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A Review

A critical review and recommendations over product designing problems faced by new product designers in agriculture

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■ **ABSTRACT :** Designers of Agricultural products have major playing roles to keep trying to uplift the agricultural sector dignity by producing innovative design insights. Product designers work alongside engineers and model makers to conduct research and device an accurate design proposal for projects. Agricultural excellence could be attained through technological advancement and innovation in design. The major implications of an innovative product development postures for the agricultural research organization and management along with the role of design function in innovation development. The appropriate agricultural technologies harmonize with the environment, maximize and minimize its benefit and harmful effects, respectively while requiring an intelligent balance of labour-intensive and capital-intensive parts of technologies. The intensive innovation activity nowadays in agricultural sector is becoming an essential part of development and considered as a major factor in the contribution to the production development and efficiency in the market economy. The shaping and advancing strategy of the innovation system is aimed at assimilating the novelties making it possible to launch new production technological structure and to ensure competitiveness of enterprises both domestically and internationally in markets. New product development in agricultural risk management using integrated approach should be made to crop insurance improvement so that farmers are drawn to adopt innovative technologies and designers are motivated to design new for no loss of uncertainties of future marketing.

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Product Designers, especially agricultural allied product designers design numerous items like agricultural tools, equipment and machinery. Product designers design a wide range of items, from day-to-day items to larger things. They apply their understanding of technology and manufacturing methods to improve design and utility of these items. Product designers work alongside engineers and model makers

to conduct research and device an accurate design proposal for projects. By producing and testing prototypes the product engineer carry out the job for the development of the technology and in case of agricultural product designing, each product is made keeping in mind the future and development of the farmers and the food production, respectively.

Importance of agricultural research through an innovation lens:

Designs are consumed by every person every day of our lives. Designers of Agricultural products have major playing roles to keep trying to uplift the agricultural sector dignity by producing innovative design insights. The excellent and ingenious technologies make the operation faster and safe without needing having much labor while continuously improving the production quality (Bajuri, 2007). Agricultural excellence could be attained through technological advancement and innovation in design. Centre of Ergonomics for Developing Countries, revealed the sad statement that in many industrially developing countries (IDC), there are an alarming exposure to risk factors in agricultural activities.

The major implications of an innovative product development postures for the agricultural research organization and management along with the role of design function in innovation development. Sumberg and Reece (2004) have presented the better use of the concepts, theory, language and experience of agricultural research from industrial and commercial field of 'new product development'. The agricultural research is argued to be better able in responding to enlarged agendas, elevated impact expectations and declined budgets by conceptualizing, organizing and managing the research activities in applied and adaptive form for a new product development.

The insurance companies of the local region most commonly, while interfacing with product design researchers serve as an important hub as well as regulators with national government to get the approval for new products (Jensen and Barrett, 2017). The products are designed and initiated by researchers from outside and are being developed and marketed by central governments, non-governmental organizations (NGOs), Consultative Group for International Agricultural Research (CGIAR) research centers, universities, private firms, and multilateral organizations.

Bajuri (2007) made a realization towards the importance of design in agriculture and making more productive land along with the wondering of jolt happenings after stopped and failed designing for agriculture. He highlighted the major hazardous factors creating alarming risks in agricultural activities involving farm machinery works, manual lifting and handling, chemicals' use and musculoskeletal injuries due to bending, stooping, repetitive activities along with high level of noise and vibration. The appropriate agricultural technologies harmonize with the environment, maximize and minimize its benefit and harmful effects respectively while requiring an intelligent balance of labour-intensive and capital-intensive parts of technologies. He conceptualized the successful generation of local designs through academic collaboration with foreign design institutions to enhance a smart assimilation of local input with foreign technologies.

Golait (2007) analyzed the issues in agricultural credit in India and revealed that the credit delivery to the agriculture sector was inadequate. He represented how the banking system was hesitant on various grounds to purvey credit to small and marginal farmers. The situation was depicted as calling for coerced efforts to augment the agriculture credit flow along with exploring latest innovations in product design and delivery methods using better technology and related processes. Facilitating credit via vertically integrated sources with the farmers such as processors, input dealers, NGOs, etc., should be included for providing them critical inputs or for food processing could make a significant increase in the agriculture credit flow.

Makhura (2008) derived the focus upon the most lending products that micro-finance institutions use but do not meet the meant requirements of borrowers, which in turn leads to highly defaulted and dropout rates. The small farmers are unable to access formal credit and the high transaction costs of serving the seasonal nature of agriculture, the institution and client satisfaction require safe design products that ought to accommodate the inability to present collateral and the uncertain incomes.

Singla and Sagar (2012) suggested an integrated agriculture risk management service by assessing different risk management practices offered in conjunction with crop insurance so that various problems and challenges faced by farmers and insurance companies could be addressed. The integrated risk

management framework for agriculture had been developed by exploring various elements that could be efficiently interlinked with the crop insurance for mitigating various agricultural risks inductively. This study proposed a basis for new product development in agricultural risk management using integrated approach of risk management and identified different elements to crop insurance improvement.

Breneman and Yang (2013) documented in their study the best practices of the time and a proposed framework for the designers of the future generation, focusing upon creating micro-enterprise fostering products. Due to steady increase in market and consumer quality interest transformation, product design has become the rapidly growing field in the emerging markets. The challenges marked by the economic and cultural barriers for designers are presented in the study along with proving guidelines for marketing of products for the emerging designers. The study also provided with the case studies for several product categories.

Odening and Shen (2014) developed a narrative on weather risk characteristics in agriculture often violating classical requirements for insurability and problem solving potential remedies. They first of all analyzed the spatial correlation of some weather risks, particularly slowly emerging weather problems like drought which ultimately cause systemic risks. Secondly, they had shown that the climate change might increase the volatility of weather variables leading to non-stationary loss distributions creating difficulties in actuarial rate making. Thirdly, they represented the hindrances caused by the limited availability of yield and weather data over the estimation of reliable loss distributions. They discussed the usefulness of approaches such as time diversification, local test procedures and observational data augmentation by expert knowledge for crop insurance companies to risk management and product design improvement. The study provided the background and development information related to weather insurance and also presents statistical tools and actuarial methods supporting the weather risks assessment along with the designing of weather and yield insurance products.

Sherwood *et al*. (2017) tried to drive an attention towards the design of bio-based products and reported the first steps towards the framework development to understand product design connection to resource efficiency. Bio-based products made from renewable materials offered a promising basis to produce sustainable chemicals, materials and other complex articles but biomass is a limited resource causing environmental and social impacts. Hence, biomass use and a bio-based economy are important but any resource must be used effectively to reduce waste displacing the non-sustainable petroleum basis of energy. The study provided standards developed to support the bio-based product market and encouraged scientists and engineers are to think beyond simple functionality and to associate potential value to the primary and further use of materials.

Mondal *et al*. (2017) made a novel approach in his research to design a closed-loop control system for monitoring and controlling soil-moisture because of the massive failure to crop yield due to improper management of water resources in agriculture. The risen demand of agricultural water management system to maximize the crop yield in agriculture field was achieved through this deployment of proposed Wireless Sensor Network (WSN) model, carrying a great importance of product cost as the end users are farmers. The processes being followed to develop the product were selecting the hardware component, development of firmware, integration and field implementation along with testing and optimization. The costs of available motes in market were much higher and beyond the reach of farmers. Due to this reason, the designed new sensor nodes created with the help of Arduino Platform and Raspberry Pi module which minimized the cost of entire product. The design benefitted to control all desired parameters to own application requirement which sometimes can't be achieved from the marketed product.

Clark *et al*. (2009) provided the concept of the Design for Sustainability (D4S) which outlined the methodologies for making sustainable product improvements (social, economic and environmental) by applying life cycle thinking elements. D4S was build on the work of eco-design including economic and social concerns including both incremental and radical innovation methodologies needed to change unsustainable consumption and production patterns.

Xuan and Sriram (2006) presented the paper over family design and development of a knowledge-intensive platform-based product paradigm. They discussed and proposed the fundamental issues covering the product family design and development, product platform and product family modeling, generation and evolution, and

product family evaluation for customization. The relevant technologies and a systematic methodology were investigated and developed for family design process of the knowledge supported product. The related family design issues and requirements were addressed to develop the knowledge-intensive support system for modular platform-based product.

Ashby and Sperling (1995) identified the key characteristics of participatory research and development (R&D) in the agricultural sector which were being client driven, decentralization requiring technology development, farmers' devolvement to the major responsibility of adaptive testing, and institutions' and individuals' requirement to be accountable for the technology relevance and quality on offer. The article through case study material from Latin America, Asia and Africa reviewed ways for institutions' response to these further elaborated characteristics and raised issues. It was argued for the insufficiency of participatory R&D alone to deliver relevant innovations to varied client groups.

Zhu *et al.* (2011) aimed in the study to explore the application of agent theory, technique to solve the process control problems, traceability, watching intelligence information and IT application to conditioned emergency reaction generally from production to circulation for the existing problems in control of agricultural product quality, management and traceability. In this study the agent application and method development was put forward. The communication and co-operative mechanism were investigated and for agricultural product quality control, the agent-based universal system framework was designed. The corresponding controlling unit and condition were increased to adapt the special aim of production and processing characteristics of different agricultural products.

Jiang *et al.* (2006) derived the focus upon the reconfiguration and Interoperability of the complicated process of Small Agricultural machinery (SAM) product development and proposed an architectural design to employ axiomatic design method and information representation of ontology. SAM has wide applications in agriculture, forestry and stockbreeding. The design process was proposed for the function decomposing and recomposing of the product for independent axiomatic design and expressed all design phases' information in ontology information model to be communicated among all engineers with XML language. A SAM design case study helped to illustrate the proposed approach showing that the proposed methods were reliable and feasible and laid a reconfigurable design system foundation of SAM product.

Sumberg *et al.* (2013) reviewed the user involvement literature from the field of new product development (NPD). A conceptual model of feedback with its loops within West Africa Agricultural research for development (AR4D) was proposed to analyze the examples of feedback generation in rice research in terms of abandoning 'business as usual'. The emphasis over the development of useful 'products', immediately bring 'users' to centre stage is referred as one of the important element for reframe of research in agriculture. Based on this initial analysis, it was concluded that, even along with many corresponding activities providing useful feedback, this potential was still not being realized among majority of the cases. Hence, the promise of AR4D for generating useful products for farmers was found to remain unfulfilled unless systematic feedback is approached.

Tabile *et al.* (2011) highlighted the methodology employment used in remote sensing to a Geographic Information System (GIS) being adapted or developed for use in agriculture. Tolerance, scale and agility parameters used in data sampling in Precision Agriculture required an expressive number of R&D automation techniques and instruments. A strong tendency to use Agricultural Mobile Robots application is there to aim the same in European countries. This work aimed to describe the experimental platform project for field data acquisition to study and operate the spatial variability and development of agricultural robotics technologies in agricultural environments. It was proposed to choose the utilization of design parameters for the model construction based on the scientific work systematization. Based on modeling and simulating of the applied framed tension, the virtual prototyping process was used to make the kinematic study of the mechanical structure.

Klerkx *et al.* (2012) investigated the design process outputs' functions as boundary objects in the concepts of agricultural production system implementation. The study analyzed the process of innovation leading to the establishment of the system of Rondeel poultry-husbandry. This revealed the design process interpretative flexibility outputs as when mutual understanding is

created among involved diverse actors to the implementation of agricultural production system concept and in mobilizing support being helped by the boundary objects. The boundary objects sometimes allow for interpretative flexibility with stability in shape whereas, themselves get changed some other times as due to the induced redesign process. The design process output was confirmed to be created purposefully to serve as a boundary object and to support implementation of novel agricultural system concept.

Kozhevnikova *et al*. (2013) made a study over the intensive innovation activity now-a-days agricultural sector, becoming an essential part of development and considered as a major factor in the contribution to the production development and efficiency in the market economy. The shaping and advancing strategy of the innovation system aimed at assimilating the novelties making it possible to launch new production technological structure and to ensure competitiveness of enterprises both domestically and internationally in markets. The article described the priority trends in agriculture innovation activities' development and also dealt with affecting conditions and factors of the farming development innovation.

Conclusion:

– Technological advancement and design innovation could attain agricultural excellence by introducing new technologies and reducing the age old existing drudgeries to farmers.

– The agent application and method development could be put forward along with increased controlling unit and condition for agricultural product quality control through communication and cooperative mechanism.

– Credit flow should be facilitated via vertically integrated sources with the farmers such as processors, input dealers, NGOs, etc., providing them critical inputs for food processing and other value adding activities which will motivate the designers to work for meeting new farmers' demands.

– New product development in agricultural risk management using integrated approach should be made to crop insurance improvement.

– The successful generation of local designs should be introduced through academic collaboration with foreign design institutions to enhance a smart assimilation of local input with foreign technologies.

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