Chapter 11
Capability Maturity Model for Agricultural Supply Chain Management Software

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ABSTRACT

Compared to the supply chain management of other business domains, agricultural supply chain management is affected with issues such as diversity of production and demand, the bulkiness of produce, perishability, seasonality, harvest uncertainty, and climate complexity. These issues are more prominent in rural agricultural sector. Availability of mature supply chain management processes and systems can enhance the productivity of rural agricultural communities. This chapter proposes a five-stage capability maturity model for the implementation and maintenance of supply chain management processes in farm management information systems. The capability maturity model is a valuable aid to determine the digitized supply chain process' ability to consistently and continuously achieve improvement and organizational objectives. The model is proposed based on the findings of the analysis of 121 supply chain management software in the farming sector, the Capability Maturity Model by the Software Engineering Institute, and the Supply Chain Process Management Maturity Model.

INTRODUCTION

Successfully managing the agricultural supply chains is essential to the development of the rural economy. In this chapter, we propose a maturity model for supply chain management processes of farm management software. Improving the performance and effectiveness of existing supply chain management processes is paramount to the development of rural agriculture. Thus, a maturity model can aid in figuring out the current level of the supply chain digitization and contribute to enhancing the processes to the next level.

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Agriculture is the science and art of cultivating plants and keeping animals by people for food and raw materials. Agriculture covers various sectors such as crop cultivation, animal husbandry, dairying, fisheries, agroforestry, organic farming, vertical farming, and other associated activities (FAO, 2017). Agriculture is one of the most critical areas of human activity worldwide (Lokuge et al. 2016a). As the growing global population is expected to surpass the 9 billion mark by 2050, the demand has heightened for increased production of nutritious food to meet the ever-increasing demand and ensure food security. Thus, placing pressure on already-fragile resources (FAO, 2017; World Bank, 2017; Kaloxylos et al, 2012).

Especially in developing countries, agriculture plays a vital role in the economy (Sedera and Lokuge 2017). It accounts for most of the rural employment, directly or indirectly. Improvements in agriculture productivity results in farmers' income rise, food prices fall, freed labor for additional employment, rural economic growth and sustainable management of natural resources (FAO, 2017; Chhachhar & Hassan, 2013; Duncombe, 2018; World Bank, 2017). In the current competitive business environment, a farm can survive financially and be sustainable only when it is well managed (Husemann & Novkovic, 2014). Farmers and related stakeholders face a significant challenge in effectively managing information generated both internally and externally to improve the efficiency of operations, reduce environmental impact and comply with various quality standards (Sørensen et al, 2010b).

The widespread and increasing use of computers and the dramatic increase in the uptake of the Internet have improved and eased the process of handling information generated in a farm environment (Lokuge and Sedera 2014a; Lokuge and Sedera 2014b; Sørensen et al, 2010a). The study conducted by Carrer et al (2010) among citrus farms in Brazil has found that the most efficient farms in the sample are already ahead in the process of adoption of Information Systems (IS) for production planning and control.

Farmers can use IS to match cropping practices to climatic trends, use resources sustainably, cope with productivity threats, apply latest farming techniques, increase production through optimizing input use, make more timely decisions, labour savings, improve market access, manage finances, and comply with regulations (Dufty & Jackson, 2018; World Bank, 2017; Esfahani & Asadiye, 2009; FAO, 2016). Thus, attempting to enhance the farm processes through sophisticated information and communication developments (Barmpounakis et al, 2015; Eitzinger et al, 2019). Many consider IS as the new revolution that will modernize farming and guarantee food security. In developed economies, innovations such as the Internet of Things, Cloud Computing and Big Data has already revolutionized farming (FAO, 2017; FAO, 2018; Lokuge and Sedera 2014c; Lokuge and Sedera 2016; World Bank, 2017).

Farm Management Information Systems (FMIS) are a specialized category of Management Information Systems (MIS) solutions. FMIS is defined as a planned system for collecting, processing, storing, and disseminating data in the form needed to carry out a farm's operations and functions (Fountas et al, 2015). An FMIS is essentially a Management Information System (MIS) for the agriculture sector (Tummers et al, 2019). These FMISs have evolved from simple record keeping software into complex systems that can manipulate large amounts of data and provide decision support capabilities (Paraforos et al, 2016).

The management of agricultural production is both qualitatively and quantitatively confronted with deciding under uncertainty, changing market demands, prices instability, climate change, lack of knowledge management, and capital availability (Borodin et al, 2016; Mittenzwei et al, 2017).

The rest of this chapter is organized as follows: The next section describes the relationship between the rural communities and the agricultural supply chain management. This is followed by a brief overview of the agricultural supply chain management software, the study motivation, SCM processes in FMIS, Supply Chain Process Management Maturity Model (SCPM3) and the Capability Maturity Model