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Information and Communication Technology (ICT) for Sericulture Knowledge Management: Case of Indian Sericulture

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Abstract

In India, sericulture is not only a tradition but also a living culture. It is a farm-based, labour intensive and commercially attractive economic activity falling under the cottage and small-scale sector. It particularly suits rural-based farmers, entrepreneurs and artisans as it requires low investment but with potential for relatively higher returns. Though the sector has registered an impressive growth during the last few decades, however, a number of factors have limited sericulture from achieving its true potential. Those factors may include insufficient capital and investment incentives, low level of technology dissemination, poor extension support, inadequate farm infrastructure, limited market and stagnant prices of sericultural products etc. In this paper,an attempt has been made to understand the importance of ICT in knowledge management particularly concentrating the case of Indian sericulture. Finally, an integrated model linking ICT with entire production chain of sericulture is suggested to establish close linkage between forward and backward sub-systems for greater efficiency and synergy.

Keywords: ICT, Information, Knowledge, Management, Sericulture

Sericulture is both an art and science of raising silkworms for silk production. It is estimated that the sericulture sector alone provides livelihood opportunities to over six million families spread over in some 59,000 villages across India(Gangopadhyay, 2009).Thissericulture sector particularly suits rural-based farmers, entrepreneurs and artisans as it requires low investment but with potential for relatively higher returns (Kumaresan*et al.*, 2008). It provides income and employment to the rural poor especially farmers with small land-holdings and the marginalized and weaker sections of the society. The Indian sericulture industry, though, registered an impressive growth during the last few decades, however, a number of factors have limited its potential from achieving its true potential. Those factors may include insufficient capital and investment incentives, low level of technology dissemination, poor extension support,inadequate farm infrastructure, limited market and stagnant prices of sericultural products etc.

Knowledge is widely recognized as one of the key drivers of productivity and economic growth of a country (Mueller, 2006). Generally, it refers to the understandings that an entity possesses and uses to take effective action in achieving the desired goal.It can be acquired by continuous learning. Recently, the horizon ofcodified knowledge has been widened in emerging knowledge economieswith the latest technological advancement in ICT (Nnadi *et al.*, 2012). Latest innovations and continuousimprovement particularly in the small and medium scale enterprise segmentsare completely based upon fast developing knowledge in emerging economies.At this juncture of globalization, it is very important to remain competitive utilizing the knowledge and its effective management (Dunning, 2002). The main purpose of knowledge management is to transform the knowledge into a valuable product or services. ICTrefers to a set of technologies that facilitate management of sharing knowledge and information more efficiently and play a vital role on knowledge management initiatives (Mathur*et al.*, 2013). Management of knowledge has now become easier with the help of advanced technological tools like computers, telephones, e-mail, databases, data-mining systems andsatellite based global information system etc. The objectives of the paper are to-

1. study the importance of ICT in knowledge management particularly concentrating the case of Indian sericulture industry and
2. develop an integrated model linking ICT with entire production chain of sericulture to strengthen the sericulture industry in India.

Review of literature: indian sericulture industry

Sericulture and rural poverty alleviation: In India, sericulture has the potential to play a dominant role in uplifting the economic conditions of the rural poor. Being an agro-based cottage industry, it fits well in the Indian rural areas, where agriculture continues to be the main source of occupation and farmers are resource-constrained by increasing fragmentation of landholding. This is mainly due to the following important features associated with sericulture (Patel, 1992; Panda, 1993)-

1. Labour intensive (can generate employment @ 11 man-days per kg of mulberryraw silk production including both the on-farm and off-farm activities throughout the year) andsuitable for small as well largelandholders (Gangopadhyay, 2009; Mathur *et al.,* 2013)
2. Low capital investmentbut with potential for relatively higher returnswithin a short span of time(Kumaresan*et al.*, 2008).
3. Large domestic (around 85 % of silk goods produced are sold in the domestic market) and international market (approximately 15 % of its outputof all types of silk goods) for raw silk (Annual Report, Central Silk Board, 2014-15).
4. Sericulture being the tradition of India is not new to most of the regions.
5. The food plant, mulberry which is central to cocoon and silk production can grow in varied agro-climatic regions of India.

Economic activities associated with sericulture: The entire production chain of sericulture includes several economic activities ranging from seed production to mulberry cultivation, silkworm rearing, cocoon production and post cocoon activities. Table 1 presents various components of economic activities associated with sericulture.

Table 1: Components of economic activities associated with sericulture

Sl. No.	Economic activity	Skill required	Type of beneficiary
1.	Production of disease free layings	High	Govt. agencies/LSPs
2.	Production of parental seed cocoons	High	Seed rearers/BSFs
3.	Raising of nursery exclusively for mulberry sericulture	Low	Farmers
4.	Cultivation of mulberry plants	Low	Farmers
5.	Preparation of agro-processed food (like jam/jelly) form mulberry fruits	High	SMEs
6.	Preparation of vermin-compost utilizing waste mulberry plant parts	Moderate	Farmers
7.	Rearing of silkworm for industrial cocoon production	Moderate	Farmers
8.	Preparation of bed disinfectants for silkworm rearing	High	SMEs
9.	Reeling, spinning and twisting of silk yarn	High	Reelers
10.	Weaving, printing and dyeing of silk cloth	High	Weavers, Printers etc.

Source: Compiled by the Author reviewing various reports/notes etc.
Note: LSPs- Licensed Seed Producers; BSFs-Basic Seed Farms; SMEs- Small and Medium Enterprises

SWOT analysis of the Indian sericulture sector: In this section, an attempt has been made to briefly analyze the strengths, weakness, opportunities and threats (SWOT) that characterize the Indian sericulture industry.

Strengths of the Indian sericulture industry

1. Large and expanding domestic production base.
2. Steady growth in the production of raw silk, currently being the second largest silk production country in the world, next only to China (International Sericultural Commission Congress Congress, 2014).
3. Huge domestic demand.

Weakness of the Indian sericulture industry

1. Sericulture, though, practiced in 21 states across the country, however, contribution of 5 traditional states together accounts for more than 95% to the total raw silk production in the country(Mathur*et al.*, 2013). Besides, cocoon productivity/unit area of mulberry plantation greatly varies (10 kg/h in Nagaland to 651 kg/h in Andhra Pradesh) among the states.
2. Bivoltine silk (which is qualitatively superior than the multivoltine ones) is traded in the international market. Indian silk loose the competitive edge in the international market mainly due to the production of inferior quality of multivoltine silk.

3. In India, around 50% of the cocoon reeling sector capacity is still dominated by the traditional charkha devices which are characterized by lower productivity and poor quality(Gangopadhyay, 2009; Mathur*et al.*, 2013).

Opportunities of the Indian sericulture industry

The supply-short situation of raw silk and increasing global as well as domestic demand clearly indicates the opportunities exist for the Indian sericulture industry for further growth and expansion(Annual Report, Central Silk Board, 2014-15).

Threats of the Indian sericulture industry

The Indian silk industry is facing stiff competition mainly from China after the liberalized trade regime whereby cheap raw silk may be dumped into the country rendering the sericultural activities unattractive to the farmers(Gangopadhyay, 2009).

Applicaltion of ICT in sericulture & knowledge manangement

In this section, an attempt has been made to identify the areas where ICT can be effectively applied in sericulture and knowledge management. Based on the areas identified, an integrated model linking ICT has been proposed with an aim to strengthen the sericulture industry in India (Fig. 1).

Sericulture research and development: The role of ICT and its importance in sericultural research is quite significant. With the advancement of web-based information system, the possibility of accessing databases and journals has increased dramatically. ICT facilitates in creating a virtual library of huge depositories of knowledge and information providing direct access to publication wherever it is located through the web. Besides, online publication systems immensely help to disseminate new knowledge to a wider group of scientific communities.More interestingly, the changing environment of research networking, possibilities of working jointly via web-based virtual communities of scholars and free flow of interactive knowledge led to a profound change in the sericultural research. For example, we have witnessed the fruits of free flow of interactive knowledge among diverse scientific communities in the advancement of seri-biotechnological research like creating and mapping the whole genome sequence in silkworm, *Bombyx mori*(Mita *et al.*, 2004).

Sericulture extension and technology transfer: Though television and radio have played a great role in extension related activities, however, great potential exists for innovative application of latest ICTs to enhance the extension deliverymechanisms in the field of sericulture. The development of community communicationcenters (known as internet kiosks/tele-cottages/tele-centers) exemplified the new partnershipsfor local information access, communicationand education in rural areas.A number of telecentres in rural India has been developed across the country through a number of donor driven and government sponsored programmes (Shanmugavelan, 2000). In that direction, Central Silk Board and State Governmentsmay formulate appropriate policies taking the advantage of recent spread of telecentre movement in India to develop alternative modes of extension delivery mechanismsin the field of sericulture.

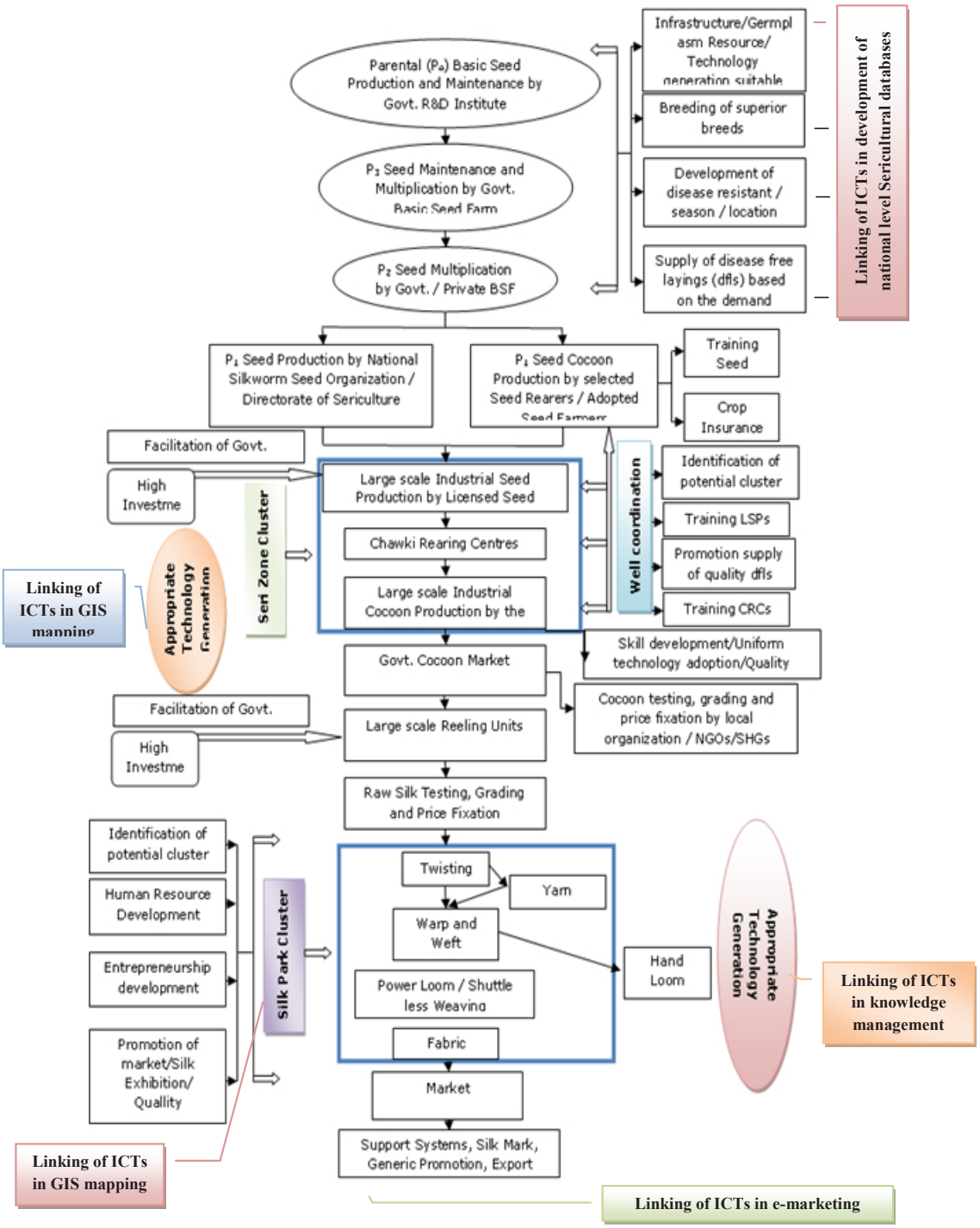

Fig. 1: An integrated modellinking ICT to strengthen sericulture industry in India

Creating new business opportunities for sericulture farmers: Overall development of the sericulture sector depends on how the farmers are capacitated linking them to the larger seri-business sector. It is very important now-a-days to take the advantageof global trade opportunities to remain competitive and innovative in the market. In this context, developing suitable mechanisms for small scale farmers to access new information, learn new knowledge and contribute to the knowledge network through integration of supporting ICT system is very much essential. Generally, the small scale farmers in India suffer from insufficient capital to run their own business. Thus, access to microcreditis very much essential topromote business environment in rural areas. In this context, the portable devices, computers and smart cards integrated with ICT systemmay supplement the information infrastructure to allowthe credit agencies in extending their support deeper into rural areas (Nnadi*et al.*, 2012).

Developing appropriate sericultural planning, coordination and implementation: Development of appropriate planning, better coordination and effective implementation are some of the critical areas where ICT can play a vital role. Indian sericulture is not only vast, highly scattered, unorganized but also multidisciplinary in nature involving both the on-farm and off-farm activities. Often the government agencies find it difficult to incorporate suitable need-based approaches in the policy matters. It may be due to lack of extension efforts and unorganized nature of the sector. In this regard, development of web-based android apps to collect data from the farmers' households may link directly the farmers with the implementing agencies (Ezhil and Kumar, 2016). Besides, technological advancement in the areas of web-based Geographic Information Systems (GIS) may offer the policy makers, planners and sericulturists an increasing wayto plan for land use, evaluate environmentalimpacts, visualize important social impacts and comparedifferent sericultural developmentsin the country.

Sericulture knowledge management: A large part of knowledgeis not explicit but tacit. This is truefor knowledge in case of sericulturetoo where a lot of good practicesbeingpracticed by the local communities and transferred by the laboratoriesare poorly documented. In this regard, ICT can play a vital role in management of sericulture knowledge more effectively. Some of the possibilities that can be explored to manage the sericulture knowledge through ICTs are summarized below-

1. *Building of national level sericultural database:* This database may include research outcomes in the field of sericulture from scholars of every country, sericulture related papers published in various journals, name of the institutions and scientists engaged in sericultural activities etc. It may be useful to formulate suitable planning and identifying research thrust areas to advance the sericultural research in the country.
2. *Developing database of traditional knowledge:*Traditional sericultural knowledge is still confined within the local communities without being properly documented. In this regard, ICT can play an important role. The traditional knowledge available with the local communities may be collected by the experts. The data collected may be compiled in the form of success stories and lessons learned for wider dissemination to the scientific communities through web-based ICT system.
3. *Mapping of potential sericulture areas through satellite based GIS:*The development of satellite based global information system (GIS) now facilitatesto store databases about natural resources with a graphical user interface. The users can access these data easily using geographical maps. For example, development of the geoportal namely, "Sericulture Information Linkages and Knowledge System" (SILKS) using open source GIS has made a significant impact in the country particularly in the north eastern states (Handique*et al.*, 2016).

Conclusion

Indian sericulture is not only vast, widely dispersed but also multidisciplinary in nature involvingsilkworm seed sector, cocoon sector (cultivation of food plants and silkworm rearing) and post cocoonsector (silk reeling, spinning, twisting, processing and weaving). Although collaborative researchactivities promoted and implemented by the Central Silk Board in association with National levelR&D Institutions, State Governments, Universities and NGOs have resulted in the development of appropriatetechnologies towards attaining higher quality and productivity of Indian silk, however, there is a big gap between the domestic demand and supply (Gangopadhyay, 2009). In spite of abundant natural resources, socio-economicbenefits of the sector like generation of employment for large sections of tribes andmarginalized rural men and women, growing export market as well as large domestic demand, avariety of problems have limitedthe Indian sericulture from achieving its true potential. The recent technological advancement in ICT has opened up new opportunities to strengthen the sericulture industry in India. For example, linking ICT with the entire production chain of sericulture starting from formulating appropriate sericultural policies to building national level databases, devising viable extension delivery mechanisms and e-marketing can be very helpful in establishing better coordination between forward and backward sub-systems for greater efficiency and synergy.

References

1. Annual Report, Central Silk Board (2014-15) Available online @ http://www.csb.gov.in/publications/annual-report/ accessed on 20th February, 2017.
2. Dunning, J. H. (2002). *Regions, globalization, and the knowledge-based economy*. Oxford University Press.
3. Ezhil V., Kumar, N. (2016) Development of android app model for sericulture.*International Journal of Innovative Research in Computer and Communication Engineering*, 4 (7): 13071-13075.
4. Gangopadhyay, Debnirmalya (2009) Sericulture industry in India – A Review. In: *India Science and Technology 2008,* Banerjee, P. (ed.)*,* National Institute of Science Technology and Development Studies (NISTADS), CSIR, New Delhi, pp. 334-339. Available online @ SSRN: https://ssrn.com/abstract=1473049
5. Handique, B. K., Das, P. T., Goswami, J., Goswami, C., Singh, P. S., Prabhakar, C. J., and Raju, P. L. N. (2016) Expansion of sericulture in india using geospatial tools and web technology. *Current Science*, 111(8): 1312-1318.
6. International Sericultural Commission Congress (2014) Statistics of global silk production. Available online @ http://inserco.org/en/?q=statistics accessed on 20th February, 2017.
7. Kumaresan, P., Devi, R. G., Rajadurai, S., Selvaraju, N. G., & Jayaram, H. (2008) Performance of large scale farming in sericulture-an economic analysis. *Indian Journal of Agricultural Economics*, *63*(4): 641-652.
8. Mathur, A. K., Roy, S., & Mitra, J. (2013). Toward sustainable development of economic sub-sectors: case of indian sericulture. *Journal of Security and Sustainability Issues*, *3*(2): 15-30.

9. Mita, K., Kasahara, M., Sasaki, S., Nagayasu, Y., Yamada, T., Kanamori, H. and Kadono-Okuda, K. (2004) The genome sequence of silkworm, *Bombyx mori*. *DNA Research*, 11(1): 27-35.

10. Mueller, P. (2006) Exploring the knowledge filter: How entrepreneurship and university–industry relationships drive economic growth. *Research policy*, *35*(10): 1499-1508.

11. Nnadi, F. N., Chikaire, J., Atoma, C. N., Egwuonwu, H. A., & Echetama, J. A. (2012) ICT for agriculture knowledge management in Nigeria: lessons and strategies for improvement. *Science Journal of Civil Agricultural Research & Management*, *2012*.

12. Panda, S.K. 1993. Scope of Mulberry Sericulture in New Areas, in 'Sericulture Development in Non-Traditional Areas', BAIF, 86-94, Pune.

13. Patel, K.V. 1992. Sericulture: An Instrument of Change, Some Grassroot Level Lessons, Indian Silk, July: 24-35.

14. Shanmugavelan, M. 2000. Information Technology (IT) in Developing Nations, Intermedia, 28 (1).