

Factors affecting the adoption of mechanization technologies in tea plantations: A systematic literature review

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1. Introduction

The tea sector plays a key role in Sri Lankan economy, being the third largest source of foreign exchange and the fourth largest tea producer in the world. Tea accounts for about 0.6% of gross domestic production (GDP) (Central Bank, 2020). The current tea extent of Sri Lanka is approximately 204,600 ha and the total tea production in 2020 was 278.5 million kg (International Tea Committee, 2020). The tea industry currently faces many challenges domestically and globally. Among them, low productivity, high cost of production, and worker scarcity are crucial challenges. Workforce employment for field operations represents over 60% of the production cost (Wijeratne, 2012). Statistics show that the number of workers employed in the plantation sector has fallen drastically by more than 40% over the past three decades (Shyamalie et al., 2020). Adoption of mechanization in tea lands is found one of the remedies in this regard (Ongonga et al., 2013). The use of tea harvesting machines saves costs that interfere with the performance of the plantations (Kirui, 2020). Although stakeholders show different perceptions of the adoption of mechanization technology (MT) in the country, there are some success stories behind the scene. However, the emerging competitive market within the industry emphasizes the importance of the adoption of MT in the long run. Therefore, there is a serious need to reveal the factors that hinder the adoption of mechanization among the tea plantations in Sri Lanka. It is important to find out what are the determinants of the adoption of mechanization technology in tea plantations.

The main objective of this study is to conduct a systematic literature review to discover the determinants of the adoption of mechanization technology in tea plantations

2. Materials and Methods

For this study, the national and international research papers related to adoption of MT in tea have been reviewed in English only. Based on the review process reported by Webster & Watson (2020), four electronic databases: Google Scholar, JSTOR, Elsevier and Science Direct were used to find research articles. Articles for this review were gathered using different combinations of keyword sets as search strings while maintaining the same meaning.

Search strings used are “factors affecting mechanization technology adoption in tea”, “factors influence machine adoption in tea”, “factors hinder the machine implementation in tea”, “determinant of mechanization technology adoption in tea”, “drivers of mechanization adoption in tea”, “factors affecting mechanization technology adoption in Agriculture” and “drivers of machine adoption in agriculture”.

The research papers available for the adoption of MT in the tea sector were extremely limited. It was therefore realized that the review should be expanded to other agricultural sectors to identify the factors influencing the adoption of MT without being limited to the tea industry. Subsequently, the research documents were filtered by selecting only published empirical studies relevant to the objectives of the review. Instead of the keyword “tea” keyword “agriculture” was used combined with other relevant keywords as search strings. After

filtering, 38 research papers were reviewed to examine factors influencing the adoption of MT adoption in tea plantations and other agricultural sectors.

3. Results and Discussion

An attempt was made to search for literature on the adoption of MT in the tea sector worldwide. The research papers on this subject are very limited in the context of Sri Lanka and globally. After carefully analyzing the titles, abstracts, and conclusion sections of papers, only 14 relevant research papers in the tea sector and 24 papers in other agriculture sectors were filtered which are aligned with keywords.

The literature review emerged with results in different countries with different research titles converging towards adopting MT. The quantitative approach and Logit / Probit analysis are predominant in these studies. The response-dependent variable defined in the reviewed studies appeared in various forms while maintaining the same meaning in research titles (Adoption of MT).

In accordance with the conceptual foundation of the technology adoption models, the complexity of the innovation adoption process is demonstrated by the range of variables of technological adoption revealed in the review. The summary presented in figure 01 demonstrates the drivers of MT adoption identified by the review. The results indicate that many of the determinants of innovation dissemination that were looked at in other agricultural sectors were missing in the literature relevant to the tea sector.

This systematic review revealed that 24 explanatory variables were addressed in the literature concerning the process of adoption of MT in tea plantations. As shown in table 01, the response variables found in the literature review were categorized based on the well-known theories of technology adoption (Rogers, 1983; Venkatesh & Davis, 2003). Roger's DOI theory was chosen as a root model for adoption theories based on co-citation analysis (Oorschot, 2018) and The UTAUT theory was chosen as the theory developed through chronological order (Venkatesh & Davis, 2003).

The demographic factors, social influence, facilitation condition, relative advantage, effort expectancy, performance expectancy, compatibility (features related to technology), voluntariness of use are the most commonly identified innovation diffusion determinants (attributes and predictor variables) in theories. However, the low frequency of repeated validation of these determinants in technology uptake studies was found to be the main gap in the literature in tea and this may be one of the reasons for the relatively slow rate of uptake of technologies in tea. In addition, very few studies examined multiple determinants of the adoption process, and most focused heavily on assessing the impact of a few determinants. It is also noted that constructs related to cultivation and resources have not been conceptualized in adoption theories though it has already been validated by recent past studies. Therefore this appears as a gap in adoption theories related to agriculture. Gaps in literature are shown in the Table 01.

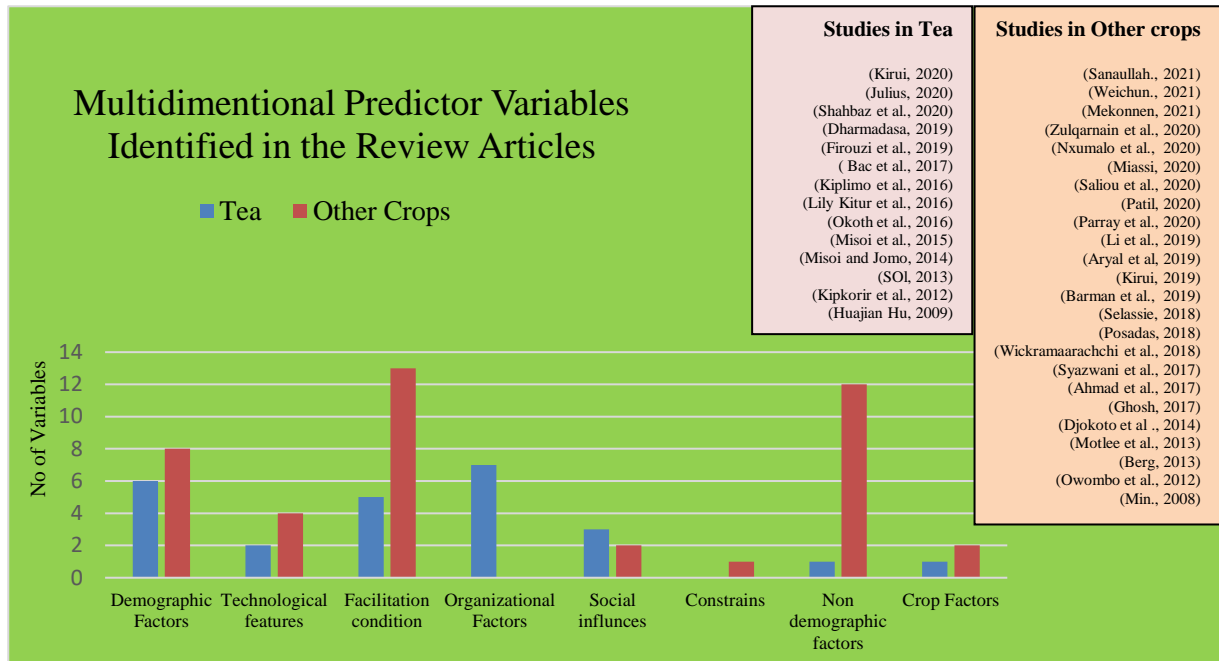


Figure 1.1 Multidimensional predictor variables identified in the review articles

Table 01. How the response variables found in the literature review are consistent with well- known theories about technology adoption

Determinants of technology adoption identified through literature review- Tea Sector	Categorization of Determinants according to already established Adoption Theories
1.Demographic & Non-demographic factors- Gender, Experience, Age, Education, Managerial skill, workers daily earning, Skill of workers	Moderator variables (Rogers, 1983; Venkatesh & Davis, 2003)
2.Social influence- Employee Resistance, Employee perception, Customer perception	Social influence as construct/ variable (Venkatesh & Davis, 2003)
3. Facilitation conditions- Information access, Training , Credit facilities, Practice of other technologies, Access to machine	Facilitation condition as constructs (Venkatesh & Davis, 2003)
4.Technological features- Effectiveness, Hazard condition	Performance expectancy as construct Variable (Venkatesh & Davis, 2003)
5. Crop factors - Planting system	Not yet established by theories
6.Organizational Factors - Firm size, Land size, Labour availability , Operation cost, Plantation ownership, Owner pressure perception, Fear of job loss	Not yet established by theories
Validation of the Variables for tea sector has not been done through studies	<p>Theoretical Gap- Multidimensional constructs</p> <p>Effort expectancy Triability Visibility Compatibility voluntariness of use (Rogers, 1983, Venkatesh & Davis, 2003)</p> <p>Emperical Gaps -Validation of determinents</p>

4. Conclusions

The results show that many of the determinants of innovation diffusion that were looked at in other agricultural sectors were missing from the review of the literature relevant to the tea sector. As Rogers pointed out in 1983, Voluntariness, compatibility, and ease of use which play important roles in the persuasion process, do not show in the findings as validated variables. Non-demographic factors do not appear to a high degree in studies of the tea sector as moderator variables. (Venkatesh & Davis, 2003). Theoretical gap in the failure to develop multidimensional constructs is noted (Edwards, 2001; Seckin, 2015). Therefore, it can be concluded that a comprehensive study on factors affecting the adoption of MT in Sri Lanka has not been undertaken with an empirical focus on the most relevant explanatory variables.

5. References

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