

A Framework To Assess

Digital Transformation

in a Technologically Less-
Developed Country

Challenges and Opportunities in Bangladesh

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A Framework to Assess Digital Transformation in a Debt-dependent Country: Challenges and Opportunities in Bangladesh

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Abstract

The journey towards a ‘digital world’, is often perceived in terms of three sequentially linked ‘phases’, digitization, digitalization and digital transformation. This paper considers digitalization as the process that transforms an analog world into a digital world. Subsequently, attempt is made to understand it’s dynamics in a technologically less developed country (TLDC). Two important departures from the dominant stands in the literature were made in this paper. First, business models for digitalization, that aim at delivering services by using digital devices, was distinguished from the engineering perspective that emphasize on innovations in digital devices and their uses. A second departure from the mainstream ideas was made by introducing the choice between procurement (buy/rent) and build (create), and how the two options have different implications for skill development in a TLDC.

Nurturing creativity for an idea economy as well as skill developments in STEM areas are associated with building or creating by the self. In contrast, the business models for digitalization go hand-in-hand with the procurements made by governments in TLDCs. The paper proposes a framework to think through when projects are designed and approved. While a TLDC such as Bangladesh is a major consumer of digital devices, absence of ‘build and create’ environment runs contrary to developing an idea economy and preparing the country’s workforce for the ensuing 4IR. It is argued that a feasible entry point for changing the status quo imposed under external loan agreements, is to redefine those contracts. It is argued that programme designs be developed by identifying digital devices that go into various phases of an economic activity, including that of delivering government services, and ensure public commitment to build/create some such devices. For Bangladesh, software development is one such option where local IT firms may be closely linked to service delivery as well as in production of goods.

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Acronyms

a2i	Access to Information
ADB	Asian Development Bank
ADBI	Asian Development Bank Institute
AI	Artificial Intelligence
DBE	Digital Business Ecosystem
BOP	Balance of Payment
BPO	Business Process Outsourcing
DP	Digital Platform
DT	Digital Transformation
ERP	Enterprise Resource Planning (software)
4IR	4 th Industrial Revolution
ICT	Information and Communication Technology
IOT	Internet of Things
ITeS	IT-enabled Services
ITU	International Telecommunication Union
LAN	Local Area Network
MIS	Management Information System
ML	Machine Language
NBR	National Board of Revenue
NLP	Natural Language Processing
P2G	Person to Government
RCT	Randomised Controlled Trial
RJSC	Registrar of Joint Stock Companies
SMS	Short Message Service
STEM	Science, Technology, Engineering, Mathematics
TLDC	Technologically Less-Developed Country
UDC	Union Digital Centre
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
WB	World Bank

1. Introduction

The human journey, since antiquity, has been marked by changes in technology that have transformed the way work is performed. This theme appears in the literature under different names. With the advancement of information and communication technology (ICT), it was referred to as ‘computerization’ during the 1990s, ‘digitization’ and ‘e-governance’ in the turn of the century, and as a consolidated concept of ‘digital world’² when recovery from the financial crisis of 2007-08 was being sought. This happened almost simultaneously in many countries³. As this paper is being written, the buzzword has started to shift from ‘digital world’ to ‘smart world’⁴. This study takes the perspective of a developing country where the digitalization process is still a long way from maturing to a level of significance⁵, and where many of these buzzwords are tied to loan projects.

The journey towards a ‘digital world’ is often perceived in terms of sequentially linked ‘phases’: digitization, digitalization and digital transformation. This paper however considers digitalization as the process that transforms an analog world into a digital world. Subsequently, an attempt is made to understand its dynamics in a technologically less-developed country (TLDC). The nature of its progression has implications for in-country skill development and knowledge creation, as well as for defining the feasibility of ‘digital transformation’ of a society. The rationale for such an inquiry is aptly phrased in Paus’ statement (2017), “To avoid being trapped at the middle-income level, the development strategy for middle income countries has to focus squarely on the promotion of domestic innovation capabilities in a systemic way.” Innovation capabilities are more apt to face a fourth industrial revolution (4IR) if efforts are linked to the digitalization process. It is therefore important to understand the digitalization process which often falters in the absence of appropriate ecosystems.

The primary objective of the paper is to develop a framework to assess digitalization after having reviewed different existing perspectives on the subject and contextualizing the term. The literature on developing countries tends to focus on business models that are innovative in delivery of services and go hand-in-hand with use of digital technology. Thus, from a Science, Technology, Engineering, Mathematics (STEM) perspective, digitalization is narrowly perceived in terms of increased use of digital technology, irrespective of whether these are created (built) or procured (bought or rented). The framework proposed in this paper unifies several dimensions to illustrate the issues that programme designers need to attend to in order to promote creativity.

Towards defining a narrative: methods and outline of the paper

The statements made in the previous section and the narrative on the faltering digitalization process presented in this paper, were arrived at through an iterative process of reviewing literature, constructing a framework, deducing a fresh set of questions, and extending the review to develop

² Examples include Digital Bangladesh, Digital India or Digital transport.

³ External loan programmes are often packaged in the guise of ‘digital world’ or digitalization, as illustrated in Relly and Sabharwal (2019).

⁴ The move towards a ‘smart world’ is evident in the narratives of the [2022 IEEE Smart World Congress](#). For a definition of smart world, one may see [‘What is Smart World’](#) on the IGI Global website. In India, Modi’s government’s Smart City Programme initiated the use of this term during 2016-18, while the Myanmar government began to use it in early 2019.

⁵ While digital transformation is made possible due to extensive digitalization, a sector-specific ‘smart world’ is possibly one manifestation of (sector-specific) digital transformation. Digital transformation is considered a sector or society-level process perceived to bring in a state of “smart world”.

further the framework and the narrative. It is essentially a mental exercise that simultaneously reconstructs the framework and the narrative that is aligned with the framework.

An extensive literature review helped in sorting the semantics, which subsequently helped operationalise the concepts used in a technology-dependent society. These concepts are discussed in Section 2, along with an introduction to regimes (often by choice) of 'build or procure' that pre-define 'ecosystem' to be introduced in programme design. Section 3 presents evidence on signs of faltering digitalization primarily drawn from Bangladesh's experience. Section 4 outlines a framework to operationalise digitalization processes and argues why the choice is skewed in favour of procurement (buy or rent) against build (create). It then elaborates further the chain of impacts following a loan-agreement on which much of present-day digitalization efforts are rooted. The concluding section summarises and suggests few entry points for change.⁶ It is suggested that leveraging digital transformation will remain elusive unless disruptions are introduced in a country's (TLDC's) contract with external agencies, and the internal agencies overseeing implementation of relevant projects are overhauled.

2. The journey towards digital transformation - concepts and frameworks

Box 1 provides definitions for the concepts and terms commonly encountered in the literature on ICT and digitalization.

⁶ Information to verify the proposition on the relation between international financial flows with the resource (mis)allocation and degeneration of local institutions, and with subsequent unsatisfactory performance in the country's efforts towards digital transformation for sustained economic prosperity, is generally not available in the public domain. Thus, the attempt to develop the narrative will be tentative.

Box 1: Definitions

Data are quantitative and qualitative measures representing real life situation.

Information summarises data that provide meaningful insights to interpret and predict situation.

Knowledge is the stock of our understanding (that is, **ideas**, which is a flow) about the reality (framed as conditionally verified hypotheses) arrived at upon theorizing/ conceptualizing existing information and presumed to guide actions till the understanding is updated or there is a paradigm shift.

Analogue data are data that are represented in a physical way, and stored in physical media. The analogue domain/space is infinite.

Digitized data originate in the analogue domain and are later digitized, capturing in a limited number of spaces only.

Digitization is the process by which analogue data in physical media are converted to digitized data.

Digital data originate in digital space. The dimension of digital space is finite, which depends on the infrastructure of the platform (inter-connected software programmes and applications) that generates data as well as the programme identifying the variables to capture.

Both digitized and digital data are amenable to digital processing.

Technology is a collection of processes that involve methods to combine skills, tools, know-how and means to transform resources into goods or services. Ideas and knowledge are important factors that underlie technology. Technology can be non-digital (manual, mechanical, electric, electronic etc.) or digital.

Digital technology functions by using digitized and/or digital data. It is broadly grouped into the following functions:

1. Transform real life measures into digital space: sensor - Internet of Things (IOT)
2. Data processing technology: algorithms, organising, and representing – Artificial intelligence (AI), Machine Language (ML), Natural Language Processing (NLP), Blockchain
3. Storing, retrieving and communicating technology: IOT
4. Reproduction technology: robot (in mechanical space), software (digital space)

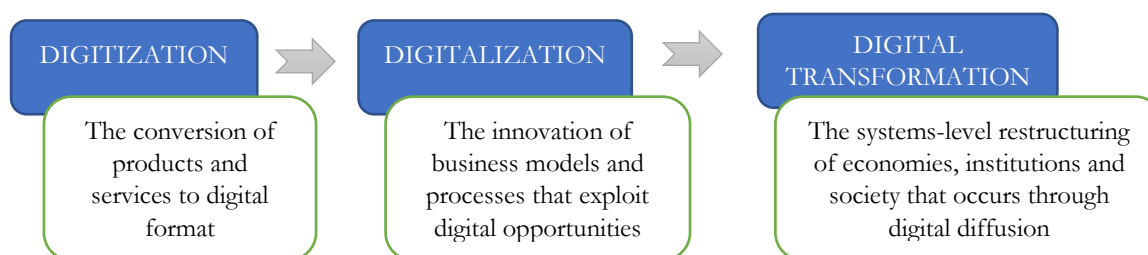
Innovation: “Simply put, **innovation** is looking at a problem, understanding it and trying to make it better. Innovation can be applied to something which already exists, or it can be used to develop something completely new.” (Gran, 2023).

Ecosystem: “The whole system ... including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment” (Tansley, 1935). The term is used to mean different things at different times, with emphasis changing with progressions.

2.1 Perspectives on the basic constituents of digitalization

There are broadly two streams of literature on digitalization. The dominant one originates from business schools while the second one, rooted in STEM, provides a technology perspective.⁷ The Sloan School of Management at MIT is a forerunner in propagating the first perspective and Figure 1 captures the essence of their views. The approach considers digital opportunities, and digitization prepares the ground for engaging with innovative business models and processes to carry forward digitalization. Even for the third stage (i.e., digital transformation), the diffusion of digital technology is facilitated by restructuring economies, institutions and societies.⁸ Such an approach appears more suitable for TLDCs whereas Technologically Developed Countries (TDCs) are keen on marketing digital technology developed and produced by them. It is therefore no wonder that innovation is mentioned in the context of developing business models, and improving existing or developing new technology is left outside the scope of innovations in TLDCs⁹. Later in this paper, questions are raised on whether joining the ‘digital world’ as ‘consumers only’ is sufficient for an aspiring TLDC keen on preparing its youth with appropriate skills. At a conceptual level, it also calls for recasting our understanding of ‘ecosystems’, as explained in the following subsection.

Figure 1. Transformation in the perception of the use of digital means



Source: Unruh & Kiron, 2017

The second perspective considers digitalization as a transformation to improve processes by leveraging digital technologies and digitized data. It is also more direct in suggesting that **digitalization involves digital transformation**. Implicit in this and included in the unified framework proposed later in this section, is the process of creating economic value out of local ideas on (and eventual production of) digital technology (even if it be in limited scale) that support creative engagement for skill and knowledge building. The latter is further elaborated in Section 3.

The two perspectives are summarily captured in Boxes A1 and A2 in the Annex, which together suggest that digitalization involves technology, but is not limited to it, and a digitalization strategy requires factoring in people, process and technology¹⁰.

⁷ In doing so, it is recognised that the two broad categories of skills we often refer to, soft and hard/trade-specific, have close correspondence to the two streams. It also alludes to the existence of two or more ecosystems that are relevant for pursuing digitalization. See Figure 2.

⁸ Ideally, causality runs both ways – digital diffusion transforms economy, institutions and society, and the latter facilitates diffusion of digital technology.

⁹ One may find most startups in TLDCs to be on business models for service delivery.

¹⁰ A review of three stages is provided in Jimmy Bumann and Marc K Peter (2019). A relevant excerpt from Bumann and Peter (2019) is reproduced in Box 2.

2.2 Basic building blocks – primacy of ecosystems with partial illustration

One important departure from a traditional economic framework in this paper is the introduction of the concept of ‘ecosystem’ as a building block in understanding statecraft, albeit not a new idea. Earlier, the promotion of industrial activities focused on geographical concentration of specialised suppliers, service providers, organisations such as universities, commercial unions and interconnected enterprises which compete against each other as well as collaborate in certain activities (Porter, 1998). With the expansion of ICT-based business and increasing interests in innovation, the use of the concept of ecosystem has gained wider acceptance.

The ecosystem perspective goes beyond a simple production function (or, input-output mapping) approach. Irrespective of the world being digital or not, the creation of economic value depends on ecosystems¹¹ that allow:

- carrying out production of goods and/or generation of services,
- marketing goods and (delivery of) services to realize economic values, and
- the reproduction and upgrading of human resources (labour with skills and ideas) that are required in production (generation), marketing (delivery), and to lead human society to a better world.

It will be wrong to assume that any random collection of entities will constitute an ecosystem. While an ‘environment’ captures random states, ‘ecosystems’ presume some degree of interconnectedness.¹² The biotic relations among constituents dominate discussions on ecosystems in biology, ecology and geography. However, the term acquired a purpose-based meaning in the ‘abiotic’ environment of economy and industry, even more so with the expansion of digital world. In the latter, inter-industry (inter-activity) linkages may be considered akin to the ‘biotic’ elements in a conventionally perceived biological ecosystem.

For Suronnen et al (2022), Moore’s business ecosystem, when meshed with a digital ecosystem, results in a digital business ecosystem (DBE). There has to be ‘suppliers’ in the system, as well as a digital platform, where all stakeholders put trust on and participate. However, it is implicit in the mainstream discourse that the (digital) technology that enables the digital system is externally provided to TLDCs. Thus, there is scope for ideas and innovations for programme design for TLDCs in the business part of the model, but less so in the fields of science and technology. Hanelta et al (2021) however, go beyond and into greater details (see Figure A1 in the Annex). The various issues associated with digitalization are: (i) the contextual conditions that trigger and shape digital transformation, under which **material** is one of the sub-groups; (ii) the mechanisms covering elements that **innovate** and the elements that integrate; and (iii) the consequences with spillovers creating changes on other levels of analysis. Though the business side is emphasised, the framework allows for ideas and innovations in the **material** context as well¹³.

The rest of this section proposes a partial framework to address two more issues often overlooked in the literature. First, skill development and hard and soft learnings are often referred to. Other than innate qualities, these skills are widely acknowledged to be acquired at workplaces. Second, there is evidence to suggest that choices regarding building/creating and procurement (buy or rent) are made a priori, which shape the ecosystem perceived in initial project designs, and subsequently,

¹¹ Since multiple ecosystems are presumed to be in operation, it is used in plural. Here, ‘system’ is defined, à la Tansley (1935) as a “set of things working together as parts of a mechanism or an interconnecting network” (Darko 2019).

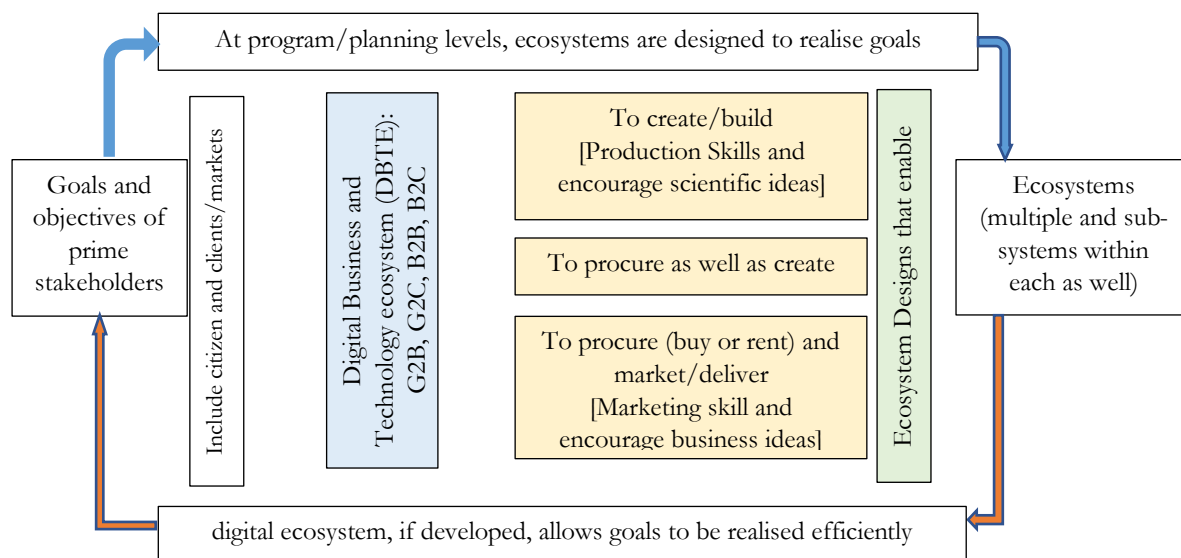
¹² The literature considers the terms ‘environment’ ecosystem as synonyms.

¹³ Words in bold highlight the recognition of the STEM side of digitalization in Hanelta et al (2021).

pre-determine the nature of digitalization and the digital business ecosystem that evolve. Both are important for TLDCs and Figure 2 attempts to capture this.

The box shaded in green refers to all ecosystems and sub-systems currently existing or put in place to realise preset goals and objectives. One of the objectives may be to establish a digital ‘business’ ecosystem. The initial ‘digital ecosystem’¹⁴, along with various sub-systems supporting production and marketing, are parts of the baseline setting. An effective digital ecosystem cannot be put in place by undermining the ‘adigital’ real space that links stakeholders, technology and resources.¹⁵ In cognizance of the business and technical dimensions of the digitalization process, the blue box mentions the establishment of a DBTE, the actual outcome of which (in TLDCs) may range from remotely controlled operators to a system where ideas generated inside TLDCs induce creation (of IOTs and even hard technologies). Much of the outcome, and therefore, the digitalization process, depend on choices made with regards to build-procure options. The three broad options under the latter are listed in yellow-shaded cells. Within such a framework, ‘digitalization’ is essentially a transformation of the initial ecosystem into a more mature digital ecosystem, covering not only businesses, but all other spheres of the society as well.

Figure 2: Perspectives from the recipients’ end (TLDCs)



Note: A TLDC engaged in procurement ought to develop skills to negotiate procurement contracts that guard against risk and ensure maximum benefits to the country. Unfortunately, ‘suppliers’ interest dominates, hence, ‘marketing’ & delivery. G=Government, B= Business, C= Customers (sometimes referred to as P=public)

¹⁴ “A digital ecosystem is a group of interconnected information technology resources that can function as a unit. Digital ecosystems are made up of suppliers, customers, trading partners, applications, third-party data service providers and all respective technologies. Interoperability is the key to the ecosystem's success.” (Brush, 2019).

¹⁵ The segments of ecosystem that are not digital ought to be addressed in ecosystem design. Figure 2 considers those exogenous and does not address, in the outcome space, how the ‘adigital’ ecosystem is affected due to intrusion of ‘digital’ ecosystem.

2.2.1 To create, buy or rent: relevance to skill development

Program designs that aim at changing the economy and society, normally list a number of interventions. These interventions require goods and services which are identified in a traditional log-frame under three broad heads: ‘inputs’, ‘activities’ and ‘outputs’. Project budgets under the auspices of multilateral agencies distinguish between local and foreign currency components. However, no distinction is made between the goods and/or services sourced at the country level or abroad. Since this has implications for the development and sustainability of the local economy and human resources, this subsection elaborates further the choice options.

The decision-tree for a meaningful classification of interventions, irrespective of whether those aim at producing (or generating) goods (or services), and/or selling (or delivering) those in markets or to specific target groups, may include the following steps:

- Will the goods (services) be produced (generated) locally, or, will those be externally procured (imported)?
- If procured, will they be bought or rented? ¹⁶
- In produced, it is likely that machineries and equipment will be required. Will these (or parts of these) be produced locally or procured externally?

With the digitalization of production technology, certain ICT services may either be ‘created’ or ‘procured’. Marketing/delivery is a service that traditionally relies upon non-tradable labour.¹⁷ With the introduction of digital technology, this no longer holds true. Platforms and software applications used to facilitate the marketing of goods and delivery of services may also be created or procured. Creation and procurement may take place in a single line of activity as well as in an economy with multiple activities.

Such classification is relevant for assessing skill development potential and sustainability.¹⁸ In extreme cases, dependence on buying may be equated with consumerism that calls for ‘no engagement’ in production, and ‘no tinkering’ with scientific ideas crucial for new product development and new methods of production¹⁹. One may learn by using a bought item – primarily as an operator and occasionally, in the realm of ideas while engaging in repair & maintenance (R&M)²⁰. When it comes to public procurements through purchases, no one seems to take responsibility for R&M, thus depriving a TLDC of potential creative learning from R&M.

Innovation survives and thrives within the fabrics of tech ecosystems and these ecosystems help support and generate enormous economic value. Whether necessity is ‘the mother of invention’ (or innovation) or whether scarcity leads to innovation, there must be a probing question around which ideas will emerge to bring about changes (innovations). The frequency of idea generation for change depends on the presence of an adequate breeding ground of ideas. The questions a

¹⁶ See for example Han et al (2022) to illustrate this. End consumable products are not rented, but services (such as, health, housing and education) may be availed by procuring the services of outside agencies.

¹⁷ As may be found in the system of national accounts of pre-digital days.

¹⁸ Referring to UNIDO’s classification of countries, UNCTAD (2023) mentions front-runners, producer economies, and user economies, which justify the framework we use to characterise ‘digitalization’ in terms of builder and users. When the global chain in supply of digital technology along with a finer distinction between ideas and fabs from physical production are considered, a greater correspondence between the framework (proposed) in this paper and the UNIDO classification can be found.

¹⁹ Unfortunately, the literature on choice between buying and renting is exclusively focused on real estate.

²⁰ In TLDCs, many durables are short-lived because markets for individual items are inadequate to support the development of R&M services. In cases of digital technology such as Siemen’s MRI machines, individuals are trained to operate the machine and digital data is in the hands of the headquarters.

consumer faces while using a bought item differ significantly from the ones faced while searching for a technical solution to a practical business problem for example, or while developing a digital business ecosystem by integrating various digital technologies. Thus, the choice made in the build-procure space is vital in guiding (or not guiding) and nurturing the development of innovative ideas.²¹

2.2.2 Political ecosystem: relevance for use and abuse of information

The discussion in 2.2.1 is relevant for all principal actors: government (public), private and quasi-private (including NGOs). However, digitization and the use of both digitized and digitalized data has largely taken off in the government sector. These initiatives have led to the collection and storage of private information. Proper use or abuse²² of the data will depend on the character of political governance, assuming that economic governance is under the control of the national-level political governance.²³ Since digitalization creates opportunities for the emergence of perfectly discriminating monopolists (or monopsonist)²⁴, it can create and sustain monolithic power, or a ‘mechanical enforcer’ on behalf of a higher authority who controls and processes information. In either case, absence of appropriate political ecosystems may lead to non-communication between in-country stakeholders. Thus, a ‘digital ecosystem’ meant to support the digitalization process in a country may fail to fulfil expectations unless compatible ecosystems in other ‘spheres’ (especially, in the political space) are put in place.

3. Evidence on digitalization: limited illustrations from the Bangladesh experience

This paper distinguishes **digitization from digitization and the mere use of digitized and/or digital data for the purposes of decision-making**²⁵. Digitalization is considered as a transformation to improve processes by leveraging digital technologies and digitized/digital data. Since use of a digital technology (as an ‘intermediate input’) is a prerequisite, one may set a threshold technology use (lowest denominator) while including a process under digitalization. Drawing from the list of potential functions of digital technologies listed in Box 1, one example may be an IOT, such as a sensor that transforms real life measures into digital space; or a customised App²⁶, a software that increases net value by reducing costs.²⁷ This description of digitalization is not adequately captured by the ‘readiness index’ that UNCTAD (2021) proposed

²¹ Even a consumable item may have to be customised and thus there will be room for innovative ideas, such as in cooking. However, consultants’ involvement in the details of operational manuals and follow-up trainings may leave little room for creative engagements at the receiving end.

²² While a private sector agency may also be privy to such personal information, the government is legally in a position to develop and protect the relevant database, and facilitate digital transactions in the private sector with limited access to cross-check identity and/or eligibility.

²³ In a globalised world, it would be foolish to assume that political sovereignty is absolute. Accordingly, present-day political governance in a TLDC needs to be understood.

²⁴ Economics textbooks describe them as ‘principals’ who have all the information on clients and therefore can enforce individual-specific pricing to extract all consumer (or producer/worker) surplus.

²⁵ Though data-based decision making is an important constituent of digital governance and of digitalization at large, the use of data for decision making predates digitalization.

²⁶ Björn-Sören Gigler et al (2018) note that “the first digital revolution, built around platforms and apps, fuelled the innovation and growth”.

²⁷ The literature often claims that value is added on account of digitalization, even though the market price of a product or service in question may not have changed. In fact, value addition may even decrease due to the use of an IOT, since the latter claims a share in the market price.

to capture the ability of countries to embrace new technology.²⁸ Apart from considering ICT deployment as a pre-requisite²⁹, such ‘building blocks’ classification does not help much in understanding the ‘digitalization’ process.

Based on the above, the rest of this section illustrates the nature of ‘digitalization’ in progress in Bangladesh drawing from reports and daily newspapers, making inferences tentative. For brevity, the discussion will be limited to characterising the digital process in terms of the elements and frameworks noted in the previous section. As a preamble, subsection 3.1 sketches Bangladesh’s journey towards e-governance.

3.1 Journey towards e-governance

Initiatives towards the automation of government records and services within a LAN environment began in Bangladesh in the late 1980s. This led to the digitization of data, which, in most cases, failed to be owned by respective government agencies. A few exceptions were in education (Figure A2 in the Annex) and under MIS-Health. With the widespread use of internet, portals were developed for data storage as well as for online services (such as for the Registrar of Joint Stock Companies (RJSC)) in the first few years of this century. In spite of repeated external assistance, these remained static for many years and the amount of data shared with the public persistently declined. While rent-seeking practices are mostly to blame for this, institutional obstacles and the absence of coordination among line agencies also contributed to the problem.³⁰ There was also largescale digitization of data on land and personal income taxes, but this did little to ‘inform decision-making’ or help deliver better services to citizens (clients) until a decade ago.

The journey towards drawing up an action plan to establish a digital world (UNDP, 2011) was preceded by the formation of an ICT Task Force in 1997, the launching of the a2i (Access to Information) programme in 2006, and an ICT policy and ICT Act in 2009. The UNDP report placed a2i, an agency under the Prime Minister’s office, at the centre of the nation-wide initiatives to establish a digital world. The report identifies key areas for intervention.³¹ While there had been several mentions of a gender strategy, unfortunately, the document had no reference to a digitalization strategy. Even the endline evaluation of a2i (Rahman et al, 2019) does not make mention of project achievements in the fields of digitalization. It does, however, mention several high-impact initiatives, such as, e-Nothi (e-filing), e-Mutation and the P2G payment system, and existing training programmes. Figure A2 in the Annex summarizes the journey with so-called digitalization in e-governance initiatives in Bangladesh, much of which appear to be in the phase of digitization.

While much of the initiatives prior to the COVID-19 pandemic confined to the domain of remote software development (i.e., initiatives to design all-purpose architecture for interactive portals/digital platforms), their success has been limited. Approximately 600 mobile apps were

²⁸ The index comprises five building blocks: (i) ICT deployment, (ii) skills, (iii) R&D activity, (iv) industry activity and (v) access to finance. Interestingly, UNCTAD (2021) is comfortable with having only a few countries with ability to invent and produce frontier technology. Thus, its prescription to other countries is to “embrace the technology, ... while continuing to diversify their production base by mastering existing technologies”.

²⁹ Contextual conditions elaborated in Hanelta et al (2019) appear more robust.

³⁰ For example, while company registration is done at RJSC, trade licenses are issued by local government (city corporation and municipalities).

³¹ The document expresses intent “to unleash potential of youth talents and create good quality employment for them in the IT sector through cluster of innovation driven entrepreneurial initiatives”. Areas of interventions include, Education, Universal Quality Healthcare, Agriculture, Judiciary, Law Enforcement, Environmental management, Social Security, Land Management, and responsive Local Government.

developed' by the ICT Division during 2013-15, only 44 of which could be found on Google Play, though those apps rarely function properly (The Business Standard, 2022b). The long and often wasteful journey in government initiatives is also evident in parts of the discussion to follow.

3.2 Selected evidence and anecdotes

Three broad areas are covered in this section. Following the proposed framework to assess digitalization, the first focuses on consumerism, irrespective of the effects it may have on ideas and skill developments in local economy and society. The second covers soft technology (software, along with data sciences), which requires a certain level of human resources before entry is possible. The third covers the hard technology, where prospects, if at all, lie in low-end IOTs by assembling chips available in the market, designing chips for external producers, and by contributing to certain segments in the externally-driven production of digital devices. While there is quantitative evidence available on the first category, most of it may not be relevant to the present work. Progress in the last category, even if achieved, is not often disclosed to the public due to corporate secrecy – which is sometimes related to taxations issues. Given the proliferation of IT firms that engage computer science graduates and software engineers, anecdotes on the second are relatively more readily available.

3.2.1 Use of digital technology in Bangladesh

Bangladesh falls in the third group of “user economies” in UNIDO’s classification of countries mentioned earlier. Imports of ICT goods and IT-enabled Services (ITeS), relative to exports, are good proxies to assess whether a country is a “user economy”. There are multiple sources of data and definitions often differ. Bangladesh imported 1.47 USD billion worth of ICT goods in 2015 ([CEIC database](#)), its import of ICT goods “increased significantly over the past decade to reach around US\$650 million in 2019”. Imports of IT/ITeS services stood at US\$2.4 billion in 2019, more than 95 percent of which comprised IT-enabled services (RAPID and CUTS, 2022). Lemma (2021) infers from the 2018 product space map for Bangladesh that the country currently has no capabilities in the production of either electronic goods or similar manufactured produces. This is reflected in the fact that Bangladesh only exported US\$15 million in 2019, presumably finding their way into global value chain.³² Bangladesh stands second to India in terms of supply of online labour to the global market (RAPID and CUTS 2022). The UNCTAD database show that the exports of ICT/ITES services stood at US\$1.64 billion in 2019, of which, around half a billion were ICT services and the rest digitally deliverable ITeS services (Lemma 2021).

Thus, Bangladesh is a consumer of digital technology with its imports exceeding US\$ 2 billion a year. This facilitates the delivery of digital services to local markets, the development of e-commerce and other digital platforms, and enables local labour to participate in and earn from the global online market. While Business Process Outsourcing (BPO) relying upon software skills has been on rise, as is revealed in rest of this section, the country’s procurement biases compel local institutions to rely on external sources of software expertise.

3.2.2 Participation in the development and production of digital technology in Bangladesh

Measures of the extent of device usage (such as, of smart phones), internet access, or on the number of persons having the requisite knowledge to use or access digital services are good proxies for the size of consumers’ market. However, these factors alone are inadequate for guaranteeing

³² Bangladesh’s export of electronic goods, an alternative proxy for ICT goods export, stood at US\$ 70 million.

progress in digitalization towards achieving a societal digital transformation.³³ The evidence to understand how choices are made between procurement and build to push digitalization beyond expansion of ‘consumer’ market, is not always amenable to quantification and mostly relies on anecdotes. Moreover, such evidence is seldom documented in political environments with poor economic governance.

Experts suggest that the agencies responsible for developing software programmes for government agencies have become intermediaries and that the procurement procedure of such agencies may sometimes be influenced by a preference to transfer resources outside the country. Unfortunately, public audits are rare and expenditure on ICT components remain concealed in major projects of individual line ministries.

Drawing upon consultations carried out by the author for several research studies and a review of electronic media, the following list has been compiled, featuring incidents, practices as well as observations that illustrate the type of digitalization underway.

- (a) Several large IT firms who develop software³⁴ for global as well as local markets have emerged in the country. However, they are not keen to work with the government because of issues with payments. Concurrently, government agencies prefer to procure high-priced services from external sources.
- (b) All banks use software programmes to run their operations and these are reportedly procured from sources outside the country. Local commission agents use senior officials of the central bank as a means to influence the type of software and the source from which it is to be obtained.
- (c) The Customs Department under the National Board of Revenue (NBR) was one of the forerunners in adopting computerisation of data in the 1990s³⁵, though subsequent attempts towards complete automation fell short of expectation. A National Single Window project was initiated in 2017 with a total project value of USD 5.85 billion of which USD 5.29 came from the WB!³⁶ After almost 5 years after inception, it is being acknowledged that the project’s aim to bring 39 agencies under one umbrella, is unlikely to be realised (The Business Standard, 2022a). Bangladesh Custom’s official website now uses the [Bangladesh Customs Office Management Software](#), which was developed by Dcastalia.com., that belongs to [DIGITALOCEAN-ASN](#) - DigitalOcean, LLC, US. The mother company, DigitalOcean has 15 centres and projects in 185 countries.
- (d) NBR bought a USD 21.8 million software from the Dubai-based company WEBB Fontaine group FZ LLC (Prothom Alo, 23/03/23) although reportedly, such work could be done by local firms employing local IT professionals.
- (e) Similar procurements are reported in another line ministry project, where the procurement of Enterprise Resource Planning (ERP) software for warehouse management is said to have been

³³ Consider a community where only one person has a smart phone and provides mobile financial services. Everyone in the community avails the services without having to acquire digital competence. The key player, the MFS operator (or the ‘entrepreneur’ at the Union Digital Center (UDC)), may develop the business without investing on mass-level competency!

³⁴ Bjit Techsci for example has offices in Japan, Finland, Singapore, the U.S.A, Sweden, Bangladesh and the Netherlands. Software ranges from simple ones that monitor cash flows in ATM machines to more complex ones embedded in AIs. Companies that store compiled data in websites and make them available to the public via a search engine are not considered software developers.

³⁵ They have used an Automated System for Customs Data (Asycuda) since 1994.

³⁶ See also, The Financial Express, “NBR to crop National Single Window project”, 26 January 2022. Similar projects with external finance are found in other TLDCs as well.

carried out separately from the main project through a local business, a consulting company and a business house in the region with specialized IT unit. Reportedly, the local firm as well as the consulting firm acted as commission agents.³⁷

- (f) Several external funding agencies support development activities in the coastal south of Bangladesh. Many such projects are housed at the Bangladesh Water Development Board (BWDB). Several low-cost digital devices are available in the global market that have the potential to generate real-time information on parameters such as water level, water quality, soil quality and more, which could feed into decision-making processes. Unfortunately, due to a lack of interest in continuity in local-level knowledge, the market for such services did not develop. Thus, neither the government agencies nor the private sector took interest in developing business models that would use these digital devices.
- (g) The local industry, including the export-oriented RMG, occasionally engages local professionals to develop IOTs. However, the general production environment is shaped by the needs of imported machinery and subsequent automation that come with imported apps and other digital devices. The market is organised to ensure the presence of representatives of tech-industry from the North who are prompt in receiving feedback and addressing any challenges. As a result, the dominant local industry is less keen on engaging with local professionals unless programmes are purposively designed with their involvement (as well as higher education) in mind.
- (h) Consider an MRI machine developed by a renowned tech-firm. The latest versions of these machines come equipped with an ever-expanding array of digital devices, including apps. These advanced versions are capable of scanning the human body, storing the information in the Cloud, and generating analytics through AI algorithms. Once the analytics are prepared, they are reviewed by a physician who may add additional observations.³⁸ The final output is then ready to be delivered to the patient in a relatively short period of time. The market for such medical equipment is not large and therefore, a trained operator from the local professional pool placed in a hospital or a health clinic is enough to fully utilise the value of the machine. Ironically, the job at the consumer end of utilising the MRI machine does not, strictly speaking, require the involvement of a specially educated physician. Yet, given the relative prices of services in the market, a physician may end up serving as an operator who markets the service while also acting as the guardian of the expensive machine, with limited or no involvement in processing medical information. Among the physician-cum-operators, there may be quick learners who acquire new techniques in data science or on AIs attached as accessories. There will however, be no demand for technical (hardware as well as software) services that can connect with local professionals in related fields.
- (i) Use of digital devices facilitated by mobile telecommunication have contributed to developing viable enterprises in Dairy Farming (The Business Standard, 2021). The involvement of a new genre of entrepreneurs/dairy farmers has been associated with innovations in both business models and ‘technical’ (IOTs and AIs) aspects. Troubles faced by the subsector in the recent past illustrate the importance of fiscal and trade policies of a country in promoting digitalization.

³⁷ The requisite human resources for delivering a comprehensive ERP may not be available in the country. For example, Hussain et al (2022) finds no noteworthy progress in adoption of blockchain technology in Bangladesh. However, project designs need to be lot more judicious to develop local resources when it is lacking.

³⁸ IDEA (2021) notes that synergy and collaboration between medical equipment manufacturers, software and new technology developers, governments, and healthcare decision-makers is pressing to ensure the digital transformation of the health sector.

These examples illustrate how Bangladesh's journey into the digital world, so far, is a mixed experience. The country depends on imports for most of the digital devices that meet consumer needs as well as for those used as intermediate inputs for the generation of services and production of goods. The opportunity for innovation and creativity lies in the development of software and a few other IOTs, and that also in the small-scale private sector³⁹. While significant government demand for software (and other IOT) development exists, there is a tendency to procure from foreign agencies and potential complexities in payment procedures hinder local IT firms' ability to benefit from the 'closed market'.⁴⁰

4. Operationalising a meaningful digitalization process

There are concerns that digitalization in a market with skewed ownership of technology will eventually marginalize TLDCs in the idea space and will push their workforce into low skills, widening the disparity across nations. Emphasis on marketing and delivery of goods and services procured from elsewhere may encourage new ideas in developing business models for delivery. This is evident from the blooming of start-ups in many TLDCs. While there are examples of startups growing into large entities serving beyond local markets, many merge into (or get sold to) tech-heavy global conglomerates, who benefit from information and network generated locally by the startups.⁴¹ Given this, TLDCs need to find entry points to establish their presence within the global value chain.

As is evident from Section 3, TLDCs largely remain users of digital technology to, for example, help them run certain functions of the government, make businesses more efficient and to introduce new services in both private and government sectors. Such changes may face resistance from stakeholders extracting rent from procurements and/or from entrenched interest groups unwilling to let digital systems function. When a digital business ecosystem evolves, say, in financial transactions, control over digital data as well as production of both soft and hard technology is likely to get concentrated among TDCs. Such trends will marginalise the sovereignty of a TLDC. Exposure of the local economy and polity to the whims of the forerunners in digital technology is unavoidable. Countries historically dependent on imported technology face shrinking choices in an increasingly digital world. Thus, opportunities to create and build assets decrease as digital transformation progresses globally. Dependence on imported ideas and technologies creates operators who face increasing de- and re-learning costs as technology changes. When just procuring, the only skills acquired are those required to perform those jobs. Unquestioned dependence on imports prevents the workforce from learning to develop digital technology suitable for local conditions and compatible with the organisational culture and ability of the workforce. Such procurement, often tied to external borrowing, is often associated with cross-border transfers of resources⁴². It also discourages the acquisition of advanced skills through creative engagements, making an idea economy and society elusive.

³⁹ The term SMEs (Small and Medium-sized Enterprises) is avoided here, as the term "medium" may lead to incorrect inclusions.

⁴⁰ There are numerous examples where open tendering has not been practised in procuring services. No attempt has been made to capture the digitalization initiatives undertaken in agencies related to the armed forces of the country. Similarly, the potential to involve local IT firms in satellite initiatives has been overlooked.

⁴¹ Kader (2022) informs that "Indonesian Gojek invested in Pathao" and Australian Seek International bought 35% shares of Bdjobs.com in two rounds".

⁴² IT is one area where precise valuation is more difficult to be established than, for example, measuring 'earth works' or assessing the quantity of foodgrain carried in a floating vessel.

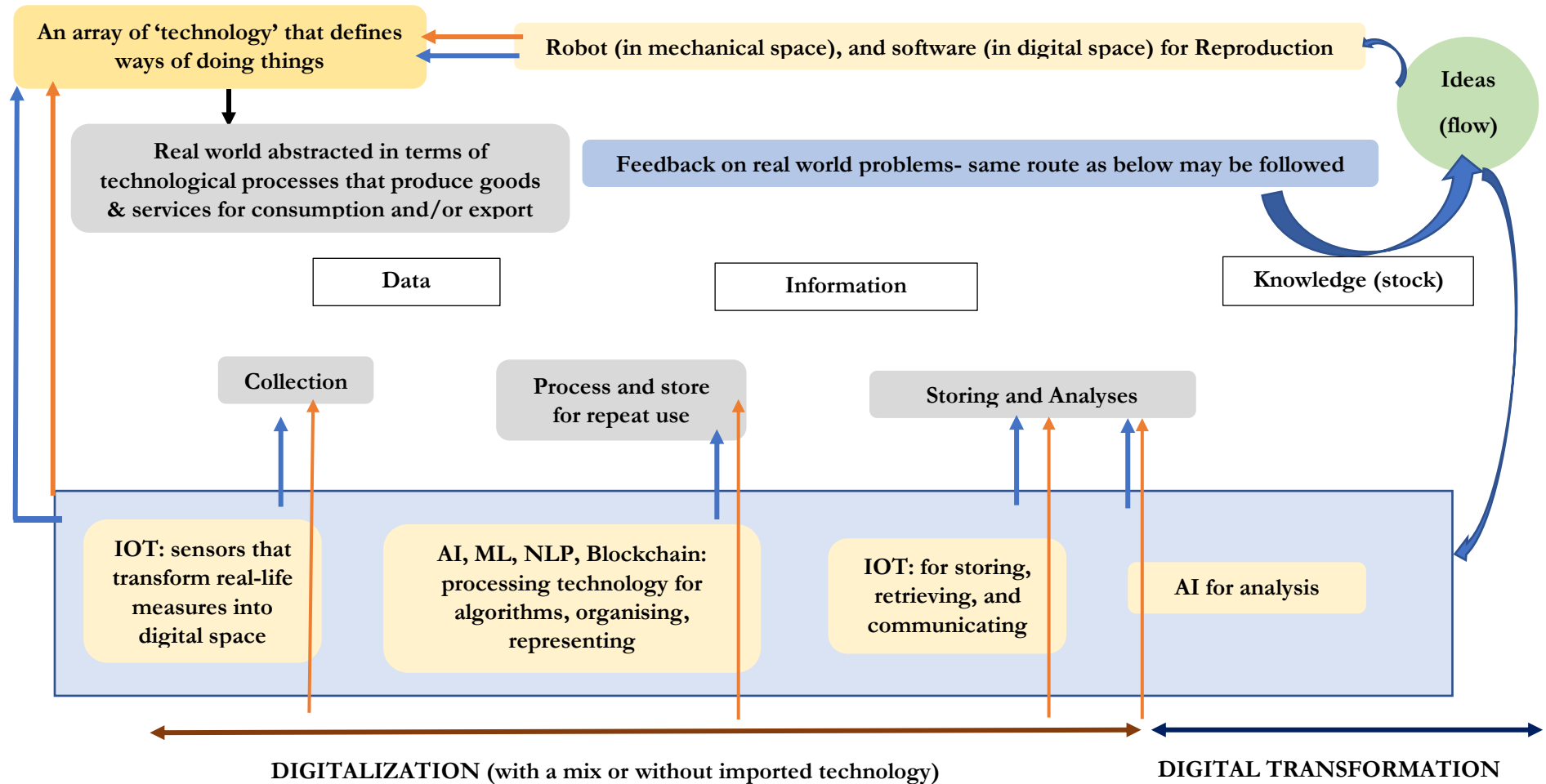
Alternatively, a TLDC may adopt a strategic approach, accept the current structure of production and consumption of digital technology as well as the skewed distribution of power among countries and interest groups, and plan entry points for change. One possibility is the ‘create and buy option’.⁴³ Creation involves the application of own ideas, using own resources, for the use in activities that meet the TLDC’s needs. Figure 3 sketches a technology-based abstract reality that includes the generic components defining (mechanical and soft) technology array whose use in production has the potential to generate digital data and to be stored and processed for information and knowledge. Those are facilitated using digital devices, and digital transformation would imply completing the loop with ideas feeding into reshaping technology space. In designing a project, a TLDC government may think through the constituents in Figure 3 and identify specific sub-activities where local content holds potential and develop the requisite ecosystem to promote the use of that content. A digitalization strategy should ideally chart the pathway to enhance the role of local soft and hard technology so that knowledge is locally generated, widely shared to promote learning process (skill development) and progress may be made towards digital transformation of the society. The prescription is not meant to bar importation of digital technology. On the contrary, it is suggested that there are tagged-in activities that need to be carried out locally and the right environment should be put in place to realise that. An example of this is data analytics using cloud facilities. Hypothetically, this is feasible with the human resources available and with a more competitive environment in sourcing out dynamic portal designs and public investment on cloud storage with affordable access without discrimination, TLDCs may gain. TLDCs also have the potential to develop IOTs if a well thought out and viable marketing plan is included while preparing a digitalization strategy.

In TLDCs, strategies are often drawn up to subscribe to the idea of moving fast with whatever technology is available in the global market. This applies to export-oriented production units who want to remain competitive and are less keen on R&D to develop suitable technology when services of equipment sellers are readily available. It applies no less in cases of government procurement, as mentioned earlier. All these are directly or indirectly influenced by loan agreements between TLDC governments and developed countries or multilateral agencies who, in most cases, represent the business interests in developed countries. Figure 4 captures some of the forces that shape the choice between ‘buy’ and ‘build’. The Ministry of Finance is likely to be more concerned with the balance of payments situation and less so with the purpose for which foreign currency is brought in. The government agency (or any other) to house a project is often pre-determined and fast loan disbursement is often the guiding principle. Thus, procurement plays a central role in loan projects and project personnel are content with such arrangements as long as they benefit from them.

The discussion above suggests that an effective digitalization strategy requires political support to disrupt the status quo in loan negotiations as well as to find the appropriate agency to house projects and professionally steer the implementation of the strategy.

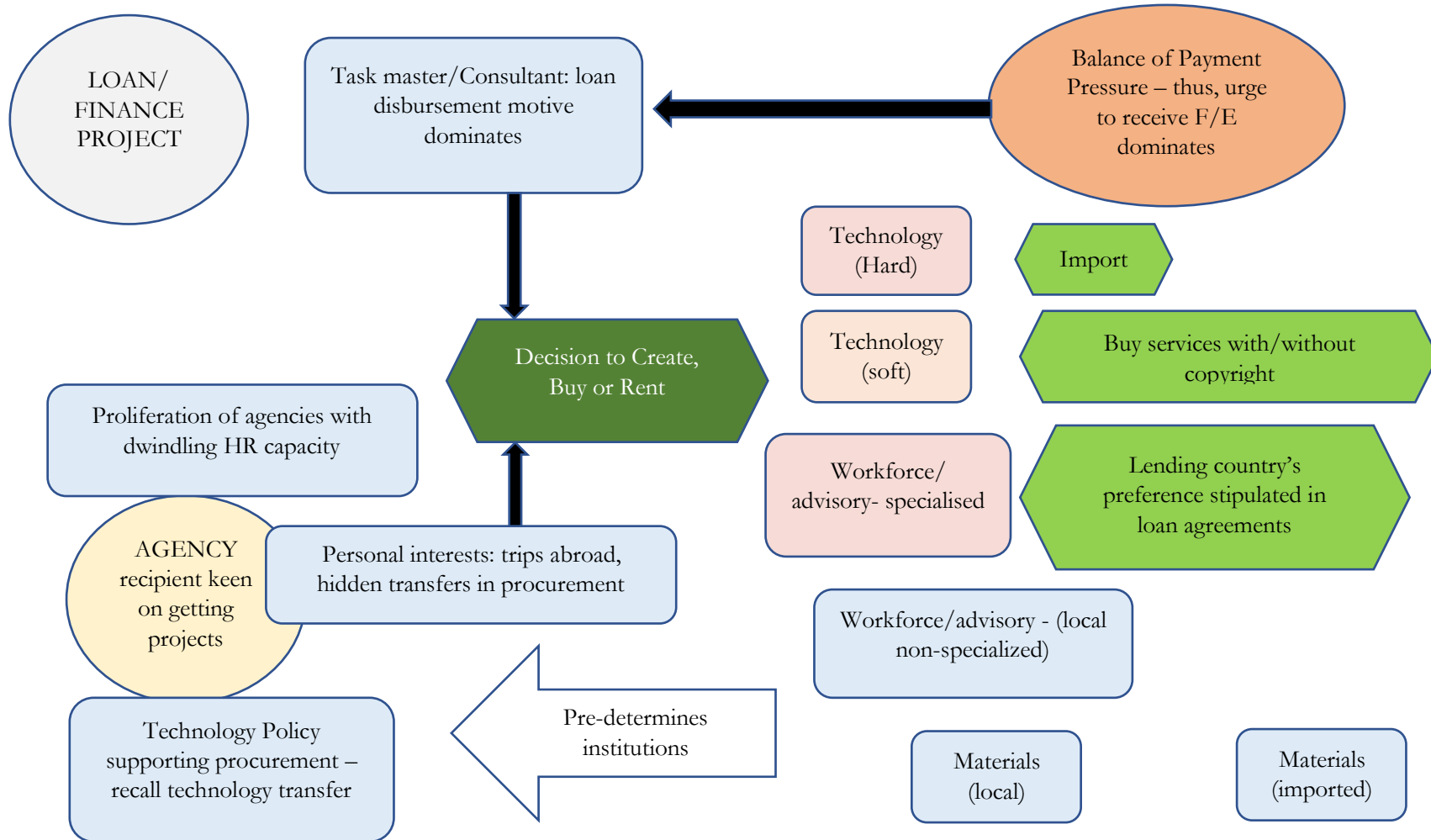
⁴³ The option of rent has several more dimensions to address in a formal contract. While those are worth probing into, this paper abstracts from the rent option.

Figure 3: Technology-defined real world, with institutions and behaviour defining a create-procurement mix



Note: Orange arrows represent imports, while the blue arrows represent locally generated ideas/digital devices

Figure 4: Decision environment influencing the Create-Procurement choice



5. Concluding observations

This paper follows an inductive approach in order to develop a framework for assessing the progress in digitalization in a TLDC. Two important departures from the dominant discourse are made in this paper. First, the paper distinguishes business models for digitalization that focus on delivering services through digital devices from an engineering perspective. The latter encompasses the development of both software programmes and hardware for digital devices. The paper argues that the two routes towards digitalization involve different kinds of skill development. The engineering perspective is considered more appropriate for developing the kind of skills TLDCs need, while the business model is necessary for the sustenance of economic activities using digital devices. The present-day literature is dominated by the business perspective, which needs critical assessment and reorientation for an effective programme design.

The second departure is made by introducing the choice between procurement (buy/rent) and build (create). Nurturing creativity for an idea economy and developing skills in the workplace is better realised in a regime where the choice is made to ‘build or create’. When relative costs and sources of fund are of little or no considerations, procurement through purchase is often perceived as the easier option for many governments in TLDCs. The purchase of digital devices from TDCs by private firms in TLDCs may be justified by wanting to remain competitive in the global markets. The allocation of public money to procure digital devices from foreign firms when resources are locally available is questionable. It is suggested that such bias in government procurement is the result of rent-seeking practices.

The business model for digitalization goes hand-in-hand with government procurement in TLDCs, especially when these procurements are funded through external borrowing. Although not extensively explored or detailed, it is widely acknowledged that external loans from bilateral and multilateral agencies are often tied to purchases of technology in TLDCs. This is echoed in reports from UNIDO, UNCTAD and other such agencies, as well as in ‘global funds’ made available to assess a country’s digital readiness. As a result, programme design is often influenced by practitioners’ pursuit to increase the use of digital technology? Such objectives set the tone for subsequent queries which attempt to identify the barriers to technology adoption. An alternative way of thinking through is captured with questions such as ‘how do we expand the reach of a service?’ This approach allows for a more comprehensive exploration of not only both technology and institutional issues, but also potential barriers.

While TLDCs cannot avoid dependence on imports of devices and software support, it is important to identify areas where a shift towards ‘build and create’ can be encouraged with strong political commitment. When the space for ideas is opened up at the local level⁴⁴ and the scope is persistently widened with purposively designed programmes, one can truly dream of digitalization that will lead to digital transformation of the society.

As globalisation and digitalization continue to challenge the sovereignty of nations, governance in the information age must conceptualise the relationship between data, technology, and digitalization (Kostkaa et al 2020). Thus, agencies responsible for digitalization in a country like Bangladesh should strive to negotiate contracts that discourage unnecessary external

⁴⁴ Ideas that reflect on problems confronted in a TLDC and engage primarily local communities to develop solutions.

procurement, allow inter-industry linkages within the country, and actively support local sources of professional services through linkage programmes. Most importantly, these agencies must ensure their own freedom to redefine a blended form of digitalization that appreciates local developments in both business and technical expertise. A good starting point could be safeguarding software and Apps development by local IT firms.

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6. Annexes

Box A1: Business perspective: excerpts from Bumann and Peter (2019)

Although the three concepts “digitisation”, “digitalisation” and “digital transformation” have distinct meanings, they often are used interchangeably as research confirmed (Bloomberg, 2018). While Bounfour (2016) has already revealed a lack of clear definitions, Unruh & Kiron (2017) assert that no consensus on the difference of these terms exist and their definition strongly hinge on the person or organisation using them. Literature tries to describe the three terms based on their scope (i.e., a narrow to broad perspective). (p. 15)

The first phase of transformation is described as digitisation, which Maltaverne (2017) refers to as “the conversion from analogue to digital” (e.g., digitisation of data). Digitalisation is the second phase and means “the process of using digital technology and the impact it has” (e.g., digitalisation of a process). Unruh & Kiron (2017) have a similar understanding and describe digitalisation as “the innovation of business models and processes that exploit digital opportunities”. (p. 15)

Finally, digital transformation ... encompasses the whole enterprise, not just a specific process. Maltaverne (2017) describes it as the designing of “new ways of doing things that generate new sources of value”. According to Unruh & Kiron (2017) it is “[...] a systems-level transition that alters behaviours on a large scale” and it arises when new digital business models and processes restructure economies. Digital transformation is customer-driven and requires cross-cutting organisational change along with the implementation of digital technologies (Bloomberg, 2018; Peter, 2017). Hebbert (2017) also asserts the dissimilarity of different definitions and in her opinion, real digital transformation is “[...] about a company’s ability to react and successfully utilise new technologies and procedures – now and in the future”. (pp. 15-16)

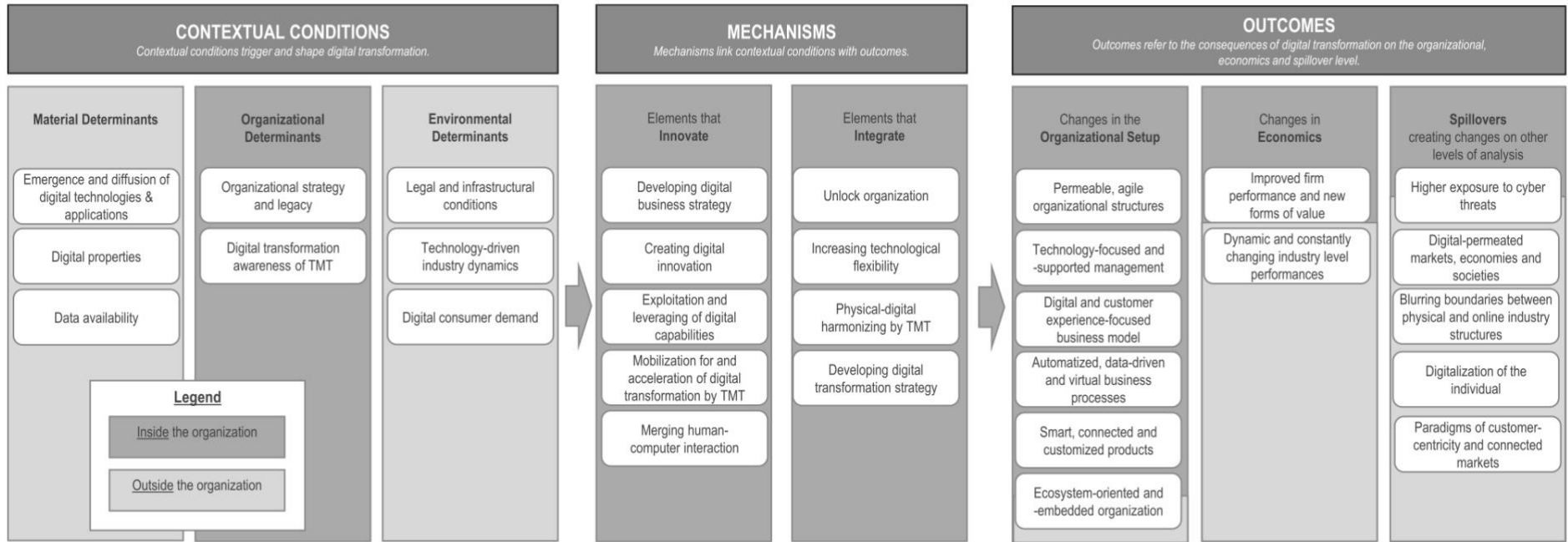
Box A2: Technology Perspective: Technology perspective: selected quotes from Leong et al (2019)

“Digitization refers to the process of encoding pieces of data into digital formats, turning analogue data into computer readable format, for transmission, re-use and information processing.”

“Digitalization is a transformation to improve processes by leveraging digital technologies and digitized data”.

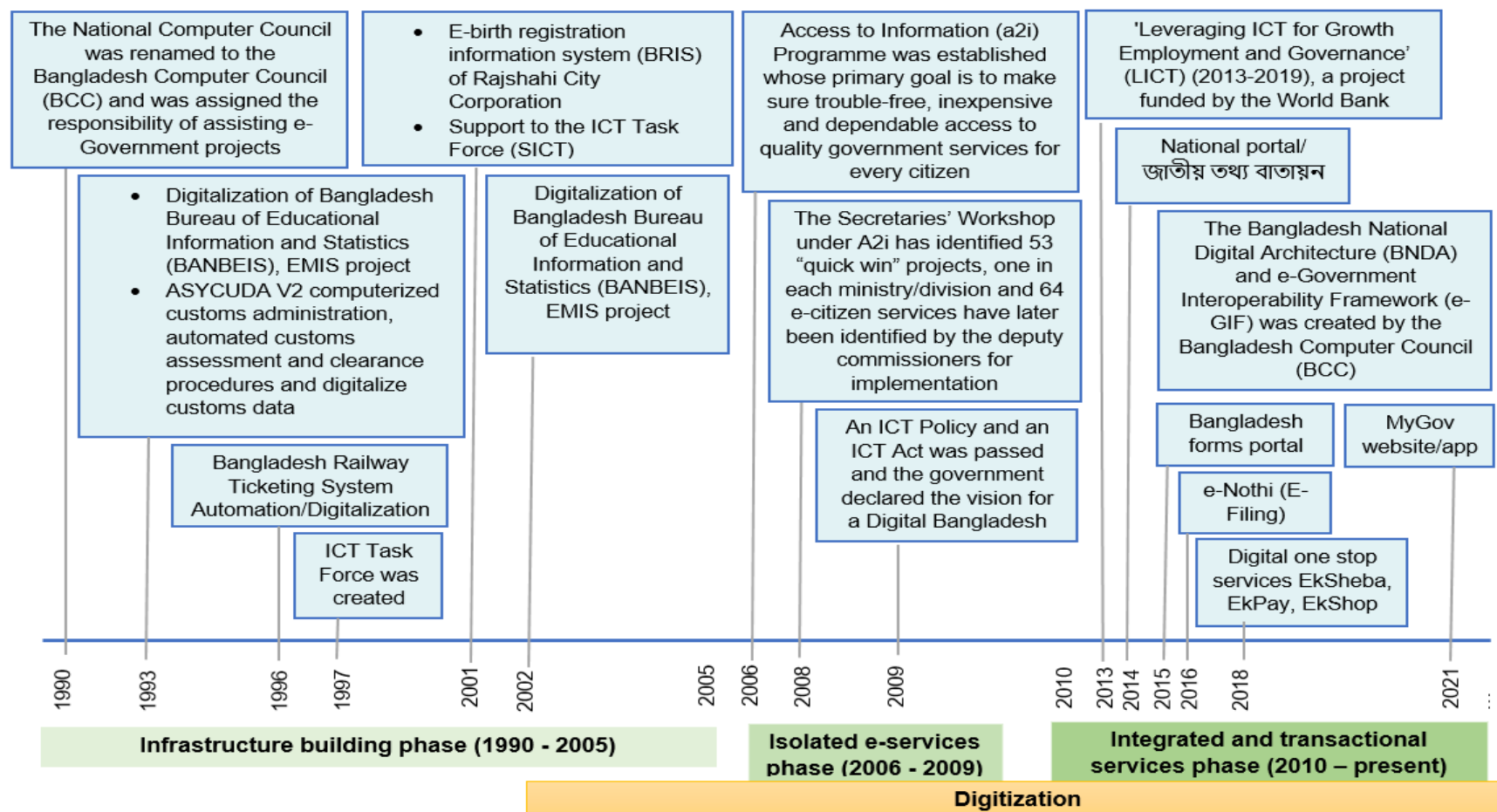
While it is acknowledged that “the act of digitization does not by itself involve digitalization”, it is asserted that “Digitalization is an eventual technological trend that leverages digital technologies to transform the data into a quantified format, turning many aspects of our life into data which is subsequently transferred into information realized as a new form of value.”

Figure A1. Multi-dimensional framework of digital transformation



Source: Hanelta et al (2019)

Figure A2 Evolution of Bangladesh e-governance



Source: Haq, N.F. (2023) Presentation at BIGD, BRAC University.