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Digital transformation for Extension: Mobile apps, Social media, E- learning

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Digital transformation in the field of agricultural extension is quite essential for agriculture as it is changing agricultural extension communication and information services. Extension and advisory organizations are depicted in the literature as socio-economic entities, which combine human resources, financial capital, infrastructures, and equipment to produce services that facilitate agricultural innovation, enhance farmers' competencies, and promote sustainable rural development. To do so, these organizations create connections with other actors, forming solution networks i.e., constellations of actors who integrate resources to produce solutions to current or future problems.

In India, where most of the population relies on agriculture, it is difficult to provide tailored information to every farmer due to the large population. This challenge makes the use of mobile phones an important initiative in the agriculture. Mobile phones can facilitate the transfer of agricultural information, but they may also aggravate information disparities between traders and farmers. Therefore, scaling agricultural extension services inclusively requires integrating digital communication into diverse advisory frameworks that combine both digital and traditional communication methods. Digital tools, such as mobile apps, social media, and e-learning platforms, play a key role in this integration. This chapter covers: 1) The role and uses of mobile applications, the flow of mobile-based agricultural information, the involvement of key stakeholders in mobile agriculture apps, and the hardships faced in using mobile apps for agricultural development; 2) Social media applications, policies for using social media in agricultural extension, and guidelines for creating social media content; 3) E-learning platforms, methodologies for e-learning, and the practices for designing and developing e-learning courses.

Digital platforms have three key features: they are driven by technology, foster interaction among different groups of farmers, and help them to accomplish specific goals. From the recent times it is observed that, digital platforms are transforming the agriculture sector. Besides updating traditional business models, they also address the issues that farmers have faced.These problems include five aspects, namely access to information (related to good agricultural practices /GAP, prices, pests and diseases, climate), access to financing and farm insurance, access to quality production inputs (such as seeds, fertilizers, and pesticides), market access, and access to mechanization and precision farming technology services. The presence of the platform seems to consolidate the prerequisites for agricultural development as formulated by Mosher that there are five basic conditions and facilitating conditions. The basic conditions include markets, technology, means of production, production stimulation, and smooth and continuous transportation. Theconditions consist of extension education, financing,cooperation, improvement and expansion of land, and development planning (Mosher, 1965).

Digital platformshave emerged to major systems, namely the food system and the agricultural knowledge and innovation system.The emergence of digital marketplaces, traceable supply chain systems, fintech-based financing (peer-to-peer lending), and mechanization and precision agriculture platforms. The transformation of agricultural knowledge and innovation systems is characterized by the emergence of new forms of agricultural information services, new sources of knowledge, and new actors in agricultural innovation.
The key challenges grouped by the three main stakeholder groups relevant to extension services are: (1) scale and complexity (farmers), (2) weak alignment with research activities (researchers), and (3) lack of evidence

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on outcomes (policy-makers and donors). Aother major challenge relates to the dependence of the agricultural extension system. The eight recent innovation directions to address communication challenges are scaling information delivery due to low per-unit cost of dissemination, tailoring advisory contents to individual users through two-way communication, supporting farmer-to-farmer sharing of experiences, increasing client-orientation of research by crowdsourcing farmers' information needs, supporting farmer experimentation and observation through agricultural citizen science, monitoring and evaluation by analyzing usage data from digital services, measuring impacts by remote household surveying integrated into advisory applications, increasing the accountability of advisory providers by crowdsourcing user evaluations within digital services.
Keywords:Digital transformation, Extension, Advisory organizations, Agricultural innovation, Mobile Apps, Social media, E-Learning, Digital platforms.

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