

ABSTRACT

There is a burgeoning global concern to transition to an inclusive and sustainable society. Countries are envisioning shifting towards sustainable practice by developing clean and appropriate technologies without compromising their living standards. Due to its significant potential for attaining social, economic, and environmental advantages at the Base of the Pyramid, Appropriate Technology is getting a renewed attention among researchers, practitioners, and policymakers. The movement of Appropriate Technology was initiated in the 1970s as an alternate development strategy to stimulate engineers and planners for creating a sustainable and just society through technologies in response to the polarized pattern of modern development. Appropriate Technology (AT) was flourishing as a pertinent social movement in many third-world and developing countries but lost its popularity during the 1980s. However, during the late 2000s, the ideals of appropriate technology were resonated in the various constrained innovation process. Therefore, it is relevant to focus on its practices and exploit its opportunities for creating development at the Base of the Pyramid. The continuance of limited research attention on appropriate technology further reinforces the need for generating new methods and knowledge to re-conceptualize its functioning in response to emerging constrained innovation. This research intends to explore appropriateness, dynamics, and sustainability in appropriate technology in a developing country context. The research adopts a multi-case study to address these concerns and furnishes empirical insights guided by a conceptual framework.

The first stage of discerning an appropriate technology was to examine its appropriateness, which signifies the accurate measure and quality of the technology. The study did a field survey of 250 respondents through a closed-ended questionnaire from different organizations belonging to India and Bhutan regarding determining appropriateness. The organizations chosen from these regions were primarily distinct, constituting academic institutions, civil society, for-profit social enterprise, and non-governmental organizations. These organizations are actively involved in designing, developing, and disseminating appropriate technologies concerning energy, handloom, textile, and agriculture. The empirical data obtained from the questionnaire was analyzed through exploratory factor analysis using SPSS20 software. The investigation resulted in four factors determining appropriateness- entailing appropriate design for sustainability, participatory mode of development, facilitating sustainable rural delivery mechanism, escalating indigenous knowledge for development. The study further evaluated the relevance of these four factors with different technologies developed from the

organizations. The results denote that appropriateness engenders economic and non-economic advantages for rural users.

The second stage of exploring appropriate technology was concerned with understanding the genesis of appropriate technology using the ideals of Institutional Theory. The study examined the potential drivers, enablers, barriers, and challenges associated with the development and dissemination process. Furthermore, the study looked into the mechanism that facilitates an appropriate outcome. Various semi-structured and face-to-face interviews were conducted with selected respondents from these organizations in response to this research objective. The qualitative data obtained from the interviews were analyzed using a thematic approach using NVivo12 software. The findings obtained from the analysis generated five themes that influence development dynamics- establishing a sense of ownership, intensive innovation practices, transformative learning, maximizing impact at grassroots, capturing psychological aspects. The generated themes stress the primary role organizations must ensure in bringing systematic transformations in the practice of appropriate technology.

Sustainability is recognized as an essential attribute of appropriate technology. Sustainability in appropriate technology is gauged by the interplay of economic, social, and environmental features. However, there is a shortage of work that evaluates how appropriate technology steers a sustainable performance. Thus, the third objective concerns developing a novel approach to predict variables that influence appropriate technology towards sustainable performance. A field survey was conducted with the same set of 250 respondents. The data were analyzed using a machine learning algorithm, and feature selection techniques that identify significant variables influencing three pillars of sustainability. The findings posit that machine learning is a promising tool to help organizations select important variables for developing technologies to ensure sustainable performance.

It is significant to enrich the discourse on appropriate technology with pertinent research findings that generate possible avenues to improve its current grounding. It is worth re-investigating if appropriate technology attains any of its objectives and is being successfully adopted at the user level. The research concludes with an empirical framework that can be utilized by various organizations, practitioners, policymakers to devise, design, and disseminate AT in a developing country. Furthermore, propositions have been formulated, and a working definition of AT has been proposed. The contribution of this research is threefold.

First, it conducts a scientific assessment of appropriateness by furnishing empirical representation from developers and end-users perspectives of choice of the technology. Second, it advances the practice and functioning of AT by identifying different activities that stimulate technology development and dissemination at the grassroots. Third, it establishes how AT can be discerned as a relevant approach to determine sustainable performance through predictive techniques.

Keywords: Appropriate Technology, Innovation, Base of the Pyramid, Sustainability, Developing Country