Societal Transformations Through ICT as a Shared Public Infrastructure

Karan Rai Bahadur, Ojas Vyas and Prashant Mehra

Abstract Advancements in information technology have played a central role in the economic, political and cultural globalization of the world. While commercial ventures have thrived by leveraging information technology, governments and multilateral institutions might often view technology as a means for doing things as opposed to the way of doing things. Owing to the multitude of development initiatives being carried out at any given point in time development institutions face challenges in scaling the collective impacts of such interventions. In order to address these gaps, the technology division for social inclusion at Mindtree has developed a cloud-based 'Public Goods Platform'. The objective is to enable governments to provide digital platforms as a public service to its citizens, integrating multiple social development models, theories of market economics and scaling the impact to a larger section of the society especially the vulnerable sections. The core tenant of the Public Goods Platform is inspired by the concept of public goods—'it is non-excludable' and 'non-rivalrous'.

Keywords E-governance · Public goods platform · Technology platform · Government programs · Interoperability · Multi-domain · Sustainable development goals (SDGs)

1 Introduction

With India positioned to be one of the fastest growing economies of the world with a projected growth rate of 7.3% in 2019 [1]; about 20% of the country's population is still below the poverty line [2] and more than two-thirds of the adult population

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constitute the low-income group [3]. This dichotomy mirrors inequitable growth in which even the most basic amenities do not reach a large section of the population. This phenomenon is typical of not just India but of most developing economies such as China, Ethiopia, Rwanda, Bangladesh to name a few [2]. Moreover, in most of these developing economies, a significant section of the population works in the informal sector. For instance, in India, more than 80% of the economy is informal [4] making it very hard for the State and concerned institutions to ensure fair wages and social securities for such communities.

In a thriving democracy, by all means, the State becomes the most crucial agency for poverty alleviation and employment generation within diverse sectors. With a surge in job-seeking youth population, especially in countries like India, the rate at which formal jobs are created annually will need to increase manifold in order to bridge the existing economic divide. Since this divide is multidimensional; constituting of the constantly widening gap of urban and rural communities, gender and caste discrimination, the disparity in formal and informal sectors, and the digital divide; governments require a paradigm shift in the way economic growth is imagined. Our societies need more job creators than job seekers and technological innovations will need to power this transformation.

Information and communication technology is fundamentally redefining the way we live and operate as a global and a hyper-local community. In the past decades, technology innovation have altered our patterns of communication, work, consumption, formal education and the way we imagine our collective future. It has brought the global community closer than ever before. And while unfortunately those at the bottom of the socioeconomic pyramid haven't been able to reap the benefits of this digital transformation, the coming decades present an unprecedented opportunity to accelerate growth for all sections of the society. In a country such as India, with 88% of the Indian households already equipped with a mobile phone [5] and almost 500 million of the country's population having access to internet, [6] the possibilities for leveraging ICT are unprecedented. It offers the opportunity to scale up the connect between rural producers to urban consumers, job seekers from economically weak sections with potential employers, entrepreneurs at grassroots with incubating agencies. Technology platforms of the for-profit worlds have successfully demonstrated such multi-sided interactions connecting value creators with value consumers; thereby creating new marketplaces and enabling new economies to emerge.

In the domain of sustainable development, Mindtree.org's Public Goods Platform (PGP) aims to enable governments to make a transition from programmatic interventions to leveraging the capabilities of the digital platform to sustain and scale grassroots growth. The approach towards developing Public Goods Platform recognizes the State as the sole upholder and guardian of public goods, services and the communities that are creating or leveraging value. It is offered to government agencies to facilitate micro-interactions with diverse change agents in the concerned ecosystems. Public Goods Platform is designed with the underlying intent to hand over an instance of the principal platform to the government entity, as the primary custodian and enable socioeconomic interventions in various domains such as agriculture, education, skills development, solid waste management etc.

What makes platforms unique and powerful are the communities of stakeholders who can engage in meaningful transactions within the offered eco-systems. It's more about the communities and their shared values, and less about the product itself. The scope and the value offered only multiplies through the remarkable phenomenon of network effects as more and more people begin to leverage the platform's natural capabilities—thus becoming a source of endless possibilities.

2 Program to Platforms

In India, various developmental agencies have been working towards improving the socioeconomic outcomes for millions working in the informal sector and especially for those coming from vulnerable communities. These agencies include state and central government driven institutions, programs, schemes, and non-governmental actors such as multilateral organizations, social enterprises, Corporate Social Responsibility initiatives, foundations, philanthropy, etc. All such initiatives combined spend billions of dollars each year to drive the country towards sustainable development, driven by their specific individual charters, target groups and specific outcomes. While there is a wider consensus within the development community to approach sustainable development with a sense of urgency; there are certain fundamental challenges that prevent related initiatives to scaled and sustain.

2.1 Challenges in Sustaining Development

Program Approach. Most of the development initiatives take a programmatic approach to development. Which basically means that there is a set duration for the intervention focusing on a particular target group with a defined budget to drive it. The challenge is that these interventions often fail to sustain impact once the budget or the program execution period is over.

Data Gap. There is hardly any comprehensive and actionable real-time data available on socioeconomic development. The data is scattered in various forms and formats. Starting from development statistics and Personally Identifiable Information of beneficiaries stored in dusty paper files in remote villages to citizen data stored through high tech biometric systems. This not only makes data cross-sharing almost impossible but also causes years of delay before data can be consolidated to take any meaningful action.

Development Silos. Various government and non-governmental institutions which work towards sustainable development mostly carry out program planning and execution in silos. While there could be multiple parties engaged in each of these developmental programs, such interventions are not necessarily planned at a larger eco-system level. This leads to either duplication of efforts or multiple development

interventions running in parallel losing out on the possibility of creating a larger collective impact.

In order to address these gaps in sustainable development, Mindtree's technology division for social inclusion—Mindtree.org has developed a digital platform called "Public Goods Platform". The primary approach is based on enabling sustainable development efforts to move from a program mode to a digitized platform approach.

2.2 Public Goods Platform (PGP) Architecture

The Public Goods Platform is a cloud-based solution. The platform's technology primarily constitutes of three layers:

1. **System of record**: This is the base layer in which all kind of data is stored. This would include people and organizations transacting on the platform, socioeconomic data, material movement data, financial transactions, geographical data etc.
2. **Layer of differentiation**: The data contained in the system of record is just raw data, the particular use case of this data is derived in the central technology infrastructure. This is called the layer of differentiation. This layer basically pulls out the relevant data from the system of records and performs the necessary computation to give a result based on the use case.
3. **Layer of engagement**: The user of the applications built on the Public Goods Platform primarily interacts with this layer. This interaction could be through a mobile device, tablet or a computer based interface. Based on the user's profile and the particular use case for the interaction, the inputs of the user is recorded in the layer of engagement, which then pulls out the relevant data from the system of records, puts it in the context of the use case at the layer of differentiation, does the necessary computation and displays the result/output back to the user (Fig. 1).

A host of digital interventions that are suitable for multiple social development domains emerge from the platform. These include but are not limited to applications for enterprise resource planning, digital payments, governance dashboards for monitoring and evaluation, tools for predictive analysis and solutions to facilitate interactions between different stakeholders who need to come together to drive sustainable development. The challenges and needs of users who deploy these solutions are unique and are dependent on the socio-cultural, geographical and political context. For example, a supply chain solution to tackle urban waste management might behave differently from a supply chain solution that connects marginal farmers directly to the market. However, since both solutions share the same technology and source code, they can represent one type of product offering. Likewise, a number of interrelated solutions can be bundled or unbundled as technology product offering and tweaked to suit the problem at hand. The layer of differentiation of the platform
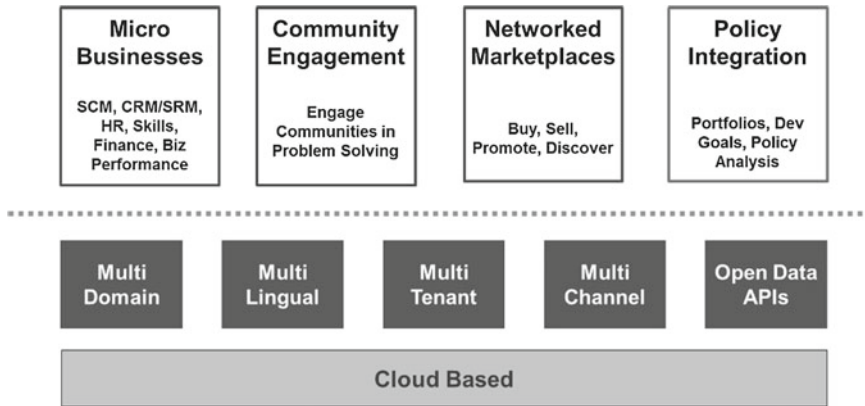
Fig. 1 Public goods platform architecture

helps codify the natural flow of interactions for the user and his larger context, barriers are being removed with each field testing experience and further understand the root cause. Further, the platform codifies people in unorganized sectors as independent micro-businesses and then proceeds to apply best practices and principals relevant to the hyper-local realities. The objective currently is to onboard different stakeholders on to the platform's marketplace in order to achieve a critical mass. This would then lead to a network effect as more and more stakeholders will find mutual value and the platform usage spreads across different sections in the society. From an architectural standpoint, it's a Multi-tenant, Multi-domain, Multi-lingual and Multi-channel platform. These are collectively termed as MULTI-X. The following section explains each briefly:

Multi-tenant. The platform leverages the principles of Multi-tenancy which primarily deals with security, privacy, subscriptions, customizations, metadata, analytics, and billing and metering. Every user uses the system as if they are the only users. Multi-tenancy is the basis for SaaS. Entities/Resources are qualified per tenant. However, we also have use cases for global data, cross-tenant data as well.

Multi-domain. It means that the platform has an ontology, white labeling, domain-mapping and multi-language. The solutions build on the platform are modular in nature and can be deployed in multiple domains. For example, the current modules of the platform are being used in domains such as education, skilling, solid waste management, agriculture, handicraft industry and community engagements.

Multi-lingual. The platform has multi-lingual enabled UI and domain labels; reference data and transaction data. For the Public Goods Platform, Multi-lingual support is the least common denominator support since languages and user preferences change from region to region in a diverse nation like ours.

Multi-channel. The Public Goods Platform is built with channel intelligence. It is channel aware and does not discriminate. It has tools and automation to build apps on any channel. This is further enabled through its App models.

Open Data APIs. The platform offers a rich API economy to open source developers, social entrepreneurs and other developmental agencies to build new solutions on top of the platform.

2.3 Interoperability

Lack of convergence in policies, schemes and programmatic interventions across government departments and institutions is often a key challenge in delivering sustainable development outcomes. And ICT can be a key enabler in overcoming these barriers by enabling meaningful multi-stakeholder and multi-process interactions. In many contexts governments and multilateral development agencies might end up using numerous ICT based solutions to address specific problems or to enable certain processes and interactions; however more often than not these technology solutions end-up being deployed and operated in silos without the attempt to cross-leverage technological capabilities by enabling information exchange and processes interaction between such solutions at a core architectural level.

While there is no limit to the kind of ICT applications that can be built on the Public Goods Platform, any government institution deploying Public Goods Platform can easily integrate its existing ICT solutions or new ones on the platform. This is made possible through the interoperability standards codified on the platform. Consider for example the domain of agriculture where a government institution may want to build a farm advisory solution on the Public Goods Platform for smallholder farmers in order to help improve farm productivity and reduce risk to crop failure. And say for instance it already has two technology solutions deployed on the field: one an IoT based system which captures data on soil and water health, and another a satellite based weather monitoring system. A farm advisory solution would need to collate and process information from these two systems and few others data sources in order to deliver an effective advisory service to the famer. It will not make much sense if these solutions provide independent outputs just in some data format. Under such a scenario, wherein multiple technology solutions are at play, the Public Goods Platform's interoperability standards would help integrate all such solutions enabling them to seamlessly interact with-each other and provide a meaningful outcome. Further if there are no such existing solutions currently deployed then the IoT based system and the weather monitoring solution can be directly built on the Public Goods Platform, using the platform's existing services and integrated into the overall farm advisory solution. With interoperability the possibilities are endless.

Figure 2 Illustrates how different isolated systems can interact with each other by leveraging the platforms interoperability standards.
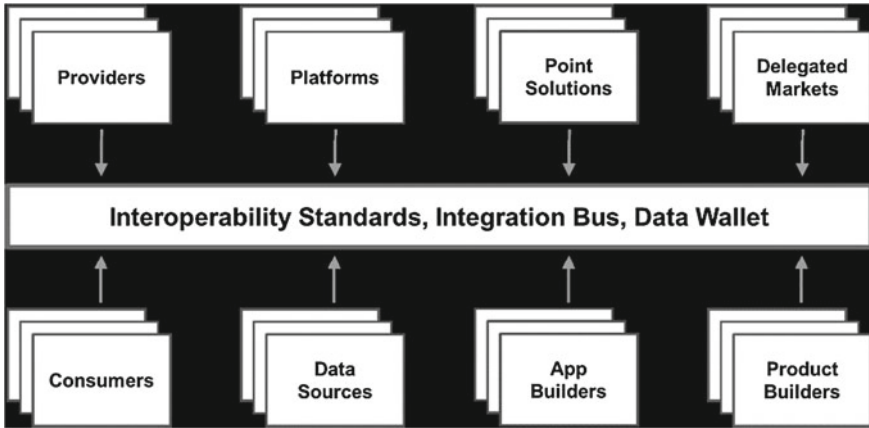
Fig. 2 Different isolated systems interact with each other by leveraging platforms interoperability standards

3 Conclusion

The Public Goods Platform has been designed for government institutions and multilateral development agencies to engage in socioeconomic transformation at various scale; be it at a hyperlocal level, national or global. Its architecture takes an ecosystem approach to development interventions with the beneficiaries at the core and enabling multi-stakeholder interactions to create greater collective impact. The primary goals of the platform is to help socioeconomic development initiatives move away from a silo approach and towards a platform model enabled through information and communication technology. As a core principal the solutions built on the platform are made available free of cost to people below poverty line and many others in the informal sector who do not possess the means to leverage ICT in carrying out socioeconomic activities. The Public Goods Platform brings together public services, development eco-system stakeholders, strategic planning, monitoring and evaluation tools and open innovations to drive sustainable and measurable development.

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