Towards a Computational Framework to Streamline the Global Digital Transformation Process in the Post-COVID Era

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Abstract— In this paper, we first introduce and define "Digital Divide 2.0", and show that, unlike the "traditional" Digital Divide, this is about the survival of countries and their ability to cope with a global environment that is more and more instable and uncertain! We build an argumenta supporting our assumption and, from there, we present the foundations of a computational framework to guide and streamline the Digital Transformation Process.

Keywords— Computational Framework, COVID19, Development, Digital Divide 2.0, Digital Transformation.

I. INTRODUCTION

A notable fact that popped-up with the COVID Pandemic, all around the world, is the predominance of Technology tools and digital environments to cope with the situation and minimize the impacts following the restriction on F2F activities/meetings. A kind of "virtual/digital" life emerged where individuals work, shop, do business, meet, etc. remotely.

All countries suffered serious impacts following this pandemic, at all levels (social, business, psychological, etc.). Countries with weaker ICT penetration (infrastructure, platforms, e-Services, etc.) were indeed more impacted since they could not take benefit of the new emerging virtual/digital life, which means no school, no commerce, no services, etc. This situation strangely recalls the concept of digital divide [7] raised by the Scientific Community in the field of ICT4D [3] to point out the gap between 2 Worlds: The world of Countries that are using technology (especially ICTs) to streamline their development at all levels, and the others that are lagging behind.

More importantly, the longer the pandemic lasts the complex/difficult the situation gets, and the higher the chances advanced (technology wise!) countries will shift to a "new-normal", leaving behind the rest of the world that will "really" struggle, and leading to an explicit manifestation of Digital Divide 2.0, which is the Covid19 release of the Digital Divide! "Fighting" against Digital Divide 2.0 requires for a Country to be advanced in the Digital Transformation Process, which globally means the ability of Citizens to dispose of / and be familiar with the effective usage of Technology Tools, at a daily basis, in the New-Normal Configuration of life.

Today more than even, World Leaders are aware of the importance of ICTs, not only from a theoretical perspective but, more importantly, from a real need on the ground, following concrete and palpable distress of the population, in all sectors, and on a daily base. Has this been possible, many of these Leaders would have not hesitated to acquire Plug-&-Play Solutions and Systems to immediately deploy and "fix" the situation! So what an extraordinary opportunity, for Academics and Researchers, to seize and try to elaborate a roadmap for the Digital Transformation Process, mainly for Developing and Less Developed Countries (DLDC) which, in the majority, have not yet launched this Process!

II. DIGITAL DIVIDE 2.0

The Digital Divide refers to the gap between countries with an effective access to / usage of digital and information technology and those with very limited or no access/usage at all [4] [8]. It includes the imbalances in physical access to technology as well as in resources and skills needed to effectively participate as a digital society.

Interest in linking ICT to Development started in 1984 when the Independent Commission of the International Telecommunication Union (ITU) delivered its final report entitled "The Missing Link" and known as "The Maitland Report" [5]. The report noted the need to pursue telecommunication reforms to extend the coverage of telephony and its effects and thereby, address the "Telecom Divide". The digital divide is closely related to the knowledge divide since the lack of access to technology creates a challenge to obtaining useful information and knowledge. Several studies found out also that digital divide is interlinked with other human development divides [2]. They pointed out two contradictory facets of Technology: a "positive" facet enabling the boosting of economy, business and public administration, and a "negative" facet consolidating the digital divide, the isolation of regions/populations and degradation of their life conditions. Because of their ubiquitous nature, Information and Communication Technologies (ICTs) are being used everywhere, in developed countries, to do almost everything quickly and accurately [1]. All important domains of our modern society have experienced a boost in progress due to the introduction and use of ICT, including: better service delivery to citizens and businesses, better access to information for decision makers, better management of administrative and business structures, better citizens/client records, and better information for the community [1].

Indeed, since the 90's, significant efforts have been deployed by many DLDCs around the world to address the digital divide especially through the enhancement of the physical infrastructure including Hardware, Telecom, Connectivity, etc. [5] and the legal framework and business environment. Unfortunately, considerable pitfalls persisted [2] and did not allow for a real take-off in terms of ICTs penetration, appropriation and usage in the daily needs of citizens. In Other words, the Digital Transformation Process did not take place, in many DLDCs and the Digital Divide grew up and grew up, until the CoviD-19 hit, living these countries with no serious means to battle against the COVID and try to survive. The COVID-19 Pandemic announced the beginning of a New-Normal, worldwide, and we can reasonably expect that similar phenomenon, of different natures/types, will pop-up soon or late. Digital Transformation, at national/global level, is in our view the only way for DLCS to be Resilient and cope with the "hazardities" of New-Normal, and ensure the Survival and of the country.

Hence, "Digital Divide 2.0" refers to the striking lack/dysfunctions of ICTs (Infrastructure, Services, Acceptance, Appropriation, Actual Usage, etc.), coupled with sudden occurrence(s) of exceptional phenomenon, worldwide, requiring from Countries an advanced level of Digital Transformation to try and cope with the situation, and survive.

Digital Divide 2.0 is different from Digital Divide 1.0 simply because the world has considerably changed since then, and the stakes are quite different: staying alive or quitting! Digital Divide 2.0 is more than a valid argument for decision makers in DLDC to launch the process of Digital Transformation in their respective countries. It clearly means that Digital Transformation is not anymore an option for any country that hopes to exist/survive/prosper in the New-Normal era!

III.   ON THE DIGITAL TRANSFORMATION PROCESS

Digital Transformation (DX) is often defined as the Process of integration of digital technologies into all areas of a business resulting in fundamental changes to how businesses operate and how they deliver value to customers". Successful DX is indeed far more than about adopting new Technologies. The 2016 World Bank report "Digital Dividends" [11] strongly emphasized that technical solutions alone do not secure development. Other decisive factors include favorable framework conditions and an education system that prepares people for modern working life and for universal participation in the global digital economy.

DX is a vector of/for renewal, simplification and improvement that is incorporated into international development policy approaches. New technologies and digital solutions help developing countries to achieve economic growth and improve welfare, and to skip some developmental stages (Leapfrogging process). DX makes it easier to achieve the United-Nations Sustainable Development Goals and promote quicker, more inclusive growth and development in many countries.

It is interesting to notice that, despite the ubiquity and omnipresence of the digital transformation manifestations and impacts at all levels, the Academic Literature has paid a little attention to these developments.

Efforts to properly addressing the DX related conceptual and modeling issues have only emerged very recently, mainly in the Business/Management Discipline. For instance, marketing researchers have focused on digital advertising and social media effects including attribution model developments [12] [13] and multi-channel and Omni-channel developments [14]. The strategic management literature has mostly focused on the conceptualization, operationalization and renewal of (digital)

business models (e.g. [15]. In Software Engineering / Computing Literature, researchers have traditionally paid more attention to technical developments regarding adoption and use of digital technologies and resulting business value (e.g. [16]).

Curiously, we don't find in the open literature, any model that specifically addresses the digital transformation, as a global societal shift/change, from a conceptual level along to the design and implementation stages, with clear transformation steps, challenges, opportunities, risks, etc. We don't find neither any academic research that addresses the Digital Transformation from a Development Perspective, which means the creation (including the conceptualization and modeling phases) of a direct relation between any country's Development Process and its general level in terms of ICTs penetration and usages among the population in their various daily needs [9]. Individuals need to be explicitly and structurally exposed to Technology, on a daily basis, for long a period, from different perspectives (discovery, learning, interacting, using for leisure, using for job, etc.) to progressively develop an ownership/appropriation feeling that allows individuals to be proactive in terms of usage, dissemination, development and Creation/Co-Creation of Technology. These are exactly the elements around which is built the DX Concept, at the conceptual, organizational and societal/human levels.

Indeed, there is no magic potion for instantly transforming a country/society digital, and that is basically why a whole DX is needed. This is by nature a long term process that is complex, delicate and somehow costly [10]. However, we can consolidate and speed-up this Process through a generic method/roadmap that will guide the various stakeholders during the whole Transformation Process. Such a method hall not only provide practical guidelines to system DX Concept, analysts and developers during the different phases of the project, but it should also provide means to raise the awareness of the various stakeholders involved in the project with respect to the impacts of their decisions on the whole DX Process.

IV.   A COMPUTATIONAL MODEL TO STREAMLINE THE DIGITAL TRANSFORMATION PROCESS IN DLDCS

The framework we are presenting in this paper is adapted from the eFez Project [6].

Let us first tart by stating the main principles on which our Framework relies (and which explicitly show the its "extra" ICTs Dimension):

- All stakeholders must be involved as early as possible in the process of developing any e-Service, and their involvement and motivation must be sustained during the whole Project. A special care must be given to sustain favorable conditions for the Project from its onset until its completion. In our current circumstances, Fighting against COVID-19 and staying alive during and after the Pandemic is a major motivation no stakeholder can deny. That is why we think the immediate upcoming 2 or 3 years are just prosperous to launch the DX process in DLDCs with as many ICT Projects as possible, with a clear focus on not only providing s-Services a such but also, and more importantly, contributing the whole Process of DX. Boosting and sustaining the motivation of stakeholders and keeping on the favorable conditions surrounding any ICT Project will both be possible through the two major arguments we already stated : a New-Normal way of living (business, leisure, work, personal relations and interactions, etc.) is being established AND exceptional phenomenon can pop-up any time from now on, requiring a high level of resilience and adaptability if one wants to survive, and assumes indeed a high level of DX at a country level;

- A special care must be devoted to the creation and update of a project vision to which all stakeholders shall adhere to. A Selection of projects to be developed in order to contribute and consolidate the DX Process is indicated in Section III.B.2 of this paper;

- Outcomes and outputs of the project must be identified as early as possible and refined during the project with a special concern for Digital Transformation Improvement. Clear indications and indicators shall be elaborated to allow for measuring the actual improvement as indicated in Section III.B.3 of this paper;

- The Framework/Roadmap that is proposed shall mandatory cover at least all the traditional steps of information system development, delivery and deployment, with an emphasis on the actual indicators to be measured as indicated in section III.B.4 of this paper.

Figure-1 that follows depicts the Phases, Actors information flows and Interactions of our Framework:
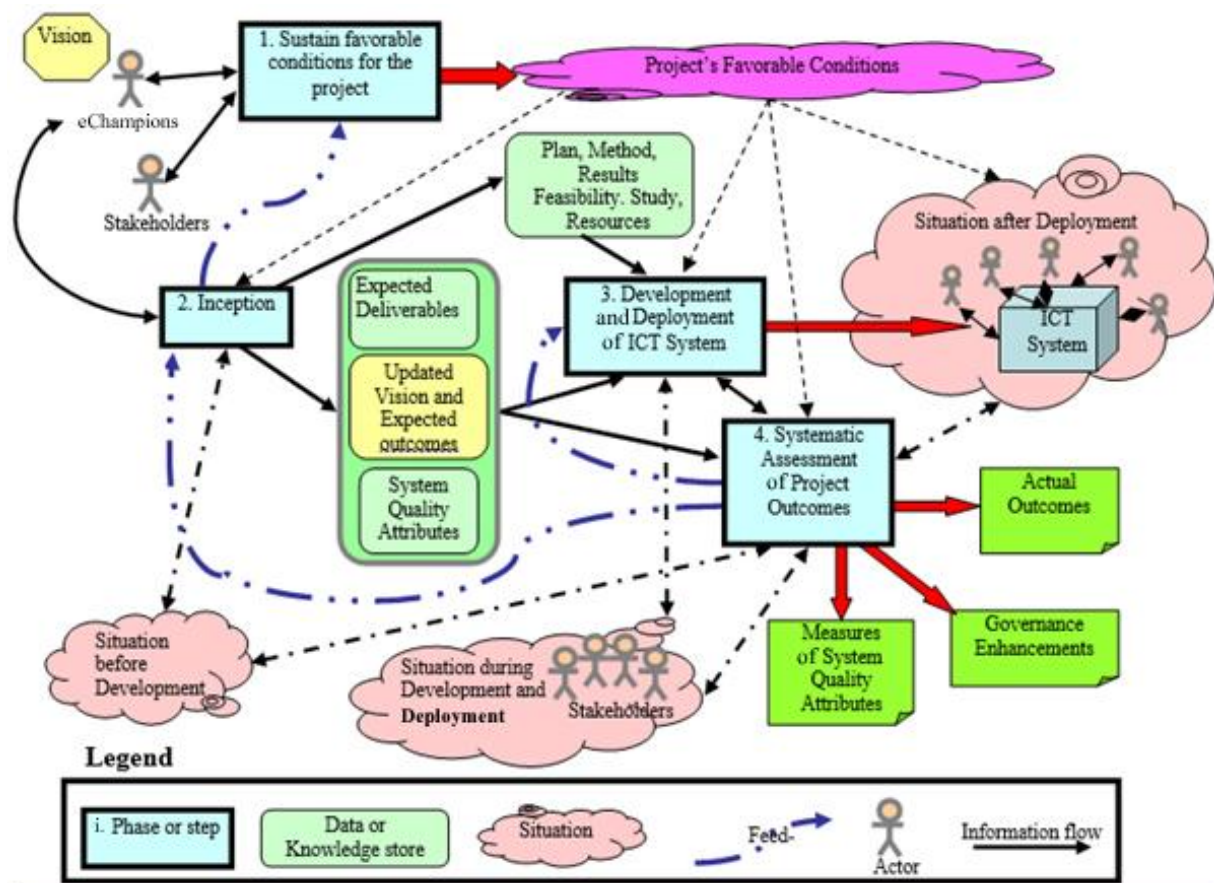
FIGURE 1: Phases, Actors information flows and Interactions of the proposer framework Approach [6]

In the following Sections we provide an overview of our Framework/Roadmap as a directed walk through the elements contained in Figure 1:

4.1   Sustaining the Favorable Conditions for the Project

This is a phase that shall "stay" active during the whole duration of any automation project. It consists in creating, enhancing and maintaining the conditions that favor the project's progress and push it forward. It involves the various stakeholders among whom we particularly point out the project's champions (called eChampions) that promotes and supports the project at all the critical levels of the organization's hierarchy.

The project's management team must be aware that certain stakeholders and the eChampions may change from one phase to the other and act accordingly in order to maintain favorable conditions for the project, given the changes taking place in the organization. The thin dashed arrows in Figure 1 show that these favorable conditions influence every phase of the project.

4.2   The Inception Phase

This is a critical phase of any automation Project and can only start when favorable conditions are met, among which the strong will and influence of high-ranked eChampions that support the project. These favorable conditions should build up during the phase.

The e-Champion and the development team must develop a clear and structured vision of the future ICT System and of the outcomes it must provide to the whole Country and its Citizens. Clearly the priority of developing ICT Projects shall be related to their potential of creating/generating global changes in the society, Country wide. For instance, Projects in the following areas would have the highest priority:

- **Datafication**: The digitization of all back office data in strategic areas including education, health, public administration, etc., along with the elaboration of national standards for Electronic data exchange and applications interoperability;

- **Localization:** Consists of developing Localized Applications, Data and Tools, needed by citizens in their daily life, both for work and leisure. These shall be in the native language of the citizens and shall focus, value and capitalize on the common social and cultural traits of the Country and its population;

- **Education:** This obviously a key success factor in the integration in the knowledge society and one of the main channels to build and consolidate the ICT awareness and readiness in any country. It should rather focus on the contents, the pedagogy, the trainers and the messages to be conveyed to apprentices in relation to the Digital Transformation, rather than on equipment, devices and technical manipulations and issues;

- **Governance:** This is a very important aspect for citizens to benefit from the advantages of ICTs, and, at the same time, to raise their level of usage, appropriation, readiness and awareness. The impact of e-Government on good governance has been demonstrated in different studies [6] and the debate is no more at this level but rather on how to take full benefit of ICTs and what the highest priority fields for a specific country are.

The Inception Phase is paramount in helping eChampions shaping their vision and refining their expectations with respect to the project's output (project's deliverables) and its outcomes. It is during this important phase that the most critical stakeholders are led to share the project's vision and reach a consensus on its main targets (output and outcomes). This increases the favorable conditions for the project as represented by the large dashed arrow linking rectangle 2 to rectangle 1 in Figure 1.

4.3   The Development and Deployment Phase

This step starts whenever the GO decision has been made after the completion of the Inception phase. A critical success factor is that favorable conditions are maintained all along this phase. All the Inception phase's outputs are available during the development of the ICTs system. It mainly consists of sub-phases similar to those found in traditional analysis and design methods applied to the creation of information systems, mainly: requirement analysis, development of a strong system architecture, business analysis, refinements and development of new workflows taking into account the introduction of the ICTs system in the organization, usability analysis, interfaces' and system's design, implementation and tests, deployment and adjustments). Again in this phase both organizational issues (procedures, workflows, business rules etc.) and software development issues are addressed. The technical norms and goals based on quality criteria fostering improved governance and set up during the inception phase are refined during the development phase and give strong directions to the development and deployment of the ICTs system. As in all the method's phases, a special emphasis is put on respecting the project's vision, which has a strong influence on the system's architecture and on making decisions with the aim of achieving the best outcomes set up during the previous phase. Hence, there is a guarantee that the project will provide the best outcomes and achieve the best results that can be achieved, given the situations that prevailed before and during the development and deployment of the system. This emphasis on working towards a significant improvement of governance should be adopted by all the development team members as well as by the majority of stakeholders.

4.4   Outcomes Assessment and Contribution to National DX Process

This a very important phase of the method that is carried out in parallel with the other phases. Its goal is to systematically assess and monitor the evolving situation during the course of the project with respect to the achievement of the expected project outcomes and to the respect of system quality attributes toward consolidated DX. Again during this phase, favorable conditions should be maintained and they may be different/complementary to those that prevail during the other phases, since the right setting must be set up in order to conduct the various investigations needed to carry out the various assessments pertaining to measuring the project success but also in measuring the impact of this project on the whole Digital Transformation Process nationwide.

So far, and to the best of our knowledge, there is no ongoing research that targets the elaboration of a formal framework that measures the Maturity level of Country/Society with respect to their level of DX. Such a framework would first require a conceptualization (through a formal Model that we call "The Digital Transformation Maturity Model: DTMM") of the structures and linkages between the ICT Systems/Applications and the "State/level" of Digital Transformation in a particular Country, Region or Population.

Once the DTMM is ready, the next important step would be elaborate a Computational Model that transforms the conceptual relations between ICT Systems/Applications and the "State/level" of Digital Transformation as stated in the DTMM into a

set of Aggregates/Attributes/metrics that are measurable and that will be measures while the system is running and serving citizens and Populations.

V. CONCLUSION

This paper reflects and describes the progress of our thoughts in relation to the role of ICTs in helping people in coping with the new-normal way of life imposed by COVID-19. We believe this is urgent more than ever in the past to launch the process of digital transformation in all countries that have not started it yet to avoid further damages and distresses to their populations. Clearly, without a solid digital "Capital", no country will be able to face the "hazards" of the future.

Our main contribution in this paper is to announce the idea of a Computational framework to justify and streamline the Digital Transformation Process in Developing and Developed Countries. Indeed we still need serious work to formalize the structure and all the constituting elements of this framework, both at the conceptual and computational levels, but the first brick is there, and others will quickly follow as we progress in our Research.

PROJECT INFORMATION

The eFez Project intended to implement the first e-Government system, at the municipal level, in Morocco and, in parallel, to develop a road map of "e-Government for good governance" to be used in future projects to ease and speed up the process of generalization of such systems in Morocco and comparable developing countries. The targeted e-Government system was related to the automation of the back and front offices' operations of the Register Office, known in Morocco as the "Bureau d'Etat Civil". Additionally, the project aimed at assessing the results, outcomes and effects of the deployment of an e-government system on governance and, overall, the transformation of a completely manual municipal service delivery process. The eFez project was funded by the International Development Research Center (IDRC) of Canada, and took place in the city of Fez/Morocco, between 2004 and 2012. For more details, see [6].

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