34], a cloud-based data exchange and consent mediation platform. Its aim is to guide businesses in their drive to monetize datasets they gather from users, while staying compliant to data confidentiality regulations [27][28]. Compared to other key players in the data sharing solutions market, iGrant.io offers mechanisms to collect data about user activity directly from products. The extent to which data is collected and used is described by the business in the enterprise management platform. Subsequently, the consumer users have to consent to the vendor's defined terms if they wish to use the product. Businesses also have the ability to control the terms under which their data can be reused and shared among other companies using a wallet. These data management features can be integrated in software products using an operator, which provides access

to an indexed metadata registry. This repository is used by businesses to discover and exchange datasets which can be aggregated as data sources in custom service improvement flows. An issue in the data governance mechanisms offered by iGrant.io is that their only focus is on consumers. They can choose which businesses associated to the product can use their data. However, businesses are not able to control access rights over their user's data, nor can they manage which data is shared in the registry. Improvements are also needed in terms of datasets quality, since collected data is not structured to be reusable or interoperable. Considering data governance techniques included in the current solution are not designed for B2B processes, the option to define formal agreements between business directly in the platform would represent the first step to forming successful partnerships.

B. Suitability of the B2B Data Sharing tools relative to technical and business requirements

Each public data marketplace, industrial data platform and technical enabler solution described in Section 2.A offers to its business clients a set of meaningful features. Table II outlines their performance relative to a collection of relevant technical criteria, in order to perform a concluding comparison of their suitability to be integrated in the suite of technologies a company chooses to use in its data monetization plan.

TABLE II
B2B DATA SHARING SOLUTIONS TECHNICAL COMPARISON

Technical criterium	B2B Data Sharing Solutions						
	DataPace	*Omnisient*	*Opendatasoft*	*LeapYear*	*Epimorphics*	*DataShareFair*	*iGrant*
System Scalability	+	+	+	+	-	+	+
Security Mechanisms	+	+	+	+	+	+	+
System Extensibility	+	+	+	+	+	+	-
Methods to protect Data Confidentiality	-	+	-	+	-	+	+
Data Governance Mechanisms	-	-	+	-	-	+	-
Data Modelling to a Structured Format	-	+	+	-	+	+	-
Data Interoperability	-	+	+	-	+	+	-
Data Accessibility	-	+	+	-	+	+	+
Data Findability	-	+	+	-	+	+	+
Formalization of legal agreements	+	-	-	+	-	+	-
Easy-to-use environment	-	+	+	+	-	+	+
Dedicated components/modules for features	+	+	+	+	+	+	+
Includes the necessary dependencies	-	+	+	-	+	+	-
Administrative and monitoring tools	+	+	+	-	+	+	+
Well-Documented Solution	+	-	+	+	-	+	+
Paid Support 24/7	-	-	+	+	+	-	-
Trial version	-	-	+	-	-	-	-
Community support	-	-	+	-	-	-	+

Based on the analysis in Table II, we can conclude that Opendatasoft offers one of the most promising data sharing tools, given that it allows companies to exchange data in a secure and structured way, while providing the necessary support and documentation to build successful B2B processes. However, the lack of integrated data confidentiality mechanisms brings a great risk for businesses willing to share raw data, since they may be open to legal repercussions in case sensitive consumer data is exposed in the data sharing process.

The second data sharing solution in terms of fulfilled evaluation criteria is DataShareFair, which addresses the data confidentiality concerns businesses may encounter when using Opendatasoft. A strong advantage of this platform is that it manages to overcome technical impediments such as interoperability, scalability and accessibility issues, while taking into consideration the potential legal issues which arise in the data sharing process. Anyhow, some improvements in terms of support and community visibility should be made, considering the lack of an automatic way to sign up for trial and evaluate the solution.

Ranking third in the presented overview, Omnisient promises to deliver to its business users a complete set of features required to easily integrate and take advantage of the valuable insight data can provide. Nonetheless, the lack of built in data governance mechanisms and support, as well as the scarce documentation can become an obstacle in the way of acquiring new business clients for their truly remarkable product.

To sum up our technical analysis, we can state that the data sharing tools approached in this paper bring a significant contribution to the proper development of B2B integrations. Anyway, as we have seen in Table II, there are still aspects to improve to the existing solutions until businesses can engage in data sharing without having any concerns about the potential financial impact of a technical oversight.

III. CONCLUSIONS

Early B2B processes merely focused on the exchange of physical products to obtain the final product to be delivered in B2C transactions. However, the constant change in society's needs forces businesses to continuously adjust their production processes in order to match their end-user's expectations. Considering the need to optimize this initiative cost-wise, companies aim to obtain data in an efficient and reliable manner from all their suppliers and buyers. As a result, having a market for B2B data sharing platforms

which meet the legal, technical and economical requirements becomes an important prerequisite for companies concerned with building successful business plans.

In this paper, seven key solutions in the B2B data sharing industry are reviewed and evaluated in terms of their capacity to offer a scalable, secure and extensible system. Furthermore, their ability to offer data governance mechanisms and methods to protect data confidentiality is assessed, given the legal implications that may be generated by the lack of such features. Usability of the analyzed systems is quantified in terms of included dependencies, offered support and effort required to take advantage of all the advertised features.

In summary, presented tools serve their goal to facilitate the development of B2B processes by giving businesses powerful tools to share their data. However, concerns are identified in terms of usability, security, privacy, data modelling and data governance techniques for each of the approached solutions. Further research is needed to improve the current data sharing products, in order to obtain an efficient and reliable software solution to conduct all B2B data sharing processes.

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The Deployment of E-Learning in the corporate World:
Employee's Perception Analysis
Evidence from Morocco

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Abstract— Digital transformation has now become a necessity in all areas including education and training. More and more companies are rethinking their way of doing things by relying on ICT to boost their performance. Nowadays, companies are increasingly developing a learning culture within their structures in order to guarantee the required skills and qualification of their employees.

E-learning and distance education are a new way to improve the skills development process. Distance learning has many advantages and makes it possible to meet the requirements for adaptation and development of specific and essential technological skills.

This paper aims to explore and investigate the use of learning in the company, to assess the perception of employees of this training method. Theoretically, the findings suggest a literature review for the use of e-learning in different areas, which can help with decision-making in corporate world to extend and improve the use of e-learning systems for training and skills development. In addition, This study investigates employees' perceptions of the benefits that e-learning is expected to yield.

Keywords— E-learning use, perception, Moroccan companies

I. INTRODUCTION

In light of the current critical situation, digital transformation has now become a necessity in all areas including education and training. More and more companies are rethinking their way of doing business based on ICT to boost their performance. Nowadays, companies are increasingly developing a learning culture within their structures in order to guarantee the competence and qualification levels of their employees(1).

E-learning and distance learning are a new way to improve the skills development process. Distance learning has many advantages and can meet the requirements of adaptation and development of specific and essential technological skills.

The objective of this research is to assess the use of e-learning in the company, to evaluate the employees' perceptions of this training method (2).

E-learning is an English term that means learning through different technological means, whether in national education programs, higher education programs (3), corporate training programs, or executive training programs, with the aim of improving the process of learning (4).

II. MOTIVATION & METHODOLOGY

A. Motivation

E-learning is becoming increasingly important in companies (5). Thanks to its ubiquitous nature, it now provides companies with universal access to knowledge, which encourages employees to seek professional development by adapting their skills to the requirements of the workplace(6).The contribution of e-learning is threefold:

i.   Development of skills in a short space of time ;
ii.   Deployment of the same level of quality of training programs for all sectors (especially multinationals);
iii.   Reduction of training costs (7) .

B. Methodology

Qualitative research was conducted using a semi-structured interview guide with 68 managers from companies operating in different sectors. The selection was made at random. The interviews had the following objectives

i. To measure the extent of the deployment of distance learning using Information and Communication Technologies (ICTs);
ii. To understand employees' perceptions of e-learning and its challenges;
iii. To consider the opportunities and benefits that e-learning could bring to their work and their recommendations.

The results were analyzed in two stages: a pivot table to measure the quantifiable data (deployment of the e-learning system, experimentation with distance learning and company characteristics). The administration of the interview guide was carried out by telephone and face-to-face.

Figure 3 The sectoral distribution of the sample
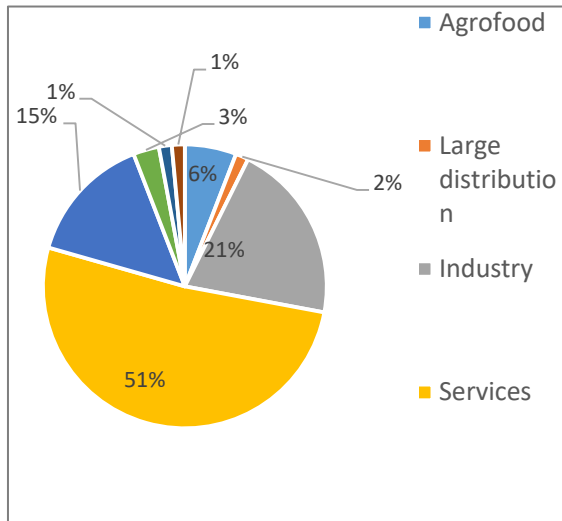
Grammar and Acronyms The sample respects the principle of representativeness of the population as more than half of the companies are from the service sector (cf.figure3).

Procedure methodology After having obtained the agreement of managers to participate in the survey, a rich interview guide was used to respond to respondents' perception of e-learning and to collect information on the company. The first part of the interview guide contained characteristics about the company such as the date of creation, the sector of activity and the

turnover. On the second part questions on the deployment of e-learning, its use, preferences and effectiveness were asked to assess managers' perception. The interviews were conducted in French , the most used language in the corporate life in Morocco .

III. RESULTS

Deployment of e-learning systems: Using the cross-sectional chart (cf. table 1), we have raised the extent of e-learning deployment.

Table N° 1 E-learning deployment and experimentation

The table shows that 55% of the total sampled respondents interviewed (N=68) declared having an e-learning system.
We can deduce therefore, the characteristics of the

companies that have implemented an e-learning system from the following elements (cf. Table1);
iii.   73% are large companies, 65% of which operate in the services sector;
iv.   The majority (43 %) are large companies with more than 50 years of seniority (cf figure 4) ;

Figure 4 E-learning deployment by seniority
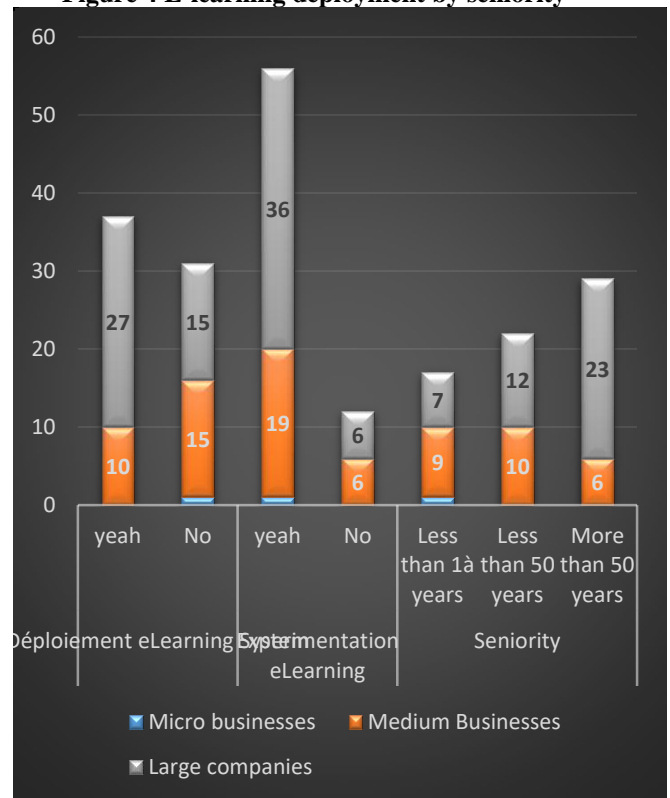
As for the experimentation of distance learning (cf. figure 5), we can say that the majority of respondents from companies of all sizes declare having already benefited from a distance learning program, which sets it as high as 82% of the total sampled respondents.

Figure 5: Experimenting with distance learning
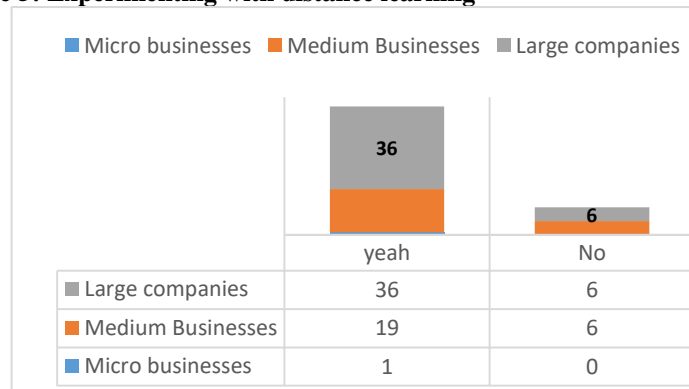
The word cloud (Cf. appendices 1) made shows that e-learning is now very common and well known. It's perceived like a tool of knowledge transfer using internet and ICT tools.

Thanks to the tree of words displayed by a vertical analysis of responds we can confirm that the vast majority of interviewees perceived the use of educational technologies positively. Nevertheless, the fact that it cannot replace face-to-face teaching is mentioned by a significant number of the participants in the study. We can conclude from the synthesis of the horizontal study that the use of educational technologies is beneficial and complementary to the face-to-face mode. (cf. figure 6 Words Tree). On the other hand, e-learning is perceived as a tool for the 'democratization of knowledge'

i. Acceptance of fully distance learning remains low compared to the hybrid mode favored by our respondents. This confirms the resistance to change observed among 16% of the respondents (figure 7)

Figure 7 Preference of training modes
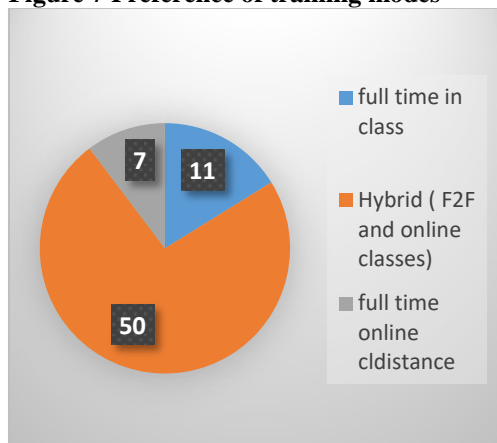
ii. Advantages/disadvantages of e-learning: The most cited advantages are consistent with the literature review in terms of cost reduction and autonomy in training and enrichment by respecting the learner's pace. The lack of interaction is often cited as one of the main limitations of e-learning, alongside technical problems such as internet speed and lack of technological equipment.

Research Limitations

The study was conducted with 68 executives, mainly from the public sector. As a result, the field of investigation was limited and does not allow for the results to be generalized over a wide spectrum

IV. CONCLUSION

The study was carried out during the covid 19 health crisis, when confinement and teleworking greatly favoured the use of e-learning in the workplace. This explains why the results of the survey are interesting as almost all respondents have experienced distance learning. In order to make the most of the integration of information and communication technologies and other innovative devices in the transfer of skills and knowledge at a distance:

i. Have a simple and adequate technological infrastructure (equipment, speed, etc.);

ii. Favouring the hybrid training mode according to the predominant preference in the responses;

iii. Provide support for employees during e-learning courses to avoid the feeling of isolation raised by the survey. This tends towards the development of e-learning 2.0 and collaborative learning

iv. E-learning itself is an innovation and requires the prior removal of resistance and reluctance to it, and it is necessary to destroy the stereotypes associated with ICT and digital technology in order to promote its use in the professional world.

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Appendices

The word tree of the responses " elearning perception'
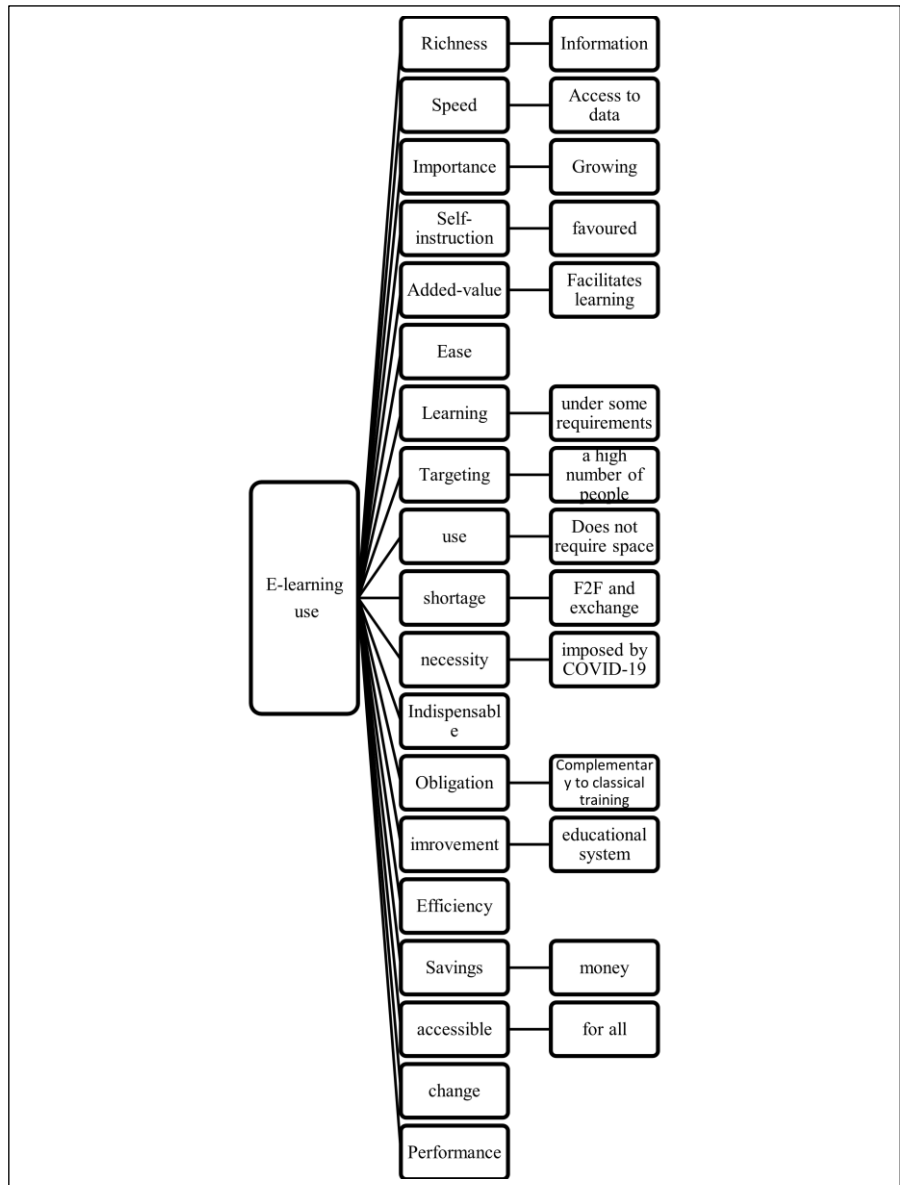
DIGITAL TRANSFORMATION IN EDUCATION IN THE ERA OF COVID-19: TOWARDS A SYSTEMIC APPROACH

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Abstract-

The containment period, following the pandemic that the whole world is now experiencing, has strongly contributed to the creation of new ways of conducting business and the adoption of innovative managerial practices. The health crisis of Covid-19 has highlighted the essential role of digital technologies in the continuity of services provided by various organizations, both public and private.

In Morocco, the rise of digital in several sectors is not only the result of the last health crisis, the digital transformation is a long process initiated by Morocco for several years to establish a new digital culture in the management of organizations. Through this article, we will study the impact of the health crisis on the digital transformation in the education sector while trying to answer the following central question: *To what extent has the current crisis laid the groundwork for the institutionalization of digital in the education sector?*

We postulate in our article that the crisis of covid-19 has only had an accelerating effect on digital transformation, while arguing that the development of digital in Morocco and particularly in education, our sector of study, should be accompanied by integrated digital strategies based on the principles of digital governance.

I. INTRODUCTION

Like many sectors where digital adoption is irreversible, the use of digitalization in education is currently undergoing a remarkable evolution.

When Covid-19 emerged abruptly, it did not give time for decision makers in all fields, including education, to gather information that they could refer to in order to deal with an unprecedented crisis.

In order to ensure pedagogical continuity, a decision was taken so quickly and without any transition or prior warning, to resort to virtual and distance online teaching, when neither the learners had the necessary skills such as autonomy and self-learning to adapt to it, nor the teachers had enough time to prepare for it, nor the infrastructure of the educational system is likely to support a change of such size both strategic and structural.

The main objective of this article is to propose a conceptual model for the institutionalization of digital in the education sector based on the accelerating effect of Covid-19 on the digital transformation in education, while trying to evaluate the measures that have been taken as a result of this crisis, to accompany this strategic shift in the field of education, insofar as it is the sector most affected and impacted by this pandemic.

II. DIGITAL TRANSFORMATION AND EDUCATION

Digital transformation refers to, according to Vial (2019), "*a process that aims to improve an entity by triggering significant changes in its properties through combinations of information technology, computing, communication and connectivity»* [1]

Faced with the current unprecedented situation, the digital transformation initiated by Morocco for several years has been an inescapable source to the challenges of the pandemic and mainly the digital challenge.

In Morocco, this transformation being a process that has materialized through the insertion, in its strategic vision of education and training 2015-2030, the development and consolidation of technologies as essential tools to ensure quality education.

The State's awareness of the importance and the stakes of digital technology for an open, smart and agile school of tomorrow must be accompanied by a preliminary work of deep reflection on the design of integrated digital strategies allowing the involvement and the participation of all stakeholders in this institutionalization of digital technology in this priority sector.

III. DIGITAL TRANSFORMATION AND THE IMPACT OF COVID-19

The education information system has undergone a significant evolution since 2013 with the implementation of platforms such as Massar and many others integrated into the ministry's information system to facilitate the management of schools. Nevertheless, the main concern of the Ministry of Education, via these platforms, was the collection of data from different parts of the system.

Covid-19 puts all organizations in Morocco, including those in the education sector, to the test of digital technology and the integration of new videoconferencing technologies to ensure the continuity of activities and services, particularly pedagogical continuity.

Covid-19 has had an accelerating effect on digital transformation through the development and exploitation of various virtual meeting options for leaders as well as several modalities of distance learning:

- Upgrading platforms to take and download courses remotely;

- Conclude partnerships with other sectors - with considerable experience in digital technologies- in order to involve them more in the management of this crisis.

- Mobilizing additional human and logistical resources to produce educational resources that may be required to meet:

*The requirements for structural change in teaching, learning and assessment methods.

*To the needs of learners during a critical period of transition and digital deployment.

In the face of this unavoidable crisis, Morocco has been able to demonstrate its agility and adaptability through a wide range of measures.

The experience of managing the pandemic clearly shows that the education system needs a new paradigm that includes innovation and agility while relying on the virtues of digital governance. *"We are facing a new need for complex transformation (...) was built on the recognition of the change of the teaching-learning paradigm"* [2]

IV. DIGITAL GOVERNANCE FOR DIGITAL TRANSFORMATION

The added value of this research is its contribution, with the help of a conceptual model based on a systemic approach, to lay the foundations for the institutionalization of digital in the education sector.

Our model advocates driving the transformation towards the institutionalization of digital through a approach :

- *Systemic*: Analyze the interactions between the flows of inputs and outputs of the educational system in order to maintain in a dynamic way, the self-regulation and the agility of the information system by adapting the decisions with the multiple changes of the environment. *"The system is not fixed; it is first of all a system of transformations (...), The key to these transformations lies in the notion of self-regulation.»* [3]

- *Transversal:* Insofar as the success of each transformation requires collaboration at several levels, and a multidimensional dialogue on the digital policies to be implemented.

- *Integrated:* An approach that should integrate both the accelerating effect of Covid-19 on the transformation process and the principles of digital governance, in order to manage the rapid evolution of this digital change taking into account an existing system that shows resistance to both the new organizational modes and the changes imposed by this digital era.
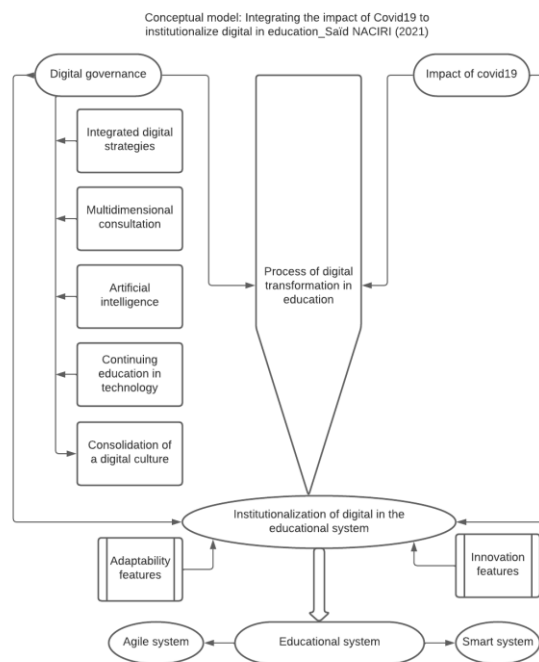
Fig.1: Model to integrate the impact of Covid-19 to institutionalize digital in education.

V. INSTITUTIONALIZATION OF DIGITAL AND THE SYSTEMIC APPROACH

The health crisis has highlighted the need to adopt a strategy where the education system must import the tools of management to move away from any logic based on the administration of education to that of the management of the educational act.

To introduce the systemic approach, GERMAIN, S (2018), based on the contributions of great authors and founders of management to explain the systemic approach as follows *"the organization is a system in interaction with its environment and it must adapt to changes in it. The approach consists of analyzing the interactions in all their dimensions: organizational, human, legal and technical in order to adapt the information system and the decision-making system of the organization. The analysis focuses more on the flows than on the elements and its main object is the regulation"*. [4]

1. **Integrated digital strategies and multidimensional consultation**

The regulation of the powers of the different actors in the field is both an issue and a key factor in this approach.

The new digital era requires a culture of collaboration and multidimensional consultation involving all stakeholders in the development, implementation and evaluation/monitoring of digital policies with the aim of moving beyond the lowest degree of coordination to a degree of consultation based on integrated digital strategies accompanied by institutional arrangements in order to provide the education system with the potential in this area:

- *Innovation and creativity* (new ways of developing policies, financing needs, designing infrastructures, managing and developing digital resources...)

- *Agility and adaptability to change* (a system capable of positioning itself in a way that allows it to better adapt to technological changes in the system's environment...)

2. **Consolidation of a digital culture**

Digital culture encompasses the cultural aspects of the relationship between people and technology, the way digital is internalized in our perception patterns, our behaviors, our habits and our interactions within the organization with everything digital.

The success or failure of any transformation depends first and foremost on the human element of each organization. The goal of establishing and consolidating a digital culture is to "*anticipate the likely resistance to change (...) change is more often experienced as a risk, a downgrade, a fuzzy and anxiety-provoking future*". [5]

This digital culture must provide answers to the reasons why stakeholders in the education system have shown resistance to change, namely, according to Torben Rick: Fear of anything new, fear of the unknown that might require new skills, entrenched habits and old ways of doing things could be barriers to change, as well as a lack of internal communication in terms of explaining the needs and reasons for change. [6]

3. Continuing education in technology and the challenges of Artificial Intelligence

The digital transforms our habits and ways of learning and teaching, with the logic of management of the educational act, made explicit by our approach, the role of the teacher manager must replace the one traditionally adopted by teachers where the latter are mainly concerned with teaching tasks while denying the development of managerial skills insofar as the school and the university constitute complex units with dynamic interactions and multiple actors.

Through continuous training for the different actors, and mainly teachers, decision-makers and teachers must accept that their roles may be challenged taking into account the digital change and its requirements in terms of new digital skills, organizational skills, agility and Design Thinking. [7]

The State is also supposed to consider a progressive integration of artificial intelligence in the teaching process in order to automate the repetitive tasks performed by teachers, which would allow them to focus on perfecting their educational methods and techniques.

This technology can only play a role of assistance, it cannot, in any case, replace the teacher, who is the ideal companion of the learner with his or her qualities of critical judgment and human interaction, which represent irreplaceable qualities.

VI. CONCLUSION

Digital transformation is a long and complex process that requires constant questioning and continuous enrichment. It is not a trendy phenomenon. The adoption of a transversal and integrated systemic approach based on the principles of digital governance in order to accompany and succeed in this transformation within the education sector, is justified, on the one hand, by the complexity of the organizational and structural changes that were triggered during the containment that had an accelerating effect on this transformation process, and on the other hand, by the diversity of the actors involved as well as the increased need for digital in education that has been highlighted by the Covid-19 pandemic.

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AUTHORS INDEX

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Abdelilah HADDOUT
Abderrahim ROUKAA
Amira SEBBAH
Cristina-Georgiana CALANCEA
Emanuel ACHIREI
Fatima Ezzahra SIRAGI
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