A Global Framework to Manage the Digital Transformation Process in the Post-COVID Era

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Abstract—In this paper, we shed light on the "Digital Divide 2.0," which we see as COVID-19's version of the digital divide. We believe that "fighting" against digital divide 2.0 necessitates for a country to be seriously advanced in the global digital transformation that is, naturally, a complex, delicate, costly and long-term process. We build an argument supporting our assumption and, from there, we present the foundations of a computational framework to guide and streamline digital transformation at all levels.

Keywords—Digital divide 2.0, digital transformation, ICTs for development, computational outcomes assessment.

I. Introduction

A notable fact that popped-up with the COVID-19 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 [1] raised by the scientific community in the field Information and Communication for Development (ICT4D) [2] to point out the gap between two worlds: The world of countries that are using technology (and specially ICT) to streamline their development at all levels, and the others that are lagging behind. More importantly, the longer the pandemic lasts the more complex/difficult the situation will get, and the higher the chances that the "developed" world 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 COVID-19 release of the digital divide.

The good news is that, today, more than ever in the past, it is reasonable to assume that world leaders are becoming increasingly aware of the importance of ICTs, not only from a theoretical perspective but, 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 basis. Many country leaders would have not hesitated to acquire plug-&-play solutions and systems to immediately deploy and "fix" the situation, if this was possible to do so. So, what an extraordinary

opportunity for academics and researchers to seize and try to elaborate a roadmap for the Digital Transformation Process (DTP) mainly for developing and less developed countries (DLDC) which, in the majority, have not yet fully 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 [3]. Further to discrepancies in access to ICTs (applications, system software, hardware, Internet, etc.), the digital divide also denotes the insufficiency of profiles and skills needed to effectively participate as a digital society. The digital divide is closely related to the knowledge divide since the lack of access to ICTs makes of Information and Knowledge accessing a real challenge.

Several studies found out also that digital divide is interlinked with other human development divides [5], [8], [9]. 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. Interest in correlating ICTs and development started around the eighties of the last century, when the International Telecommunication Union (ITU) delivered a commissioned report entitled: "The Missing Link" (also known as "The Maitland Report"), which noted the urgent need to pursue telecommunication reforms in order to extend the coverage of telephony (and its effects) and thereby, address the "telecom divide" [5].

Since then, significant efforts have been deployed by many DLDC around the world to address the digital divide, especially through the enhancement of the physical infrastructure including hardware, telecom, connectivity, etc. [6], as well as the legal framework and business environment. Unfortunately, considerable pitfalls persisted [4] and did not allow for a real take-off in terms of ICTs penetration, appropriation and usage in daily needs of citizens. Somehow, the so-called DTP [7] did not take place for different reasons[1] and the digital divide was continually growing until COVID-19 hit, leaving these countries with no serious means in their fight to surviving against the virus.

As the COVID-19 pandemic announced the beginning of a new-normal era worldwide, we reasonably can expect similar

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[1] An exhaustive list of this pitfalls is exposed and fully explained in [4].

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phenomena, of different natures/types, to pop-up sooner or later. From this perspective, Digital Divide 2.0 refers to the striking discrepancies between DCs and DLDCs [8], in a changing world where sudden/exceptional phenomenon can hit anytime, requiring from countries/societies an advanced level of Digital Transformation (DX) 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 with the COVID-19 pandemic, and the stakes/risks are quite different (i.e., staying alive or quitting). Today, it is more urgent than ever before to launch the DX process in DLDCs, as, in our view, this is the only way to strive and "fight" against Digital Divide 2.0, and try and survive.

III. A GENERAL FRAMEWORK TO SUPPORT THE DX PROCESS IN DLDCS

Obviously, DLDCs are facing great levels of uncertainty in developing and providing their citizens with "structured" and "institutionalized" ICT services because of the complexity of the technology, deeply entrenched organizational routines, and great diversity in the acceptance of technology by individuals [5].

There is no magic potion for instantly transforming digital a country/society and that is basically why a whole DTP is needed [8]. This is by nature a long-term process that is complex, delicate and somehow costly.

Individuals need to be explicitly and structurally exposed to technology on a daily basis, for long a period, and from different perspectives (discovery, learning, interacting, using for leisure, using for work, etc.) to progressively develop an ownership/appropriation sense 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.

From our perspective, and in order to consolidate and speed-up the DX process which our main focus in this paper, we claim that the entire process of developing and deploying any e-service (i.e., a software that provides an automated service/functionality, generally online), at any level and for any need, should be carried out with the aim of improving the constituting elements of the DX. Hence, there is a need for a generic method that will guide the various stakeholders during the whole transformation process. Such a method should provide not only practical guidelines to system developers on the DX concepts during the different phases of the project, but also a 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.

A. The Proposed Framework Principles

The main principles on which the proposed framework relies are as follows:
- 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.

Special care must be given to sustain favorable conditions for the project from its outset 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 that the immediate upcoming 2 or 3 years there is just the right momentum to launch the DX process in DLDCs, with as many ICT projects as possible with a clear focus on not only providing e-services (e-business, e-health, e-education, etc.) but also, and more importantly, on contributing to/and consolidating 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 stated: a new-normal way of living (business, leisure, work, personal relations and interactions, etc.) is being established and, exceptional phenomenon can pop-up at 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;
- Special care must be devoted to the elaboration and update of a global vision to which all stakeholders shall adhere and the selection of specific projects to be developed to contribute to consolidating the DX process shall align with the guidelines 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 DX 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.

B. The Dynamic of the Proposed Framework

Fig. 1 depicts the phases, actor's information flows and interactions of the proposed framework:

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 which 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 Fig. 1 show that these favorable conditions influence every phase of the project.
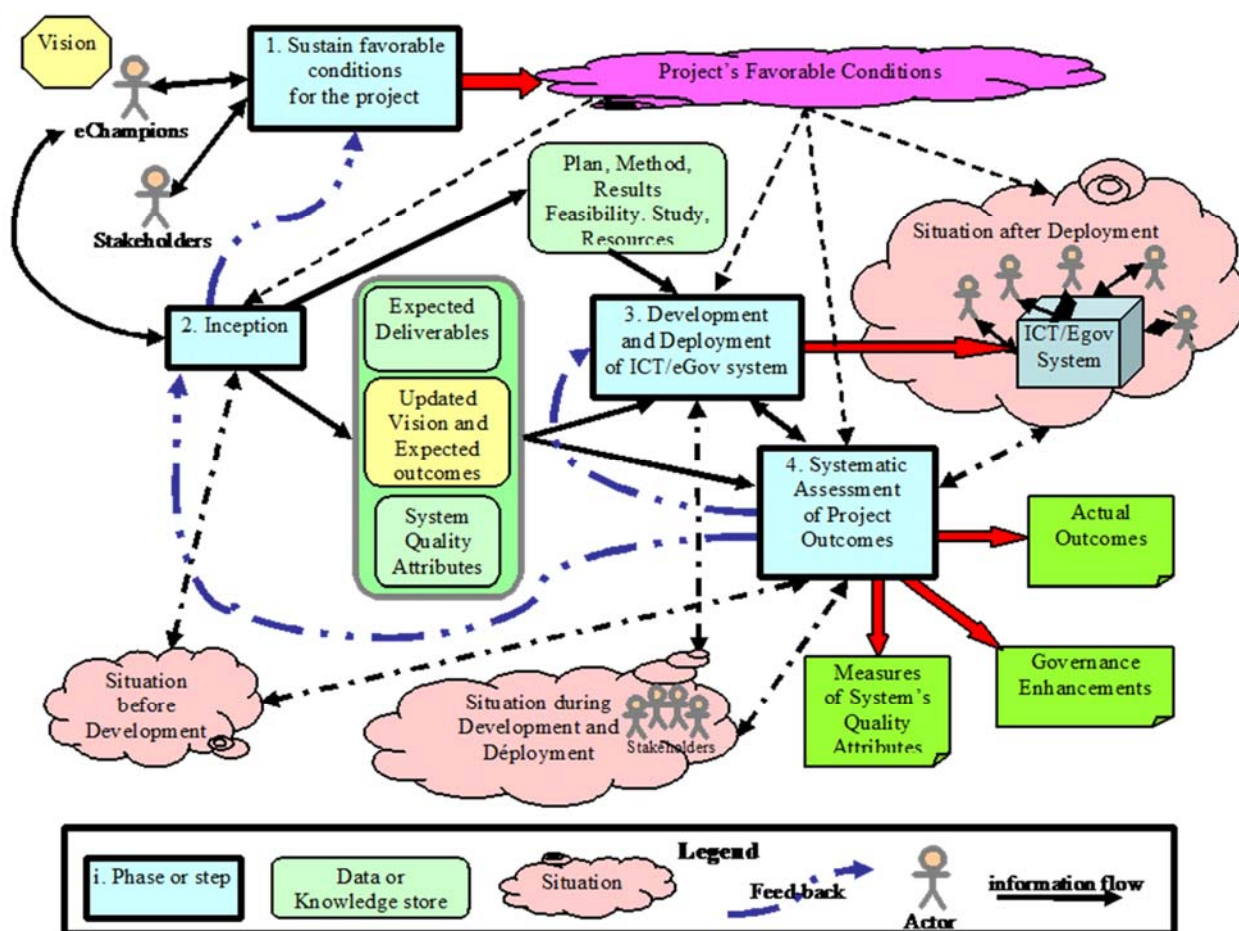
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International Journal of Information and Communication Engineering
Vol:16, No:10, 2022

Fig. 1 The phases, actors information flows and interactions of the proposed framework approach [5]

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. The eChampions 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: Developing the 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: 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 focus on the contents, the pedagogy, the trainers and the messages to be conveyed to apprentices in relation to the DX, rather than the on equipment, devices and technical manipulations and issues;

- Governance: 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 including [5], [8] and [9], and the debate is no longer at this level but rather on how to fully benefit from ICTs and what the highest priority fields for a specific country are.

The inception phase is paramount in helping eChampions in 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 stage 2 to stage 1 in Fig. 1.

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3) The Development and Deployment Phase

Upon completion of the previous phase (inception), a go decision is generated to indicate that we can go forward in the project development. A critical success factor is that favorable conditions are steadily maintained along this phase.

All inception outcomes are available to this implementation phase. It mainly consists of steps and associated milestones similar to those we find in conventional analysis and design methods applied to the creation of information systems, mainly: requirement analysis and modeling, 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 the organizational aspects (business processes, workflows, rules etc.) and the software development issues are addressed. The standards and goals based on the quality criteria fostering improved governance which were set-up during the inception phase are technically defined/described in this current phase, and provide 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) The Systematic Assessment of Project Outcomes

This a very important phase of our method that is carried out in parallel with the other phases. It consists of systematically assessing and monitoring the evolving situation during the course of the project with respect to the targeted quality attributes toward a consolidated DX. Again during this phase, favorable conditions shall steadily 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 DTP nationwide.

IV. 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 it is urgent, more than ever in the past, to launch the process of DX in all countries that have not yet started it in order 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.

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 a country/society with respect to their stage 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 DX in a particular country, region or population.

Once the DTMM is ready, the next important step would be to elaborate a computational model that transforms the conceptual relations between ICT systems/applications and the "state/level" of DX as stated in the DTMM into a set of aggregates/attributes/metrics that are measurable, and that will be measured while the system is running and serving citizens and populations.

Our main contribution in this paper is to propose a computational framework to support and streamline the DTP in DLDC. Indeed, more work is needed to formalize the structure and all the constituting elements of this framework, both at the conceptual and computational levels but the foundation is there.

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