Technology Transfer Efforts towards Tea Manufacturers in Matara District, Sri Lanka

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ABSTRACT

This study was conducted to identify the sources of advisory and extension services received by tea manufacturers, and the level of knowledge and skills acquired by the tea manufacturers in view to planning and implementing extension programs. The Matara, Sri Lanka is confined to five Tea Rangers which include 96 manufacturing factories. Among them, a sample of 55 tea manufacturers was selected for the study following a stratified random sampling technique. A questionnaire survey followed by discussion was employed to collect data during January- June 2019. The findings of the study revealed that tea manufacturers received advisory and extension services from both government and private sector organizations. The majority of the tea manufacturers (83%) received advisory and extension services from Sri Lanka Tea Board while 52% and 48% of them received the services from Tea Small Holdings Development Authority and Tea Research Institute. Further, 77% of the tea manufacturers obtained advisory and extension services from private-sector agri-input supply companies. The tea manufacturers obtained higher knowledge on the assessment of green leaf standards (90.2%), tea manufacturing processes (88.2%), post-harvest damages (86.3%) and reasonable price calculations (80.4%). They gained a moderate level of knowledge on auction price determination (63.7%), value-added tea production (52.9%) and the importance of factory certifications (51.0%). The level of knowledge obtained by the tea manufacturers on the elements of awareness on training available (24.5%), tea promotion (21.6%) and alternatives to Glyphosate (21.2%) was very low which should be further addressed by appropriate advisory and extension programs. The findings of this study reveal that tea manufacturers in Matara District received a wider range of knowledge and information from both public and private organizations and which was utilized by them towards the production and quality management of made tea in a sustainable manner.

KEYWORDS: Extension services, Knowledge dissemination, Tea manufacturers

Introduction

An agricultural knowledge system can be explained on three sub-systems such as technology generation, technology transfer and technology utilization.

Such functions are performed by different institutions as; technology generation by research stations and universities, technology transfer by extension and advisory divisions of relevant agencies and technology utilization by end users- the farmers and stakeholders of the value chain (Wijeratne,1988). McDermott (1987) has elaborated on the different functions and responsibilities of the above three components.

The application of the above concept to the tea sector reveals that the Tea Research Institute (TRI) is very much confined to technology generation for the tea industry, and formulates and disseminates technical inputs or knowledge elements as recommendations through its agricultural extension/ advisory arm. The technology transfer is fulfilled by several state and private sector organizations in addition to TRI. Technology utilizers are the tea growers of the estate (corporate sector) and the tea smallholders, tea manufacturers and the other stakeholders in the tea supply and value chain. In fact, such utilizers adopt the technologies disseminated by different extension services which have linked to the institutes involved with technology generation. Tea Research Institute (TRI), Tea Smallholdings Development Authority (TSHDA), Sri Lanka Tea Board (SLTB), Baur and Co. (Pvt) Ltd, and CIC Agribusiness (Pvt) Ltd are the main organizations which provide extension services to the tea sector. The Public Private Partnership (PPP) extension model was also applied as a pilot scale (Amarthunga and Wanigasundera, 2010). Further, National Institute for Plantation Management (NIPM) executes training programs on plantation crops leading to crop husbandry, quality control, management and certification.

The tea processing includes a series of highly technical components such as withering, rolling, roll breaking, fermentation, drying and grading. In addition, storing, packing, dispatching etc. are also other functions of the tea factories. The tea processors are advised to maintain the standards of Good Manufacturing Practices (GMP), ISO 22000 and Hazard Analysis Critical Control Point (HACCP). Lakshman and Wanigasundara (2017) reported that many factories have not acquired relevant certificates for the above procedures and in most instances, the stakeholders in the processing sector need extensive training to advance their knowledge and skills about these aspects. in the tea, A study by Wickramaratne et al. (2014) reported that the entrepreneurial skills and competencies of the tea manufacturers of Sri Lanka have a direct impact on the global competitive market. Often, the Advisory and Extension services target tea growers on cultural practices to improve the production capacity of green tea. TSHDA (2013) reported that despite the research and extension efforts, the national average of made tea was recorded as 2100 kg/ha/yr. this is far below the potential yield of 3000 kg/ha/yr. It is important to realize that tea processing marked an integral component in the tea industry as the final product quality greatly depends on the performance of in-house factory management and processing. Hence, it is necessary to refresh and advance technological interventions through technology dissemination.

This study aims to investigate the sources of advisory and extension services received by tea manufacturers, their standard of knowledge and skills in a view of planning and implementing extension programs and also their view on existing extension services.

Methodology

The study selected Matara District, Sri Lanka to represent the low country. There are 96 tea factories in the district in five Tea Instructors' (TIs) ranges demarcated by SLTB as Akuressa (24), Urubokka (19), Morawaka (15), Deniyaya (21) and Kotapola 09). Among the existing 96 tea factories, 55 were selected as the sample according to the stratified sampling technique. A questionnaire was developed, and pre-tested and a field survey had been administrated during the period from January to June 2019. All the tea manufacturers of the selected factories were personally interviewed. Primary data required for the study were obtained through checklists, semi-structured questionnaires and discussions. Further, a knowledge scale was developed to assess the knowledge elements selected for the study. Each knowledge element included 5 factorial statements in the checklist and based on the results knowledge level for each element was calculated. The secondary data on the tea industry was collected from available sources such as Central Bank reports, documents of SLTB, TSHDA, TRI etc. Data were analyzed and presented by simple statistical illustrations.

Results and Discussion

The study investigated the sources of advisory and extension services received by the tea manufacturers. Fig. 1 demonstrates the extension input received by tea manufacturers through different organizations.

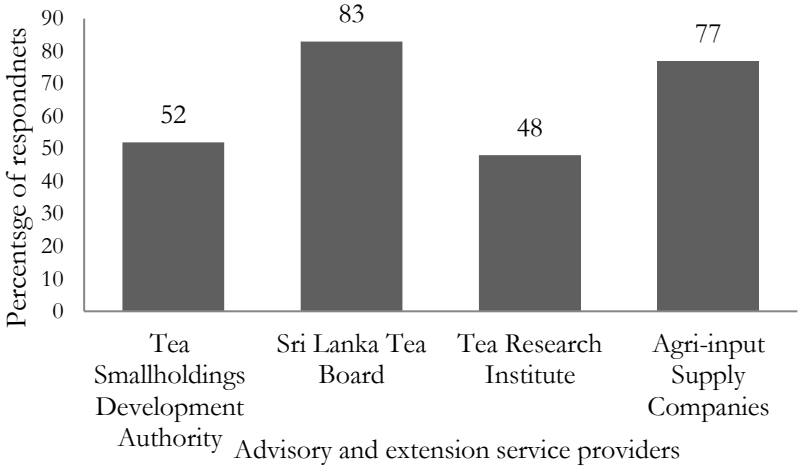

Figure 1: Extension Input Received by Tea Manufacturers

Note: Due to multiple responses, the total exceeds100%.

Figure 1 illustrates that tea manufacturers obtain advisory, and extension input from both government and private sector service providers. The Tea Small Holdings Development Authority (TSHDA), Sri Lanka Tea Board (SLTB) and Tea Research Institution (TRI) are public organizations and their activities are confined to the commodity approach. That is, the mandate focuses on a single crop or commodity.

The majority of the tea manufacturers (83%) obtained advisory and extension services from SLTB while 52% and 48% of them received advisory and extension services from TSHDA and TRI, respectively. It is important to note that 77% of the tea processors obtained extension services from private-sector agri-input supply companies. All the above service providers represent the technology dissemination sub-sector.

TSHDA focuses on the cultivation aspects of smallholders and their green leaf quality supply to factories. The growers are categorized into small and medium-scale landowners and holders are collectively forming tea smallholder societies or organizations whilst medium-scale holdings are grouped into proprietary holdings and which are monitored by tea commissioners' tea inspectors. The subsidy scheme is connected with the technology transfer function. Moreover, this agency disseminates knowledge and skills on human resource development and cultivation aspects of tea land. The small and medium-scale growers provide green leaves to tea factories. The quantity and quality of green leaf requirements have to be maintained and monitored by the tea manufacturers as well as officials of TSHDA at the field level and tea commissioners at the factory level. As still, 52% of the tea manufacturers received advice from TSHDA; it is advisable to strengthen the links between tea growers and factories for the sustainability of the tea industry.

The SLTB is responsible for focusing on the cultivation and replanting of medium-scale tea holdings, establishing and operating tea factories, maintaining quality standards, packaging, and handling warehousing requirements. The main stakeholders of SLTB are tea landowners having more than 4ha (10 acres), registered tea manufacturers, registered green leaf dealers, tea exporters, warehouse owners, tea blenders and packers, tea brokering companies, local and foreign buyers, and logistic companies, etc. The manufacturers (83%) have established sound extension links with SLTB and which is a good indicator of the relationship between officials of SLTB and tea manufacturers. Printed media such as leaflets, brochures, cutouts, banners, monthly and annual publications, statistical summaries, annual reports and annual statistical bulletins, and factory visits are the main modes of sharing information (Sri Lanka Tea Board, 2016). The tea commissioner's division engages in the development, regulations and extension-related activities through electronic access such as sending e-mails, online facilities in issuing refused tea transport permits, and factory registrations and disseminates monthly elevation averages and reasonable price information.

The TRI provides extension services mainly to the estate sector with an advisory network. This is the leading institute which provides technical recommendations based on the research findings and constitutes the technology generation sub-sector. TRI shares such technical interventions with other stakeholders through horizontal linkages. The regional centres established in tea-growing regions also play a significant role in technology dissemination.

A number of private companies operating in Sri Lankan agriculture focus on the tea sector, too. The private sector agencies make efforts the promotion of agrochemicals through the sales network. At the same time, they are inclined to include knowledge input as a package to attract clients.

This approach is convenient for the tea growers as they could obtain hardware and software of the technology; physical input and knowledge input at the same time and same place.

The study investigated the level of knowledge and skills acquired by tea manufacturers. Table 1 demonstrates the average knowledge levels established by factory management. It is worthwhile to note that if a respondent is correct in all the answers pertaining to an element, the level is considered 100%.

Table 1: **The Level of Knowledge and Skills of Tea Manufacturers**

Knowledge Element	Level of knowledge standard (%)
1. Assessment of green leaf standards	90.2
2. Tea manufacturing process	88.2
3. Post-harvest damages	86.3
4. Reasonable price calculation	80.4
5. Auction price determination	63.7
6. Value-added tea production	52.9
7. Importance of factory certifications	51.0
8. Awareness of training available	24.5
9. Tea promotion	21.6
10. Alternatives to Glyphosate	21.2

Table 1 illustrates that tea manufacturers have a considerable level of knowledge and skills for most of the elements. The manufacturers have gained a higher level of knowledge on the assessment of the green leaf standard (90.2%), tea manufacturing process (88.2%), post-harvest damages (86.3%) and price calculation (80.4%). Further, the tea manufacturers gained a moderate level of knowledge on auction price determination (63.7%), value-added tea production (52.9%) and the importance of factory certifications (51.0%). The level of knowledge obtained by the tea manufacturers on the elements of awareness on training available (24.5%), tea promotion (21.6%) and alternatives to Glyphosate (21.2%) are very low.

Knowledge of assessment on the green leaf standard is an important indicator for factory management as the raw material enters the processing floor and the quality of the final product significantly depends on the uniformity of the input. The factory receives green leaves from different supplying sources; hence, the green leaf quality differs to a wide range. Therefore, the application of knowledge to establish good-quality green leaves is a valid phenomenon. Tea manufacturers have gained a 90.2% knowledge level concerning this aspect. Amarathunga et al (2017) have demonstrated the validity of Public Private Partnerships in collaborating with stakeholders in the tea supply and value chain. This could be applied to receive good quality tea leaves from the growers.

During the different processing steps, tea leaves are subjected to physical and chemical reactions. At the withering stage, the moisture content of tea leaves will be reduced by approximately 45% by sending air and hot air whenever required. The tea manufacturers have to decide on the correct withering point. The rolling activity disrupts the cell structure facilitating the condition for enzymatic reactions.

This brings colour, strength, taste and aroma to the final product. The roll breaking removes the twisted leaves into even size particles by sieving in the roll breaker. Drying is done to deactivate the fermenting enzymes and the moisture is reduced to 3%.
Shifting and grading are done to sort the tea particles into different grades. At this stage, the baked tea will be passed through a series of vibrating screens of different mesh sizes. It is also important to note that by-products such as stalks, fibre etc, are removed from tea using electrostatically charged devices. The tea manufacturers must ensure a high calibre of knowledge on this process and they have achieved a good knowledge level of 88.2%.

The post-harvest damages affect the green leaf quality. Such damages have occurred during plucking, transportation and handling, etc. The tea processors have to identify such damaged leaves before processing the tea leaves. A knowledge level of 86.3% on post-harvest damages helps them to identify good-quality green leaves. The factory-based Public Private Partnership (PPP) model could be utilized to minimize the post-harvest damages that occurred by different stakeholders (Amarathunga and Wanigasundara, 2010).

Green leaf suppliers namely smallholders, leaf collectors and tea estates receive a reasonable price for their leaves based on the Tea Control Act. No. 51 of 1957. The Tea Commissioner's Division regulates this function. This price is calculated based on several factors, such as the price fetched at the Colombo tea auction (known as NSA-Net Sale Average), elevation average (EA) price (average price of the agro-climatic district), and the out-turn ratio. The ratio between the made tea to green leaf is the outturn, which is considered as a constant value of 21.5%. The percentage share of the price goes to the tea processor is 32% whereas the leaf supplier receives 68%. Moreover, if a higher NSA value than the EA value is received, 50% of the difference is given to the leaf suppliers as an incentive. However, due to the competition to purchase more leaves among tea factories and leaf collectors, the rate paid to them is mostly slightly higher than the reasonable price. Hence, the application of the price formula is transparent to the stakeholders in the value chain. This is a powerful indicator to facilitate a strong relationship between the factory and growers, and factory managers have established an 80.4% of knowledge level which can be regarded as the governing factor for trustworthiness and sustainability.

The approved channels for tea disposals are Colombo Tea Auction, forward contracts, direct sales and private treaties. Tea manufacturers send invoices with tea samples to tea brokers or brokers who value the tea lots and cataloguing teas. At the auctions, the teas are sold on ex-estate terms or main sale catalogues. In ex-estate mode, only samples are forwarded to the auction. In main sale catalogues, the entire consignment to be offered for sale should be delivered to the warehouses. All registered tea brokers are allowed to offer/ bid higher prices at the auction. Tea manufacturers have the right to sell at the agreed price. Broker's valuation of teas depends on several factors such as the quality of the tea, previous price level, future market trends and demand and supply in the market. Auction price is a vital indicator for a factory as it gives specific identity/royalty for the products marketed.

The processors have recorded a 63.7% knowledge standard on action price determination. This is especially important to promote the brand name.

The value-added products have recorded 40% of the exported tea and earned SLRs 47.2 billion in foreign income in 2018. Tea is available in diverse products such as green tea, organic tea, flavoured tea, iced tea, instant tea, and ready-to-drink tea. Next, tea-based soap, bath gel, shampoo, and cosmetic products are added to the product range. The healthy teas came as recent interventions have captured the market. The ginger-coriander tea produced by St. Clair's Tea Factory to combat Covid19 is a fine example. The processors have demonstrated a 52.9% knowledge level and hence, there is an opportunity to advance their knowledge and skills in this field. In fact, research and development should be encouraged to evolve the products according to consumer preference and disseminate them to the clientele via a dissemination system. The TRI makes an effort to fulfil this need. The individual factories have to find relevant resources to undertake this task.

Tea manufacturing is a highly complex operation executed in organized premises, equipped with machinery, raw materials, skilled labour and an environmentally friendly working atmosphere. On the other hand, consumers are highly health conscious and seek certified products in the market. The product quality is declared by a third party either nationally or internationally in the form of valid certificates. GMP (Good Manufacturing Practices), HACCP (Hazard Analysis of Critical Control Point), RA (Rainforest Alliance) and ISO 22000, ISO8000, etc. are prominent certificates governing tea quality. Further, there are different types of certificates mainly focused on product quality, social welfare, environmental concerns, etc. These certificates ensure the good practices adopted by the tea processors leading to quality estimation. In fact, the buyers offer higher prices at the auctions for tea produced in the factories with such certificates. In turn, all the actors in the value chain receive higher prices and ensure long-run survival. The certification facilitates establishing links with the other stakeholders, too. The processors imply a 51% knowledge level of achieving factory certificates. This aspect has to be advanced through an extension system the certification is vividly important to establish a brand for the factory.

Training is a vital tool to advance knowledge. This component is basically handled by the dissemination system. SLTB, TSHDA, TRI and private companies execute training programs. As horizontal coordination is marginal among the agencies, there may be duplication of services. Further, the agencies stick to the annual training agenda. The manufacturers recorded only a 25.4 % knowledge level on the awareness of training. Hence, it is worthwhile to identify the training needs of both trainers and the clients prior to the planning training agenda. The participatory rural appraisal (PRA) techniques will be a valid extension approach to apply to identify the needs of the clients and Wijeratne and De Silva (2005), and Koralagama et al (2007) have provided valid practical experience in this context.

The tea promotion bureau of SLTB is concerned about tea promotion; especially for international markets through its network. The individual factories make efforts to promote made tea and value-added products with their brand identity.

The tea promotion at the factory level uses a range of strategies as sending tea samples directly to foreign buyers, participating in exhibitions and tea conferences, popularising the products through making advertisements in mass media, introducing attractive and innovative packages with value-added tea products, etc. The study reveals that 21.6% of tea processors have gained knowledge of tea promotion. In all, as the knowledge level pertaining to this aspect stands low, tea manufacturers should advance their knowledge of different marketing strategies through training.

Glyphosate is a common weedicide applied heavily in the tea sector. The government banned this agrochemical as it causes health and environmental hazards. Glyphosate belongs to category 3 of the toxicity range and the LD50 value is recorded as 5600mg/kg body weight. Therefore, at present, the use of this chemical is not permitted in many countries. The processors encountered serious issues due to the identification of chemical residuals in the made tea. In fact, several foreign consignments were returned and this made a bad reputation for the Sri Lankan tea industry. As the situation is such, the tea sector granted attention to finding alternative measures to glyphosate use such as Diuron. Further, manual weeding is promoted using sorandi. The study records a 21.2% knowledge level on finding alternatives to Glyphosate. This is a currently important issue in the tea industry and the research sub-sector should grant attention. Recently, the state decided to ban agrochemicals completely and shift to organic production mainly on compost. This decision might lead to an adverse effect on the tea economy and social repercussions. However, the extension services have to rest the responsibility of transferring alternative techniques to replace inorganic applications. This, in fact, is a great challenge.

Conclusion

The well-established scenario on sub-sectors of technology generation, transfer and utilization can be applied to the Sri Lankan tea sector. The investigation is confined to revealing the existing situation of tea processors in the framework of technology transfer. The tea industry includes a range of stakeholders in the supply and value chain. Among them, tea manufacturer marked an important role as they tarn the tea leaves to make tea through a complex technical procedure. The knowledge and skills applied to this process ensure the quality of the final product. Good quality tea establishes a brand name in the competitive tea market. Hence, the advancement of knowledge and skills of the processors through existing extension networks is a valid phenomenon.

The tea manufacturers received advisory and extension services from both government and private sector institutions. The government sector institutions namely, Sri Lanka Tea Board, Tea Small Holdings Development Authority and Tea Research Institute have rendered extension services to 83%, 52% and 48% of tea manufacturers, respectively. Further, 77% of the tea processors obtained relevant know-how from private-sector agri-input supply companies. The tea manufacturers obtained higher knowledge in the aspects of assessment on the green leaf standards (90.2%), reactions in tea manufacture (88.2%), post-harvest damages (86.3%) and reasonable price calculations (80.4%).

They gained a moderate level of knowledge on auction price determination (63.7%), value-added tea production (52.9%), and the importance of factory certifications (51%). The tea manufacturers obtained a low level of knowledge on the elements of awareness on training available (24.5%), tea promotion (21.6%) and alternatives to Glyphosate (21.2%) which should be further addressed by appropriate advisory and extension programs. (Note that the author should rewrite the conclusions by condensing the key finding derived from this study to match with the objective)

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