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TECHNOLOGICAL ADVANCES AND THE SUSTAINABILITY OF NATURAL RUBBER CULTIVATION IN DIGITAL INDIA: A STUDY WITH A FOCUS ON KERALA STATE

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Abstract

There is growing unsustainability of natural rubber (NR) cultivation in India due to mounting production costs as against low market prices that are constantly fluctuating, and other factors. Many cultivators find it difficult to be in NR cultivation in Kerala State, the most NR cultivating State in India. They tend to take up alternative occupations, like, conversion of cultivating land for real estate purpose, partly using it for tourism purpose, etc. In this context, this paper discusses the strategies for the sustainable growth of NR cultivation. It points out the vital need for technology adoption, like, technology adoption, use of ICT-enabled tools, intervention by the Government of India (GOI) to control imports of NR, fixing minimum support price, and so on.

Keywords: NR, Price fluctuations, Sustainability, Social Media, ICT, AI, e-NAM, e-WOM.

1. INTRODUCTION

The production of natural rubber (NR) is fast becoming unaffordable in India for the NR cultivators given the mounting production costs as against the low market prices that are fluctuating also (Pradeep and Jacob 2021)[2], (Sruthy et. al. 2021)[3]. NR sector accounts for only 0.4 percent of the cropped area in India and can contribute very less to Agriculture-GDP (0.64 percent), but its contribution Manufacturing-GDP is significant (3.63 percent). (Sajitha 2023)[1]. NR cultivation or production co-exists with fast growing rubber products manufacturing sector. As a vital segment NR can contribute significantly to India's GDP or GVA since NR helps the fast growth of manufacturing. A stagnancy in India's Agriculture-GVA is seen since 2021.(GOI, Jan 2023, Figure I)[62].

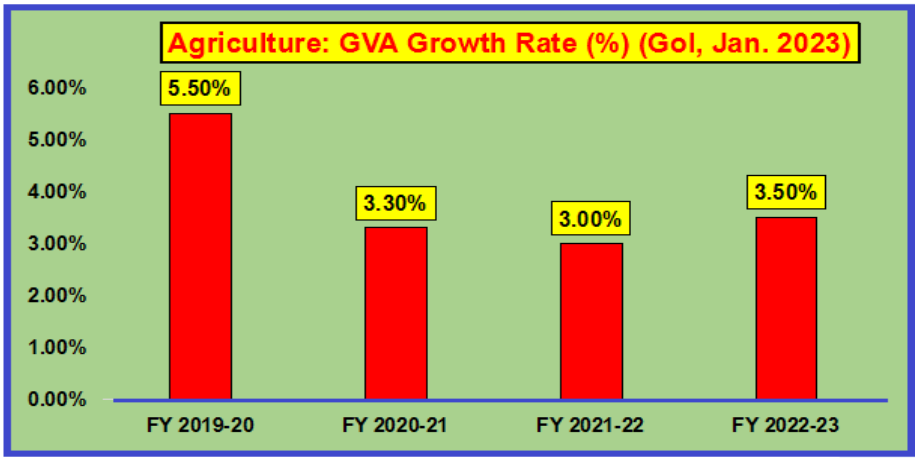

Figure I: GVA-Agriculture – Growth Trend

Source: GOI (2023). *Economic Survey 2023*, Jan. [62].

2. SIGNIFICANCE OF THE STUDY

As per the more recent statistics of the GOI (PIB, March 21, 2023) [61] and RBI (2023) [64] (*RBI Bulletin*, April 2023), the revised estimates of India's GVA-Agriculture is less hopeful than the GOI data (Jan. 2023) as in Figure I; as suggested by Figures II and III.

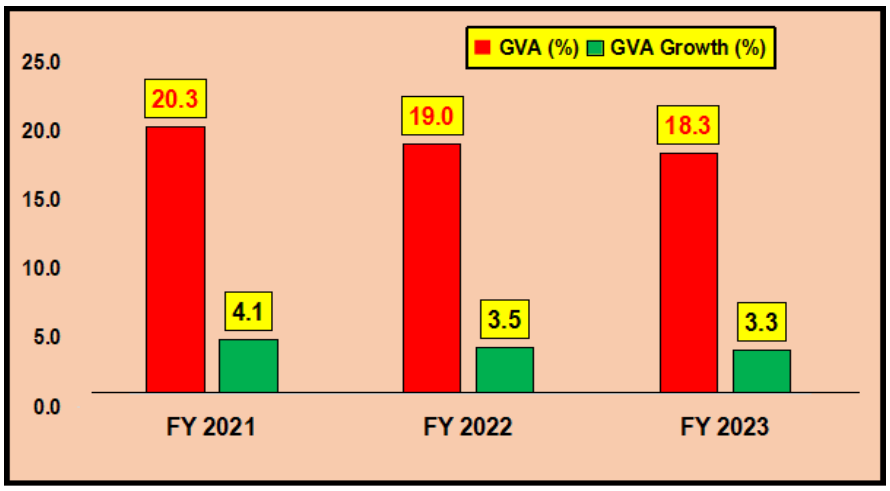

Figure II: GVA-Agriculture and its Growth

Source: GOI (2023). *PIB* dt. 21 March. [61]

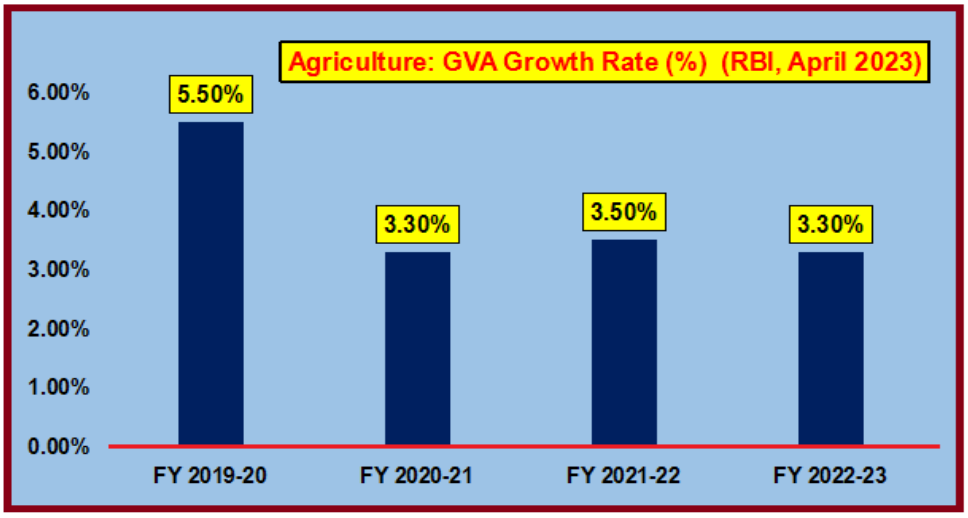

Figure III: GVA-Agriculture-Revised Trend

Source: RBI (2023). *RBI Bulletin*. April. [64]

More value added agricultural goods, including the plantation crops like NR-based ones, especially processed ones and those with export potential are vital for the rapid economic development of India. With the globalization of Indian economy since the early 1990s, volatility of NR prices has been growing fast (Sajitha, 2023)[1]. Fluctuations in global NR prices affect the domestic prices of NR, and thus scientific cost management and innovative modes of raising productivity are vital for the survival and growth of NR cultivators and producers of NR-based products. While India continues to be the second largest consumer of NR (after China) in the world, it is only in the sixth rank in NR production and there has been a drastic fall in NR exports from 11343 tonnes in FY 2021 to 3560 tonnes in FY 2022, a fall by 68.62 percent. Also, it

is noted that NR imports to India has gone up by 33 percent, from 4.10 lakhs to 5.46 lakhs during the same period. In respect of NR production in India, there has been a growth of 8.4 percent to the level of 7.75 lakhs in FY 2022 but the NR consumption has gone up only by 12.9 percent as already noted. In this context, technology adoption becomes an imperative for cost management and for enhancing the export competitiveness of NR and NR-based products, given the volatility in NR prices, the domestic vis-à-vis global. (Figure IV).

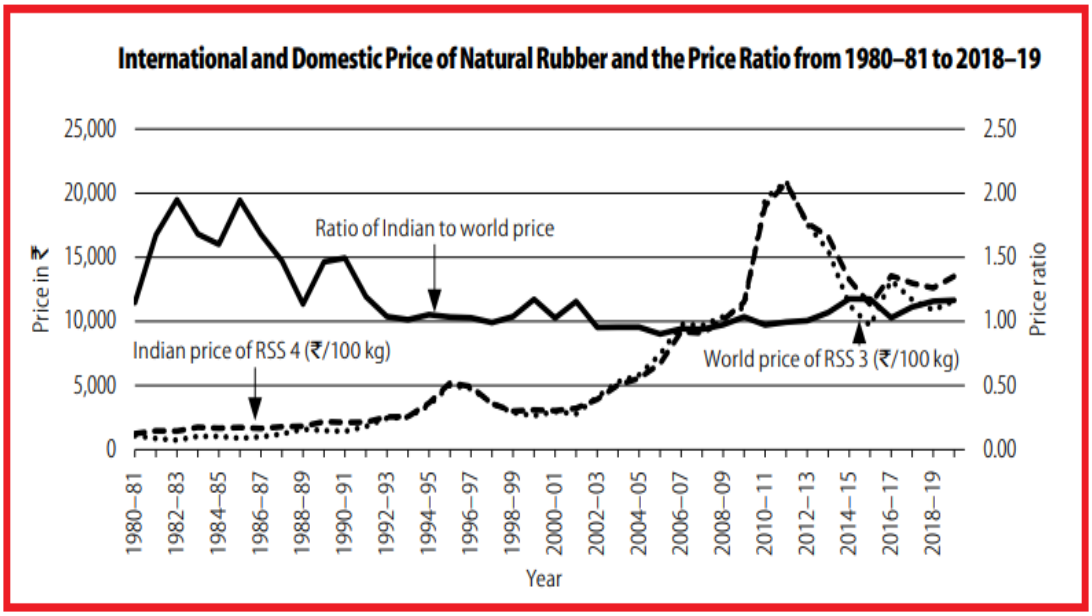

Figure IV: International and Domestic Prices of NR (FY 1981- FY 2019)

Source: Sajitha (2023), Economic & Political Weekly, LVIII, 5, Feb. p.29. [3].

3. OBJECTIVES AND RESEARCH QUESTIONS

Objectives are: (i) to study the role of ICT and other innovative technologies for the fast and sustainable growth of agricultural sector in India in this era of *Digital India*; (ii) to study the natural rubber (NR) sector in India focusing on using technological innovations for its sustained growth with special reference to Kerala; (iii) to suggest strategies for the sustained growth of NR sector in this era of rapid technological changes, fast ICT-adoption, constant price fluctuations. Given the exploratory nature of this study no hypothesis has been set. The following are the research questions set for this research: (i) how ICT and other technological advances like AI (artificial intelligence) can ensure the faster growth of Indian agriculture sector?; (ii) how technological innovations can help the sustained growth of NR sector in India?; (iii) what could be the strategies for the sustained growth of NR cultivation in India in this era of fast technological changes and widespread ICT-adoption?

4. METHODOLOGY AND DATA SOURCES

Designed as a descriptive-analytical and also an exploratory study, this study has drawn data from authentic secondary sources, like, the publications of the Govt. of India (GOI), RBI, Rubber Board, etc. Common statistical tools have been used for data analysis.

5. PREVIOUS STUDIES

Several studies have noted that ICT could adorn a key position as a catalyst of rapid economic growth, including growth of diverse economic sectors and economic issues like, rural economy, women empowerment, etc. The prospects of the ICT industry too were studied by some scholars, and so also the need for adopting scientific methods. Manoj (2007)[20] "ICT industry in India: a SWOT analysis" *Journal of Global Economy* has studied at national level about ICT industry in India, pointed out the vital significance of this industry in the development of Indian economy, and made suggestions for sustainably promoting it. Manoj, P.K. (2005) [21] "Cost accounting systems in Banks-for strategic advantage through effective cost management" *The Management Accountant* has noted the need for managing costs scientifically in banks, and in Manoj, P.K. (2005) [22]. Scientific pricing of bank products through cost accounting-a vital need in the LPG regime, *The Management Accountant*, the need for scientific pricing of bank products for prudent financial management in banks is noted.

Pickens (2009)[23] has demonstrated as to how a common ICT tool (mobile phone) has played a key role in financial inclusion, empowerment of women and rural development through 'banking the unbanked' in Philippines. Manoj (2010) [24] "Impact of technology on the efficiency and risk management of old private sector banks in India: Evidence from banks based in Kerala" has observed that ICT-adoption by banks has made them more efficient. The imminent need for a concrete policy at the national level to address the issues of the rubber sector has been dealt in detail. *The Hindu* (2015) [25] wherein the welcome features of the new policy announced in April 2015 has been discussed. A study by Nasar and Manoj (2013)[26] "Customer satisfaction on service quality of real estate agencies: An empirical analysis with reference to Kochi Corporation Area of Kerala State in India" has noted that greater level awareness should be provided to real estate agents; and that transparency and social networking are needed for customer service and business growth. Manoj (2013)[27] "Prospects and Challenges of Green Buildings and Green Affordable Homes: A Study with Reference to Ernakulam, Kerala" has noted the good growth potential of green homes as they can create huge employment avenues and can ensure fast and sustained economic growth.

Besides ICT adoption, some studies have pointed out the need for faster sustained economic growth through diverse kinds of technological interventions, development models and tools; right from educational loans to exports and from SEZs to ecotourism. Varghese, K.X, and Manoj, P.K. (2013)[28], "Educational loans and the higher education sector in India" have noted that study loans can improve HR quality in the nation, youth employability and they should be promoted. Manoj, P.K. (2014) [29] "Role of ICT in Women Empowerment: A Study with a Focus on 'Kudumbashree' programme in Kerala State of India"*. International Journal of Information Technology & Computer Sciences Perspectives* has pointed out the excellent women empowerment potential of SHGs under *Kudumbashree* poverty alleviation programme. K.K Nasar and P.K Manoj (2014) [30] Factors influencing the purchase of apartments: some empirical evidence. *Clear International Journal of Research in Management, Science and Technology* have noted the major factors influencing the apartment buyers which include infrastructure like ICT. Manoj, P.K. (2015) [31] "International Container Transhipment Terminal (ICTT) and its impact on coffee exports from India: An analysis" has observed the vital role of ICTT to boost exports

and economic growth. Manoj, PK (2009)[32], *Special economic zones in India: financial inclusion: challenges and opportunities* has noted the role of SEZs for expediting economic development. Manoj, P.K.(2017)[33]"Segmentation Strategy for Promotion of Ecotourism Products: Evidence from Thenmala Ecotourism" the author has pointed out that meticulous planning using segmentation of tourists can lead to economic growth through ecotourism.

Rajesh and Manoj (2015)[34]"Women Employees work life and challenges to Industrial Relations: Evidence from North Kerala" has noted the crucial importance of a trade-off between job life and family life of employed women to improve the industrial relations. Manoj (2016)[35]"Employment Generation from Rural Tourism: A Field Study of the Local Community at Kumbalangi, Kerala" has noted the vital capability of tourism to create employment avenues, along with suggestions like better infrastructure, ICT resources, online services, etc. Manoj (2016)[36] "Real Estate Investment Trusts (REITs) for Faster Housing Development in India: An Analysis in the Context of the New Regulatory Policies of SEBI" has observed that innovations in financing models such as REITs are vital to bring about rapid development of India's housing status which could lead to faster development of the whole Indian economy, given the linkages of housing. Manoj (2016)[37] "Bank marketing in India in the current ICT era: Strategies for effective promotion of bank products" observed ICT-enabled marketing as a key need for India's banking sector in this digital era. A study by Lakshmi and Manoj (2017)[38] "Service quality in rural banking in north Kerala: A comparative study of Kannur district co-operative bank and Kerala Gramin bank" has pointed out that KGB could make greater use of ICT than KDCB thus enabling the former to get an edge in the market. Another paper by Lakshmi and Manoj (2017)[39] "Rural Customers and ICT-based Bank Products A Study with a Focus on Kannur District Co-operative Bank and Kerala Gramin Bank" has observed that ICT-enabled services of Kerala Gramin Bank (KGB) have been accepted to a greater level than KDCB's non-ICT-enabled services.

A joint study by Joju, Vasantha, and Manoj (2017)[40] "Future of brick and mortar banking in Kerala: Relevance of branch banking in the digital era" has observed the vital need for 'human touch' as in 'brick and mortar' banking even if ICT or virtual banking is the new normal. Another study by Joju, Vasantha, and Manoj (2017)[41] "Financial technology and service quality in banks: Some empirical evidence from the old private sector banks based in Kerala, India" has observed that Fin-Techs could significantly enhance quality of banking service and they have become essential for superior service delivery by banks. Manoj (2017)[42] "Construction costs in affordable housing in Kerala: Relative significance of the various elements of costs of affordable housing projects" ordered the different elements of cost based on their relative priority for effective control of costs, and ICT has been noted to be a vital tool for effective cost control. Manoj (2017)[43] "Cost management in the construction of affordable housing units in Kerala: A case study of the relevance of earned value analysis (EVA) approach" has demonstrated EVA as a powerful weapon that could effectively manage various costs of construction.

A study by Joju, Vasantha, and Manoj (2017)[44] "Electronic CRM & ICT-based banking services: An empirical study of the attitude of customers in Kerala, India" has noted the key significance of ICT-based banking practice called e-CRM (Electronic Customer Relationship Management) as an enabler of efficient and competitive banking, along with noting good feedback of customers to latest ICT-based products

like e-CRM. Another CRM paper relating to bank management area by Manoj (2018)[45] “CRM in old private sector banks and new generation private sector banks in Kerala: A comparison” has noted that CRM adoption by the new private sector banks (NPBs) being to a greater extent than that of the old private sector banks (OPBs) particularly in respect of the latest ICT-enabled or Electronic version of CRM (i.e. e-CRM); thus enabling the NPBs to get a clear competitive edge in the market vis-à-vis the OPBs. Manoj (2019)[46] “Social banking in India in the reforms era and the case of financial inclusion: Relevance of ICT-based policy options” has suggested ICT-based strategic options to enhance social banking that fits into the current digital banking regime. Manoj (2019)[47] “Dynamics of human resource management in banks in the ICT era: A study with a focus on Kerala based old private sector banks” observed the key relevance of ICT-enabled policies for the management as well as development of bank staff in this very competitive digital era. Manoj (2019) [48] “Competitiveness of manufacturing industry in India: need for flexible manufacturing systems” pointed out the vital significance for adoption of ICT as well as other technological advances such as flexible manufacturing systems (FMS) so as to make Indian manufacturing sector more competitive, given the globalization pressures.

A paper by Joju and Manoj (2019)[49]“Digital Kerala: A study of the ICT Initiatives in Kerala state” has studied the major initiatives in the ICR front in Kerala, the State in India having many unique ‘firsts” like the topmost in internet penetration, topmost in literacy (universal literacy) etc. and has suggested strategies for the better use of Kerala’s vast ICT potential for its faster development. Joju and Manoj (2019) [50] “Banking Technology and Service Quality: Evidence from Private Sector Banks in Kerala” have observed ICT as an enabler of banking quality and as such ICT-adoption should be encouraged.

Ali and Manoj (2020) [51] “Impact of Falling Price of Rubber-A Case Study of KothamangalamTaluk in Ernakulam District” has pointed out that due to frequent price falls affect the livelihood of farmers and that governmental interventions like minimum support prices are vital. Manoj (2015)[52] “Prospects of Responsible Tourism in Kerala: Evidence from Kumarakam in Kottayam District” has noted that responsible tourism (RT) has vast potential for supporting economic growth, if sustainably promoted. Manoj (2016)[53] “Determinants of sustainability of rural tourism: a study of tourists at Kumbalangi in Kerala, India” has noted the key variables affecting tourism’s sustainability in the rural context and also suggested strategies like upgrading digital (ICT) resources as of the factors. Manoj (2015)[54] “Impact of Rural Tourism on the Environment and Society: Evidence from Kumbalangi in Kerala, India” noted certain adverse impacts that are imminent in rural tourism and that it is vital to control such effects. Manoj (2019)[55] “Tourism Sector in Kerala in the Post-Flood Scenario: Strategies for its Sustainable Growth With a Focus on Responsible Tourism” observed the crucial part that RT could play for revival of flood-hit Kerala economy.

A study by Saritha and Manoj (2023) [56], “Social inequalities in IT sector: Evidence from Kerala State in India” has observed the existence of inequality among IT sector employees in Kerala along with the key requirement for removing it for equitable development of Kerala’s IT sector.

Manoj, P.K. (2015) [57] Housing Microfinance: A Study on Quality, Cost and Default Rate with Respect to Bhavanashree in Kerala has noted that housing microfinance (HMF)type home loans have lower quality (higher NPAs) and also that their

transactional costs are higher. Manoj (2023)[58] "Affordable Healthcare and Affordable Housing: Need for an Integrative Approach for the Holistic Growth of the Digital Economy of Kerala, India" *Community Practitioner,* has noted that a knowledge society like Kerala must promote housing and healthcare sectors holistically using ICT. Manoj, P.K. (2023) [59].

ICT for Sustained Community Development in India in the 5G Era. *Community Practitioner* has noted the vital need of high-end ICT resources to provide better internet connectivity for fast and equitable growth.

6. TECHNOLOGY IMPERATIVE IN AGRICULTURE

ICT and other technologies, including AI (artificial intelligence) have revolutionized the agriculture worldwide, e.g. use of drones for spraying pesticides in rubber plantations. Electronic National Agriculture Market (e-NAM), an electronic trading portal came into being on 14th April 2016, completely funded by GOI and SFAC (Small Farmers Agribusiness Consortium).

By 2018 e-NAM could provide a common e-market platform for 585 selected wholesale markets. The benefits of e-NAM are greater accessibility, price discovery on real time basis. Better as and stable price realization (for producers) and lower transaction costs (for buyers) are the other benefits of e-NAM. Availability of the information on commodity prices on the e-NAM mobile app, SMS alerts on the price and quantity of commodities sold, better efficiency in respect of supply chain and warehouse based sales, direct online-mode payment to the bank accounts of farmers etc. are some of the other advantages of e-NAM. Figure V shows the stakeholders of e-NAM.

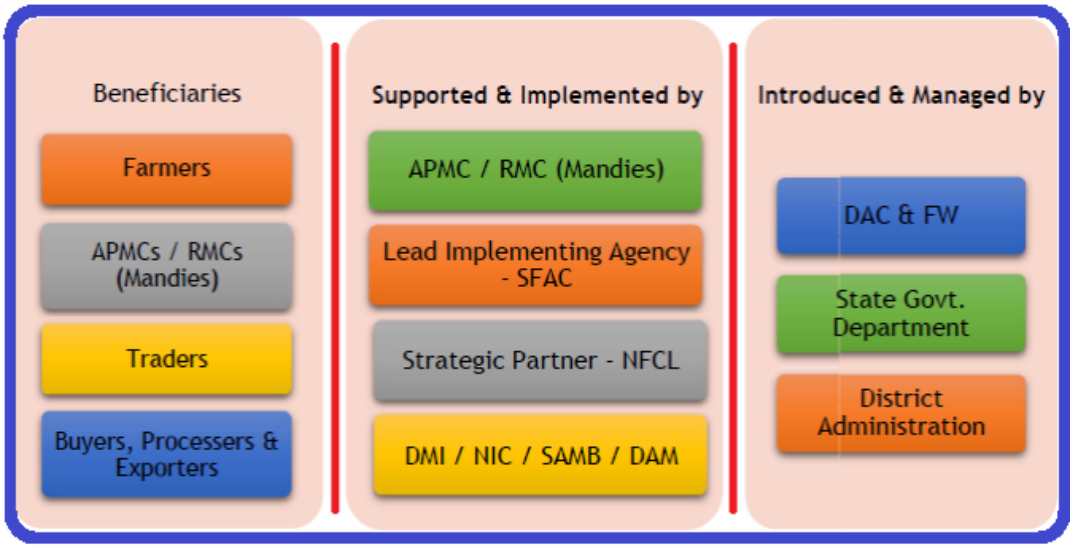

Figure V: Major Stakeholders of e-NAM

Source: GOI (2017) (www.enam.go.in).

In fact, just like e-NAM being aggressively promoted in India by the GOI, diverse kinds of technologies are being adopted by the Governments across the globe. Often called 'Agtech' (for Agriculture technology), these technologies seek to use modern and scientific practices (like, through the use of ICT-based tools), artificial intelligence (AI) etc. as well as innovative methods of farming, application of pesticides etc. in

agriculture. Rapid mechanization of diverse agricultural operations are being done day by day. A recent McKinsey study (2023) has estimated that Agtech would add about USD95 Billion to Indian economy annually by the year 2030.

The use of ICT and other digital technologies have been reported to be of immense help to embrace the latest agricultural practices with the use of digital technologies. By way of embracing modern technologies hundreds of Billions of dollars can be added to the Indian economy, according to the report. It has been pointed that Indian Agtech start-ups could raise nearly USD 1.6 Billion funding from investors over the last 4 years, by primarily focusing on platforms and products that play across the value chain, generate digital solutions, offer “Agribiotech” – one that uses biotechnology platform to design innovative and sustainable products.

7. RUBBER CULTIVATION IN INDIA AND THE TECHNOLOGY IMPERATIVE

It is noted that there are wide fluctuations in the yield, market price etc. of NR. The exports are on the decline. There is scope for improvement. The wise use of ICT and technological advances for better yield, quality etc. is vital in respect of NR. (Table I).

Table I: Area, Production, Yield, Consumption, Import, Export and Price of NR

Financial Year	Rubber Area (ha)	Tappable Rubber Area (ha)	Production (tonne)	Yield (kg/ha)	Consumption (tonne)	Import (tonne)	Export (tonne)	Price of RSS-4 (Rs/100kg)
FY 2017	818000	584600	691000	1553	1044075	426188	20920	13549
FY 2018	820900	612000	694000	1458	1112210	469760	5072	12980
FY 2019	822000	637900	651000	1453	1211940	582351	4551	12595
FY 2020	822000	663700	712000	1459	1134120	457223	12872	13522
FY 2021	823000	692900	715000	1442	1096410	410478	11343	14185
FY 2022	826660	718300	775000	1472	1238000	546369	3560	17101
FY 2023	850000	743650	839000	1482	1350000	528677	3700	15652

Source: GOI (2023). Official Statistics of Rubber Board.

NR cultivation has been subjected to major technological impacts in NR cultivation in past years. The technological advances that can be meaningfully used in the rubber sector include: (i) the use of high-yielding varieties of seedlings, scientific application of fertilizers, scientific detection and/or prediction of weather, improved tapping methods, etc.; (ii) the use of ICT-based market information services, including AI (artificial intelligence) based tools and techniques in NR cultivation, processing and marketing. ICT-based market information services are getting wide importance as a means of empowering farmers. ICT ensures informed decision-making, devoid of information asymmetry. Besides technological changes in NR cultivation, processing, etc. there is scope for learning innovations in this field and adopting them meaningfully by the rubber-based industries. NR is a widely used commodity found in countless essential products. Since rubber is a renewable resource, it is become increasingly important to produce and process sustainability due to rising global demand. NR production in Kerala has fallen by over 15 percent in the last year, as the low NR prices have forced many NR growers to take up other occupations.

Figure VI: AI-based Agriculture Pest and Disease Identification System

Source: Govt. of India (2020), *Yojana,* Vol. 64, No.2, Feb., p.18.

Productivity in NR cultivation in India, especially in Kerala, is poor and this indicates the need for the adoption of technological advances (like, the high-yielding variety of seeds) including the use of modern ICT-based tools and techniques. Significant productivity losses arise from pests and diseases.

Given the fact that India has 1.18 billion mobile phone users with 600 million internet users and 374 million smartphone users, one of the lowest data rates ($0.24/GB)in the world with an average data speed of 6 Mbps, the immense potential of artificial intelligence (AI) needs to be tapped in India. For instance, the e-Governance agency (Government of Tamil Nadu) has partnered with Anna University and has launched “Anil”, an NLP-based smart Tamil assistant that provides step-by-step guidance to people to apply online for many vital Government services. The government of Tamil Nadu (GOTN) has become one of the pioneers in AI adoption for providing public services. The said GOTN agency has launched an AI-based agricultural pest and disease identification system and made it available to over 5 lakh households through a mobile app. The farmer clicks on an image of a diseased crop or a pest, the system processes the image through an AI algorithm, identifies the pest or disease, and sends a message to the farmer citing the remedies. This AI-based system has gained high acceptance in Tamil Nadu. Similar AI-based applications suitable for NR cultivators in Kerala are advisable.

8. NR PRODUCTION IN KERALA AND ITS MAJOR CHALLENGES

The first rubber plantations in India were set up in 1895 on the hill slopes of Kerala. However, rubber cultivation on a commercial scale was introduced in 1902. As already stated, Kerala is the largest producer of NR (about 90 percent) in India. Tamil Nadu, Karnataka, Tripura, Assam, Andaman and Nicobar, Goa, etc. are some other rubber-producing States. Over the years, the share of Kerala has been gradually falling, with the shares of other States slowly going up. Kerala has always been the leading State in India in NR production which contributes about 90 percent of NR produced in India. Rubber is a prominent plantation crop with considerable significance to the Indian Economy. Small estates make up more than 90 percent of rubber-producing land in Kerala. As per GOK (Government of Kerrala) statistics Kottayam (KTM) district has been the first in respect of NR cultivation (114250 Ha) and KTM is distantly followed by Ernakulam (EKM) (60125 Ha) and then by Pathanamthitta (PTM) (50870 Ha) and so on. (Figure VII).

Figure VII: Market Prices of NR – Indian and Global Markets

Source: GOK (2023). *Agricultural Statistics 2022*

The current statistics compiled by the Rubber Board (Govt. of India) are primarily based on information collected from registered growers, who account for less than half of the total NR produced. So, efforts to use remote sensing data to map out the region under NR cultivation in Kerala are appreciable. The upswing in NR prices, which started in 2005, reached a peak in 2011 with the price crossing Rs.200 per kg before the downward trend began towards the end of 2012. The fluctuations in NR prices, with a downward trend is a crucial challenge that NR cultivators are facing because NR cultivation is fast becoming unaffordable given the low prices that they get in the market. There are other challenges. Kerala's share in NR production used to be over 90 percent till the 1990s. But, Kerala's share has not been growing fast vis-à-vis other States in India. In the north-eastern States, for instance, NR production is fast growing. As of FY2023, Kerala's share of NR production in India is about 75 percent only, down from about 90 percent in 1990s.

Over the years the market price of NR has been fluctuating. Besides, there has been high level of convergence between Indian (Kottayam) and Global (Bangkok) NR prices throughout the period. (Figure VIII).

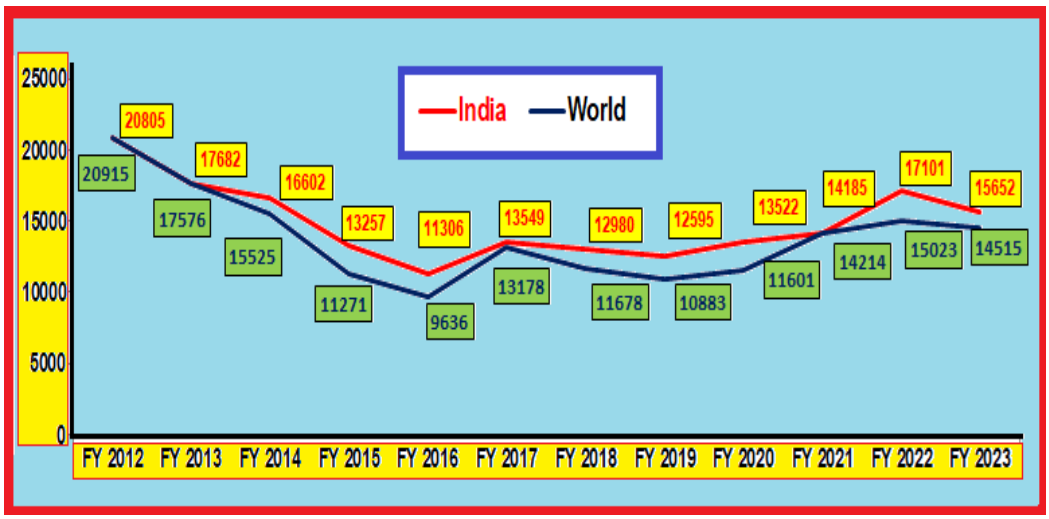

Figure VIII: Market Prices of NR – Indian and Global Markets

Source: GOI (2023). Official Statistics of Rubber Board.

9. SUGGESTIONS AND CONCLUDING REMARKS

It may be pointed out that ICT-based tools and techniques may be adopted by the Govt. of Kerala (GOK) for the benefit of the NR cultivators, on the lines of the Govt. of Tamil Nadu. Training is imparted to NR farmers for the use of ICT-based applications, including AI-based ones. As technologically advanced seedlings, like the High Yielding Variety (HYV) of NR clones like, RRII 105, RRII 414, and RRII 430 are not available adequately these should be produced more and provided to the interested NR cultivators. Thus, a higher yield from NR cultivation can be ensured. As climatic changes do affect NR cultivation, ICT-based (like AI-based) applications that can guide the NR cultivators need to be developed. As stability in NR prices is the need of the hour, the Governments at the Union and also State levels (especially GOK) should design their macroeconomic policies in such a way that they ensure minimum support prices (MSP) for NR as well as reduce the NR imports through higher tariffs and duties. Such policies could favor the cause of NR cultivators. Higher allocation for Price Stability Fund is one such policy measure, and whenever the NR prices approach the MSP levels suitable market interventions need to be made by the Union and State Governments.

Adequate facilities for bank credit be made available to the NR cultivators at reasonable rates and flexible terms and conditions, and also the credit policies of commercial banks be aptly rationalized in favor of the NR cultivators through Governmental interventions. Besides, higher allocations towards subsidies to the rubber sector are ensured. Besides, effective steps are taken by the Rubber Board and Union and State Governments to scale up rubber productivity (yield) per hectare, primarily by way of promoting the adoption of technological advances, including ICT. The development of ICT-based (especially AI-based) applications deserves special mention here. Marketing of rubber is made hassle-free and remunerative too for the cultivators through ICT-based applications for getting the prevalent market prices and by minimizing the role of agencies (intermediaries) between the NR cultivators and the end-users of raw rubber. Since social media is very commonly used and it ensures instant communications as well as sharing of information, concerted efforts need to be initiated by the Government to popularize the use of social media among NR cultivators. Social media, especially electronic word of mouth (eWOM) is a powerful tool for marketing of any product. Promotion of farmers' organizations, like, FPOs (Farmer Producer Organizations) by NR cultivators is highly desirable. FPOs of NR cultivators be promoted and such FPOs also be encouraged to use ICT-based tools.

At the Governmental level adequate arrangements that facilitate the scientific methods of cultivation, like, providing high yielding variety (HYV) of rubber saplings for the cultivators, mechanization of processing of the rubber latex, scientific methods of control of fungi, bacteria, pests, insects etc., like, application of Bordeaux mixture etc., use of drones for spraying pesticides in NR plantations etc. These technological advances can be suitably used only with the support and assistance of the Government authorities; as these services require high capital investment and can be availed jointly by cultivators. With the Governmental support, the cultivators can use such facilities jointly, for instance the Rubber Board (under the GOI) can take the necessary initiative. Let us hope that the Rubber Board, other agencies under the Union/State Governments will take the initiative.

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