A Key Model to Provide Required Information at Farming Life Cycle of Crop Production Through A Real-Time Mobile-Based Application

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Introduction

Agriculture plays an essential role in the developing countries and is the backbone of the Sri Lankan financial system with a large number of small holdings and rural farmers (Chhachhar and Hassan, 2013; Potts, 2016). Farmers face many difficulties relating to low production, marketing, and agribusiness (Henegedara. G.M, 2015). In the digitally connected era, people are given their maximum effort to address the challenges. But the current Gross Domestic Product (GDP) from agriculture in Sri Lanka (7.4%) indicates a diminishing value (DCS, 2019) due to the designed ICT platforms which focused on a limited area of crop production instead of the whole process. Therefore, farmers require context-specific, complete and actionable information to make timely-quality decisions (Ginige et al., 2016).

Identification of the factors/parameters/conditions that influence the whole farming lifecycle of crop production is vital for farmers in order to take crucial steps. Hence, mobile phones play an important role in solving collective action problems. Further, speeding up the information which is conveyed to the farmers help them to take decisions much more easily (Cieslik et al., 2018; Nyamba and Mlozi, 2012).

This research contributes to identify the factors that impact on the different farming lifecycle stages of crop production and to develop a model that can be effectively addressed through the Govi-Nena mobile-based application (www.govinena.lk).

Methodology

This study was carried out in the districts of Badulla, Nuwara Eliya, Jaffna, and Monaragala in Sri Lanka and collected agricultural information/knowledge from domain experts (experienced farmers, agriculture instructors, and research officers) through interviews using a pre-tested structured questionnaire and secondary sources.

The Design Science Research (DSR) methodology was used; a constructive research method which generates an innovative artifact as a research output (Hevner et al., 2004).

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Hence, to provide contextual information to the farmers, conditions/parameters/factors for each stage of the crop farming lifecycle were identified using DSR and modeled those factors and sub-factors as the Packages of Practice (PoP). We verified and redesigned the developed model based on the need assessment of domain experts. The ontological crop knowledge base is used to store the PoPs and the model is fed through a mobile-based platform. According to the user requests, the information and knowledge is acquired from the knowledge base.

Findings

The study revealed that poor yield, gathering real-time accurate information in the correct format and low quality of agro-technology are the key challenges for farmers. Hence, the factors for the stages in the crop farming lifecycle (Crop/variety selection, pre-planting, growing, harvesting, and post-harvesting) consisted of sub-factors which were identified (Table 1) and arranged in a package of practices for a real-time mobile-based information system (Fig 1). For instance, farmers will be able to get information and reminders based on the sowing date of the crop such as crop selection according to the soil and climatic factors of the area, date and rate of application of fertilizers, herbicides, recommend pesticides, and weather alerts, etc.

Table 1: Key model for farming life cycle stages of crop production

Farming life cycle stages	**PoP Depend on**		
	Factors	**Sub-factors**	**Sub-sub factors**
Crop/variety selection	Agro-ecological zones	Climate	
		Soil characteristics	Soil pH
			Soil moisture content
			Soil texture
			Soil type
		Location specific characters	Pest & Disease incidence
			Extreme weather conditions
	Previously grown crop		
	Cropping system	Field planting	
		Protected agriculture	
	Input needs	Input types	Water (Rainfed, Irrigation system
			Planting material
			Labour/ machinery
			Agro-chemicals (Amount needed, Availability, Types, Application rate, Time of application)
		Market price	
		Economic status of farmers	
	Cultivation season	Maha	
		Yala	

		Perennial	
	Market demand	Market price	
		Product purpose	Seed
			Consumption
		Preferences	
	Supporting service	Training & guidance	
		Subsidies	
		Certificates	
	Financial service	Agri-loan	
		Agri-insurance	
Pre-planting	Land preparation	Soil characteristics	
		Availability of water	
		Extent	
	Fertilizer application	Crop/variety	
		Planting time	
		Quantity	
		Location	
		Method of application	Broadcasting
			Localized placement
		Soil type	Soil pH
			Nutrient availability
		Fertilizer type	Organic
			Inorganic
	P & D management	Crop/variety	
		Weather pattern	
		Prevention method	Mechanical
			Chemical
			Biological
	Weed management	Weed type	Weeding method (manual, Chemical)
Growing	Fertilizer application	Crop/variety	Amount
			Time of application
		Irrigation type	Rainfed
			Irrigation systems
		Fertilizer type	Organic
			Inorganic
		Application method	With irrigation water
			Direct application to soil
			Foliar application
			Broadcasting
			Placement
		Soil type	
	P & D management	Weather	
		Control method	Mechanical
			Chemical
			Biological
	Weed management	Crop/variety	
		Weed type	Weeding method (manual, Chemical)

	Crop-specific practices	Earthing up
		Pruning
		Vine training
		Trellising
		Artificial pollination
Harvesting	Crop/variety	Stage of harvesting
		Method of harvesting
		Frequency of harvesting
		Market demand
	Weather	
Post-harvesting	Crop/variety	
	Seeds	Extraction
		Treatment
		Storage
	Direct consumption	Packaging
		Durability
		Storage
		Transport to market
	Other uses	Product specific process
		Storage condition
		Transport

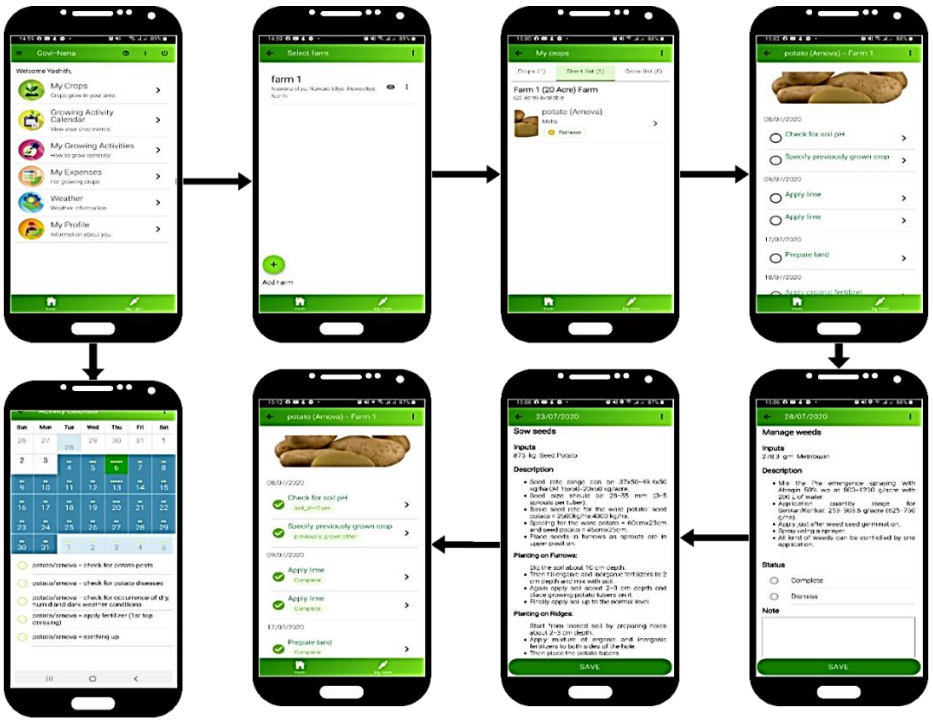

Fig 1: User interfaces designed for the packages of practice

Conclusion

Context-specific and actionable information is required for the farmers to get a better decision for effective farming. The proposed model is consisted of identified factors which impact the stages of the farming lifecyclreferencee and is represented through a mobile-platform that is connected to the crop knowledge base.

Keywords: *Challenges For Farmers In The Agriculture Domain, Farming Life Cycle Of Crop Production, Model For Pops, Real-Time Mobile Application, Sources Of Agricultural Information.*

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