

INTRODUCTION

The study of agrarian and non-agrarian production in British Gujarat has found attention by the Social Scientists, Historians, Economists and Planners. The issue of transformation registered in both of these productive zones had been addressed in the historical writings on Gujarat. This thesis offers an understanding about the transformation in the agriculture and non-agrarian means of production under the influence of existing skills of the natives and the impact of the imported European technology during the study period.

Theme and the Rationale of the Dissertation

The Ph.D. thesis entitled “Science, Technology and Transformation in the Means of Production in British Gujarat, c.1750-c.1950” is submitted in the Department of History, Faculty of Arts, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat under the supervision of Dr. Adhya Bharti Saxena for the award of Doctoral degree. The purpose of the submission of the thesis is to elucidate the thematic scope and content for the understanding of its applicability to the general readers working in the field of science and technology. The chapters incorporated in this dissertation will furnish the salient features of the mode of production in agrarian and non-agrarian sectors of economy. Dissertation also attempts in drawing the relevance of theme in contemporary times.

Agrarian and non-agrarian means of production will be the focus of our study. The different parameters of each sector are incorporated in the thesis writing for their role in the transformation of established structures. The doctoral dissertation is an analytical study of scientific and technological transformation in the means of production in British Gujarat. The purpose of selecting the time period from 1750 to 1950 itself is significant. The periodisation is deliberately fabricated to understand the continuity and change in the technological development. The said time span is also important because this era was the period of dominance of the British rule in Gujarat. The theme is an emerging perspective in the writing of history of the region from the scientific point of view; to understand the nature of colonialism; its strength and limitation in British Gujarat.

The survey of available literature establishes the significance of science and technology as an important factor for the significant change in the agrarian and non-agrarian sectors in British Gujarat. It is ascertained that the focus of the historical writings on British Gujarat sub-regions is largely based on commercial, social and political dynamism and ‘transformation’ registered in Gujarat is based on the enquiry of these themes. Agriculture has seldom been studied from the technological point of view, though sources available in various repositories in New Delhi, Mumbai and Gujarat offer lot of information on the issues of crops yield; seeds selection; irrigation potentiality; nature of tools and implements; animal’s husbandry, diseases and other related issues. Therefore, writing on this perspective becomes essential when one tries to understand the transformation in production process with the evolution of British rule in Gujarat. Non-agrarian production further needs to be interpreted with the understanding of the scientific base and economic dynamism.

Research Problems and Hypothesis

The study will try to understand the changes registered in British Gujarat when their rule was firmly established in the region. The establishment of the British rule started an era of implementation of various political, social, economic and of course technological skills in order to enhance the potentiality of the region’s resources in order to fulfill the colonial needs. Technology is very important tool to rule over a country. The new ruler, i.e., the British government was aware of the significance of technology and therefore, it became their top most priority. This was followed by the understanding of the colony’s ecology; flora and fauna and knowledge of the inhabitants to enhance their technological skills for exploitation of resources. In turn, the implementation of imported technology opened new vistas in the development and its assimilation in the *Gujarati* society.

The dissertation will try to define the structure of colonialism in British Gujarat on the above stated aspects. It will also try to pose different questions and try to seek possible answers with the study of agriculture and non-agrarian set up of Gujarat during the colonial period. Was colonialism absolute and universal in British Gujarat? Was it exploitative and what was the extent? Was British technology

superior to indigenous one? And finally, how both the native and British technologies affected each other? These are some of the vital inquisitives and the dissertation will try to offer plausible explanation about the nature and mode of transformation.

Research Aims and Objectives

In recent times, history of science and technology has generated immense interest among the social scientists as a result of scientific and technological contribution in the improvisation of thought process in the growth of society, economic systems and political apparatus in time and space. The survey of the available sources both primary and secondary reveals the contribution of science and technology in the evolution of British Gujarat. Historical writing on British Gujarat sub-regions is widely addressed by the Social Scientists as well as Historians and they have registered change in society. But from the scientific point of view, the published literatures reflect limitations about the impact of technology in the transformation of British Gujarat.

It is well established fact that the colonial rule in India and Gujarat in particular was based on the exploitation of natural resources to fulfill the demands of the mother country, i.e., England. The impact of Industrial Revolution which changed the face of England was the guiding factor for the systematic exploitation of Gujarat region. Pre-conceived with the superiority, the British in the initial phase introduced imported technology for quick results. Without proper understanding of the geo-morphology, the British authorities witnessed limited success. This episode was significant not only to the British government but also Gujarat region got the opportunity for assimilation of improved and adjusted technology for the betterment of society. The authorities understood their limitation and in the next phase, they introduced improved technology to suit the local environment. For the progress of this, there shall be a proper knowledge of theory, system of dissemination and application for human purposes. The region witnessed complex reactions in terms of assimilation of imported science and technology.

The purpose of the thesis is to offer a critical appraisal of the changes registered in British Gujarat districts with the establishment of British rule; to offer the importance of indigenous knowledge formation since antiquity; introduction of the European technology; its interaction with existing agrarian and non-agrarian structures; resistance offered by natives to the imported expertise and finally, its assimilation in the society.

Literature Review

The references consulted from the various repositories provide an insight about the motives and applicability in the mode of production with the implementation of the European technology and its interaction with the existing set-up. Both primary and secondary sources are consulted for the writing of this thesis.

For the understanding about the emergence of British Gujarat, *Gazetteers of the Bombay Presidency for Surat and Broach* (1877); *Ahmedabad* (1879) and *Kaira and Panch Mahals* (1879) are consulted. This is further supported by the Ph. D. theses of Jaspal Kaur Dhot's (1986), "Economy and Society of Northern Gujarat with Special Reference to Kheda District, circa 1750-1850", Unpublished Ph. D. Thesis, Vadodara: The M. S. University of Baroda; R. K. Hans's (1987), "Agrarian Economy of Broach District (Gujarat) During the First Half of the Nineteenth Century", Unpublished Ph. D. Thesis, Vadodara: The M. S. University of Baroda; Renu Saxena's (1989), "Ahmedabad from circa 1750-1850: A Review of It's Society, Economy and Institutions", Unpublished Ph. D. Thesis, Vadodara: The M. S. University of Baroda and H. J. Maurya's (2003), "Small Urban Centers in South Gujarat in the Nineteenth Century", Unpublished Ph. D. Thesis, Vadodara: The M. S. University of Baroda. Published books, articles, *Atlases*, *Encyclopedias*, *Dictionaries*, *Imperial Gazetteers of India*, are also used to understand British Gujarat.

Sanskrit, Persian and indigenous sources are consulted in the writing of the pre-colonial agrarian structure. *Krishi-Parasara* probably written by Parasara is one such source. Persian documents like *Risala Dar Falahat* (anonymous) and *Nuskha Dar Fanni-i-Falahat* by Amanullah Husaini (written c. 1693) provides information

on techniques of agriculture; manure making; preservation of seeds; knowledge of seasons; harvesting of crops; etc. *Lekhapaddhati: Documents of State and Everyday Life from Ancient and Medieval Gujarat* by Pushpa Prasad (2008) an indigenous source focuses on local practices employed by the cultivators. Other contemporary sources like Abul Fazl's *Ain-i Akbari*, (tr.) by H. Blochmann (2008); Ali Muhammad Khan's *Mirat-i-Ahmadi: Supplement*, (tr.) by Syed Nawab Ali and Charles Norman Seddon (1928) have also helped me in understanding agrarian environment in pre-British period.

Cotton cultivation in pre-British period is supported by the works of Irfan Habib's (1999), *The Agrarian System of Mughal India, 1556-1707*, 2nd Edn, New Delhi: OUP and Shantha Hariharan's (2002), *Cotton Textiles and Corporate Buyers in Cottonopolis: A Study of Purchases in Gujarat, 1600-1800*, Delhi: Manek Pub., which discuss about the mode of cultivation and varieties of cotton grown in Gujarat. Shantha Hariharan in the same book provides information about the state of indigo cultivation and its demand in the Indian Ocean markets. Sugarcane was grown in the different pockets in Gujarat and information is available in Adya Prasad Pandey's (2007), "Indian Sugar Industry: A Strong Industrial Base for Rural India", *Munich Personal RePEc Archive*, Paper No. 6065. Tobacco was introduced by the Portuguese in Gujarat and over the period, it became one of the important cash crops. B. G. Gokhale's (1974), "Tobacco in 17th Century India", *Agriculture History*, 48 (4), provides details about its cultivation in different pockets of Gujarat.

The well suited tools and implements were the products of the knowledge formation since antiquity and accommodated the increasing prosperity of agriculture. Irfan Habib's (2008), *A People History of India: Technology in Medieval India, c. 650-1750*, New Delhi: Tulika Books documents the different tools used for the cultivation of crops. Ranabir Chakravarti's (2008), "Agricultural Technology in Early Medieval India (c. A. D. 500-1300)", *The Medieval History Journal*, 11 (2) discusses the techniques used in manure making. For judicious use of season and rainfall, the following articles by Kafil Ahmed Choudhury's (1968), "*Krsi-Parasara*", *IJHS*, 27 (1) and M. Majumdar's (1984), "*Risala Dar Falahat*", *IJHS*, 19 (4) are immensely helpful. These texts highlights the knowledge of the cultivators

about the nature of season and skills used to predict rainfall. The state of agriculture also led to emergence of region specific animal husbandry. *Krsi-Parasara* categorically mentions to the breeding practices, quality of fodder and knowledge about the disease control among cattle and animals.

The non-agrarian sector was known for the production of excellent quality of commodities; this became the chief reason for ever growing interest of the Europeans. Cotton textiles received the major attention. K. L. Tuteja's (1990-91), "Agricultural Technology in Gujarat: A Study of Exotic Seeds and Saw Gins, 1800-50", *IHR*, 17 (1-2) refers to the traditional instruments used in the manufacture of cotton cloth and output generated was considered excellent in terms of its quality. Dyeing industry also attracted the attention of the European merchants and they preferred their cloth to be dyed in Gujarat. Following sources namely B. C. Mohanty, *et. al.* (1987), *Natural Dyeing Processes of India*, Ahmedabad; Shantha Hariharan's (2002), *Cotton Textiles and Corporate Buyers in Cottonopolis: A Study of Purchases in Gujarat, 1600-1800*, Delhi: Manek Pub. and Surendra Gopal's (1975), *Commerce and Crafts of the Gujarat in the Sixteenth and Seventeenth Century*, New Delhi are consulted for the understanding of the pre-colonial Gujarat dye industry.

S. A. Khan Ghorī and A. Rahman's (1966), "Paper Technology in Medieval India," *IJHS*, 1 (2) and Sita Ramaseshan's (1989), "The History of Paper in India Upto 1948", *IJHS*, 24 (2) deal with the paper manufacturing in various centres in Gujarat and different qualities of paper made were known for its whiteness. Radhakumud Mookerji's (1912), *Indian Shipping: A History of the Sea-Borne Trade and Maritime Activity of the Indians from the Earliest Times*, Bombay inform us about the techniques used in ship making, size of the vessels and skills used in the navigation.

The establishment of the British rule in Gujarat opened new chapter in terms of change registered in both agrarian and non-agrarian sectors. For this period, we have information available in the form of Correspondences, *Revised Revenue Survey Settlement Reports (RRSSR)*, *Monographs*, *Memoirs*, *Annual Reports of the*

Agriculture Departments, etc., in the archives and libraries in India. “*Survey and Settlement Report (SSR) of Purgunnas of Puranteej, Hursol, Morassa, Bayur and Veeramgam of Ahmedabad Collectorate*”(1853), *Selections from the Record of the Bombay Government (SRBG)*, No. 10, Bombay; “*Report on the Portions of Dholka Purgunna Situated in Ahmedabad and Kaira Collectorate*” (1853), *SSR*, No. 11, *SRBG*, Bombay; “*RRSSR of Broach Taluka of Broach Collectorate*” (1902), *SRBG*, No. 407, Bombay; “*RRSSR of Jambusar Taluka of Broach Collectorate*” (1903), *SRBG*, No. 412, Bombay; “*RRSSR of Ankleshwar Taluka of Broach Collectorate*” (1902), *SRBG*, No. 529, Bombay; “*RRSSR of Dohad Taluka of Panch Mahals Collectorate*” (1927), *SRBG*, No.612, Bombay; “*RRSSR of Halol Taluka of Panch Mahals Collectorate*” (1927), *SRBG*, No. 616, Bombay; “*RRSSR of Bardoli Taluka of Surat Collectorate*” (1897), *SRBG*, No. 360, Bombay; “*RRSSR of Chorasi Taluka of Surat Collectorate*” (1897), *SRBG*, No. 359, Bombay; “*RRSSR of Olpad Taluka of Surat Collectorate*” (1897), *SRBG*, No. 361, Bombay; “*RRSSR of Chikhli Taluka of Surat Collectorate*” (1899), *SRBG*, No. 381, Bombay; “*RRSSR of Bulsar Taluka of Surat Collectorate*” (1900), *SRBG*, No. 303, Bombay; “*RRSSR of Jalalpur Taluka of Surat Collectorate*” (1900), *SRBG*, No. 305, Bombay; “*RRSSR of Pradi Taluka of Surat Collectorate*” (1904), *SRBG*, No. 425, Bombay; “*RRSSR of Mandavi Taluka of Surat Collectorate*” (1904), *SRBG*, No. 426, Bombay, etc., are primary sources which provide information about the name of different food as well as cash crops cultivated in different *talukas* of British Gujarat; increasing yield of crops and changes in the cropping pattern. *Annual Reports of the Agriculture Department of the Bombay Presidency* and *Annual Reports on the Experimental Works of the Agriculture Stations* of British Gujarat districts in the first half of the 20th century further registers the progress made in the agrarian sector with the implementation of exotic seeds; experiments carried out to increase the yield of the crops; introduction of implements; disease control; manure making and role of the established agricultural experimental stations of districts of British Gujarat. *Gazetteers of the Bombay Presidency* for British Gujarat districts further substantiate the understanding of agricultural change during the British rule. George Watt’s (1897), *A Dictionary of the Economic Products of India*, 6 Vols., Calcutta is very important compendium to understand about the different species of crops, methods used in their cultivation and benefits of the crops. John Augustus Voelcker’s (1897), *Report on the Improvement*

of *Indian Agriculture*, 2nd Edn, London is also incorporated in the writing of this chapter. This report establishes amazing facts about the craftsmanship of agriculture in late 19th century and indicates the creation of new agricultural environment for the forthcoming 20th century.

The transformation in cash crops cultivation received maximum attention during the colonial period owing to the commercial needs of the British. Cotton as usual was the chief cash crops and the British government tried to increase the yield of cotton by introducing exotic seeds. *Gazetteers of the Bombay Presidency for Surat and Broach* (1877) and *Ahmedabad* (1879) inform us about the methods used in the cultivation; name of the different varieties of cotton plants in sub-region of British Gujarat. R. D. Choksey's (1968), *Economic Life in the Bombay Gujarat, 1800-1939*, Bombay: Asia Pub. House; K. L. Tuteja's (1990-91), "Agricultural Technology in Gujarat: A Study of Exotic Seeds and Saw Gins, 1800-50", *IHR*, 17 (1-2); etc., are the secondary sources which further substantiate the information about the cotton cultivation, introduction of exotic seeds, improvement of indigenous staples and so on. Besides, improving the cotton staples, the government introduced measures to control the attack of insects and pests. B. P. Deshpande and N. T. Nadkarny's (1936), "Spotted Boll-Worms of Cotton in South Gujarat", 1923-31, *Scientific Monograph No. 10*, ICAR, Calcutta is one such document referred to understand the policy taken to eradicate the damage done by Spotted Boll Worm. The same source also refers to the techniques employed to control the worm, application of insecticide and use of trap crops.

George Watt's (1897), *A Dictionary of the Economic Products of India*, Vol. IV, Calcutta refers to the methods used in the indigo cultivation. "Papers Relating to the RSS of Borsad taluka of Kaira Collectorate" (1895), *SRBG*, No. 337, NS informs us about the attitudes of the natives regarding its cultivation. Prakash Kumar's (2001), "Scientific Experiments in British India: Scientists, Indigo Planters and the State, 1890-1930", *IESHR*, 38 (3) make us understand about the reasons for the decline of indigo cultivation in Gujarat's pocket where earlier indigo cultivation was carried out.

“Correspondences Regarding the Manufacture of Sugar” (1876-88), *Huzur* Political Office, Baroda Record Office, Baroda refers to the initiatives of Baroda State to increase the yield of sugarcane; experiments conducted by importing expertise help from the outside and the opening of mills to manufacture sugar. George Watt’s (1897), *A Dictionary of the Economic Products of India*, Vol. VI discusses the cultivation of sugarcane in Gujarat sub-regions. *Annual Report of Department of Agriculture of the Bombay Presidency*; P. R. Mehta’s (1905), *The Elements of The Agriculture of the Bombay Presidency*, Bombay and G. Keatinge’s (1921), *Agricultural Progress in Western India*, London further inform us about the introduction of new canes introduced in Gujarat. Ghulam Ahmad Nadri’s (2007), “Eighteenth Century Gujarat: The Dynamics of Its Political Economy, 1750-1800”, Unpublished Ph. D. Thesis, Leiden refers to the demand of sugar and other products made from canes in the international markets. Ramrao S. Kasargode’s (1920), “The Sugarcane Borer and Its Control”, *Bulletin No. 94 of 1919*, Department of Agriculture, Bombay peeps into the measures taken to control the diseases of sugarcane plants. *Voelcker Report on Indian Agriculture* (1897) and R. G. Padhye’s (1924), “Sugar Industry in Western India and Methods of Sugar Manufacture”, *Bulletin No. 116*, Department of Agriculture, Bombay discuss about the improvement of sugarcane yield, increasing its yield and importation of machinery from Europe and its applicability in the Indian environment.

Harold H. Mann, M. L. Patel and V. M. Majmudar’s (1926), “The Improvement of Tobacco in Northern Gujarat”, *Bulletin No. 132 of 1926*, Department of Agriculture, Bombay refers to the introduction of exotic seeds in Kaira District and its limited output. It also discusses about the improvement of indigenous tobacco plants; hiring of experts from outside; establishment of experimental farm and other initiatives for the improvement of tobacco industry in Gujarat. *GBP* (1879), *Kaira and Panch Mahals* discusses about the different tobacco plants, disease control and its cultivation in Kaira. B. G. Gokhale’s (1974), “Tobacco in 17th Century India”, *Agriculture History*, 48 (4) tells about its demand in the overseas markets.

For opium cultivation in Gujarat, following references are consulted namely Nathan Allen's (1853), *The Opium Trade Including a Sketch of its History, Extent, Effect, Etc., as Carried on in India and China* and G. Graham Dixon's (1922), *The Truth About Indian Opium* which let us know about its cultivation, methods used in the preparation of opium and so on.

Information from "Colonel Alexander Walker's Report on Indian Agriculture" is traced from the book of Dharampal (1971), *Indian Science and Technology in the Eighteenth Century: Some Contemporary European Accounts*, Delhi: Impex. The report (1820s) refers to the rotation of crops, mixed cropping pattern and satisfactory results achieved by the natives to maintain the soil fertility. J. B. Shukla's (1937), *Life and Labour in a Gujarat Taluka*, Bombay further provides information about the understanding of the natives to cultivate different crops by preserving the fertility of the soil. "Papers Relating to the RRSS of Nadiad Taluka of Kaira Collectorate" (1895), *SRBG*, No. 295, NS is used to pen down the interesting case of Nadiad Pit used by the natives for manure making. Harold H. Mann and S. R. Paranjpe's (1919), "Artificial Manures: Experiments on Their Value for Crops in Western India", *Bulletin No. 89 of 1918*, No. 2, Department of Agriculture, Bombay refers to the introduction of artificial chemical manures and various experiments conducted to improve the manure making.

Both primary and secondary sources are consulted for tools and implements used in British Gujarat. Edward Gorden Fawcett's (1849), "Report on the Collectorate of Ahmedabad", *SRBG*, No. 5, N. S., Bombay informs us about the different tools used by the cultivators in cultivation of crops. G. C. Mukhtyar's (1930), *Life and Labour in A South Gujarat Village* and J. B. Shukla's (1937), *Life and Labour in a Gujarat Taluka*, Bombay refer to the superiority of the natives instruments used by the cultivators and these were well suited to the local topography.

J. Forbes's (1834), *Oriental Memoirs: A Narrative of Seventeen Years Residence in India*, Vol. II cites numerous examples of systematic exploitation of the traditional water bodies. "Papers Relating to the Second RRSS of Matar Taluka of

Kaira Collectorate” (1900), *SRBG*, No. 579, NS discusses about the introduction of pumps and its limited acceptability in Kaira District. G. C. Mukhtyar’s (1930), *Life and Labour in A South Gujarat Village* and J. M. Mehta (1930), *A Study of Rural Economy of Gujarat Containing Possibilities of Reconstruction*, Baroda: Baroda State Press provides important information about irrigational knowledge of the populace. Secondary sources like David Hardiman’s (2006), *Histories for the Subordinated*, New Delhi: Permanent Black; Daniel R. Headrick’s (1988), *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940*, New York: OUP, etc., are further referred for the understanding about the irrigation techniques used in British Gujarat.

Voelcker Report on Indian Agriculture (1897) refers to the improvement made in cattle and the initiatives taken by the government for the development of animal husbandry. G. Keatinge’s (1921), *Agricultural Progress in Western India*, London; J. M. Mehta’s (1930), *A Study of Rural Economy of Gujarat Containing Possibilities of Reconstruction*, Baroda: Baroda State Press and J. B. Shukla’s (1937), *Life and Labour in A Gujarat Taluka*, Bombay discuss about the fodder used for cattle, disease control measures and other issues related to animals. H. H. Mann’s, *The Social Framework of Agriculture: India, Middle East and England*, ed. by Daniel Thorner (1967), Bombay: Vora Pub. and M. S. Randhawa’s (1983), *Agriculture in India*, Vol. III, New Delhi: ICAR provide instances of progress made in the animal husbandry.

Various *Annual Reports of the Agriculture Department of the Bombay Presidency* and *Annual Reports of Experimental Stations of British Gujarat* for the first half of the 20th century are consulted to understand the initiatives taken for the introduction of exotic plants; general improvement of local staples; implements used; manure making and other related issues associated with agriculture.

The non-agrarian sectors are equally supported by the references traced from archives and various repositories. Both primary and secondary sources are consulted for writing on the non-agrarian potentiality of British Gujarat.

Cotton manufacture is discussed first because it received the maximum attention of the British government and natives were also instrumental in the transformation of this sector. R. E. Enthoven's (1895), *The Cotton Fabrics of the Bombay Presidency*, Bombay refers to the process used by the natives to manufacture cotton cloth and details are incorporated regarding the traditional instruments used for the manufacture of fabric by the artisans. Ruth Barnes's (1997), *Indian Block-Printed Textiles in Egypt: The Newberry Collection in the Ashmolean Museum*, Oxford traces the overseas centres known for trading link with Gujarat in terms of purchase of cotton finished products. Some of the articles like Beverly Lemire's (2012), "Revising the Historical Narrative: India, Europe and the Cotton Trade, c. 1300-1800"; Pedro Machado's (2012), "Awash in a Sea of Cloth: Gujarat, Africa and the Western Indian Ocean, 1300-1800" and Prasannan Parthasarathi and Ian Wendt's (2012), "Indian Cotton Manufacturing from the Late 18th Century", all these articles published in Giorgio Riello and Prasannan Parthasarathi (eds.), *The Spinning World: A Global History of Cotton Textiles, 1200-1850*, New Delhi: Primus Books provide a global perspective about the development of spinning world of cotton; inter-exchange of manufacturing process; movement of cotton commodities across the globe; etc. Secondary sources are further consulted to portray the transformation witness in this sector with the introduction of the European machines like gin, fly shuttle, mule and later on powerloom. The role of the natives and their attitudes towards the acceptance and assimilation of imported technology by establishing mills in sub-regions is also discussed. N. K. G. Parikh's (1962), "Cotton Industry in Ahmedabad", M. A. Dissertation, The M. S. University, Baroda refers to the responses of the natives of Ahmedabad in the establishment of mills in the region. Dwijendra Tripathi's (1996), "Colonialism and Technology Choices in India: A Historical Overview", *The Developing Economies*, 14 (1) refers to the introduction of the some of the best machinery for cloth making in Gujarat by the natives which posed a picture of competition with the British machinery used for textile manufacturing in the European modelled mills. Daniel R. Headrick's (1988), *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940*, New York: OUP discusses the utility of introduced technology in mills and its adjustment with the needs of the local environment. Douglas Haynes's (2012), *Small Town Capitalism in Western India: Artisans, Merchants, and the Making of the*

Informal Economy, 1870–1960, New Delhi, CUP is mandatory for scholars working on the impact of European machine made cloth on the western India sub-regions. The book is based on the survey work carried in the last decade of the 20th century by Haynes. His work is the enlargement of some of the articles published before the writing of this book in various *journals*. One such reference is published as Douglas Haynes (2001), “Artisan Cloth Producers and the Emergence of Powerloom Manufacture in Western India, 1920-50”, *Past and Present*, 172 (1). In this article, he refers to the positive role of the British government in the introduction of powerloom when electricity was available in the first half of the 20th century. The native artisans who were working with traditional loom were encouraged in terms of monetary help and expertise support to adopt the loom which worked on electricity. Some of the local weaving families were reported to adopt this loom without much difficulty. The book “*Small Town Capitalism in Western India*” of Haynes is significant because it offer some of the fresh observation about the nature and impact of Industrial Revolution in western India. According to him, both traditional mode of cloth making and machine made cloth had their respective sphere of influence. For example, urban regions gradually transformed into manufacturing of textiles with the establishment of mills with European machines. But, the rural areas remained less affected and weavers continued with their traditional methods to weave cloth.

The sub-regions were also known for silk cloth manufacturing. S. M. Edwards’s (1900), *A Monograph upon the Silk Fabrics of the Bombay Presidency*, Bombay is important to understand about the process associated with the making of silk products, traditional instruments used and dyeing of the cloth. Sabyasachi Bhattacharya’s (1970), “Cultural and Social Constrains on Technological Innovation and Development: Some Case Studies”, in Surjit Sinha (ed.), *Science, Technology and Culture: A Study of the Cultural Traditions and Institutions of India and Ceylon in Relation to Science and Technology*, Delhi: IIC discusses about the attitude of the natives regarding the adoption of silk filature for silk rearing from silk-worms. He also informs us about the technicalities of the imported instrument and reason for its limited acceptability among the natives.

Dyeing of cotton and silk fabrics in Gujarat enjoyed reputation in the European markets. The dyes of different colours were made from vegetables and animals. H. C. Bhardwaj and K. Kamal Jain's (1982), "Indian Dyes and Dyeing Industry During 18th-19th Centuries", *IJHS*, 17 (1) discusses about the varieties of natural dyes made by the natives for colouring the cotton and silk fabrics. But, this traditional industry showed the sign of decline with the introduction of cheap artificial dye in the western India. One should be cautious about the state of dye industry in colonial period. It was reported that natives started manufacturing artificial dye and one such case is registered in Baroda State. Dhruv Raina and S. Irfan Habib's (2004) in *Domesticating Modern Science: A Social History of Science and Culture in Colonial India*, Delhi: Tulika Books make us know about the readiness of the natives to emerge in the midst of heavy odds.

Ceciel L. Burns's (1904), *Gold and Silver Work in the Bombay Presidency*, Bombay reports about the gold and silver work in the Bombay Gujarat during the colonial period. He refers to both the indigenous and European methods for thread making from gold and silver; its dyeing, polishing and tools used in the process. G. P. Fernandez's (1931), *Art-Crafts of the Bombay Presidency*, Bombay informs us about the interest of the government to learn the techniques employed by the natives in the making of threads from gold and silver. Tirthankar Roy's (1999), *Traditional Industry in the Economy of Colonial India*, New Delhi: CUP discusses the change registered in this traditional industry under the impact of the British rule in the sub-regions.

B. A. Brendon's (1899), *A Monograph on the Woollen Fabrics of the Bombay Presidency*, Bombay informs us about the techniques employed by the natives for manufacture woollen articles, name of the some of the articles manufactured and communities associated with the dyeing of woollen fabrics.

For carpet making, H. J. R. Twiggs's (1907), *Art and Practice of Carpet Making in the Bombay Presidency*, Bombay is consulted to understand about the impact of the British rule in this industry. The monograph refers to the process used in the carpet making, centres known for its making and colours including artificial

used in the process. Salt manufacture continued to employ traditional methods and the initiatives of the British authorities led to the very limited change in this industry. Monier Williams's (1855), "Memoir on the Zilla of Baroche", *SRBG*, No. 3, Old refers to salt making in coastal region of Broach. *Gazetteer of the Bombay Presidency* (1879), *Ahmedabad* provides detail information about the centres known for salt making; communities associated in this work; making of salt pans; cleaning of salt and precaution taken to control diseases while working in the salt pans.

J. A. G. Walls's (1902), *A Monograph on Wood Carving in the Bombay Presidency*, Bombay discusses about the traditional methods of wood carving in the various sub-regions of Gujarat. The industry received lukewarm response from the government for its survival. For ivory work, Ceciel L. Burns's (1900), *A Monograph on Ivory Carving*, Bombay refers to the sources of ivory; ivory carving industry; tools used; centres in British Gujarat and various products made from it. Stone work suffered great loss with the establishment of the British administration in the sub-regions. It was reported that officials serving in these pockets were ignorant about the importance of heritage buildings and these structures received scant attention from them. J. E. H. Tupper's (1906), *Stone Carving and Inlaying in the Bombay Presidency*, Bombay refers to the tools and process used in the stone work in sub-regions of Gujarat. Pottery work received the same attention and was on the verge of decline. E. Maconochie's (1895), *A Monograph on the Pottery and Glass Ware of the Bombay Presidency*, Bombay discusses about the clay property used in the making of pottery, natives tools used and the process associated with the working on pottery. The same monograph also refers to the traditional glass work in Kaira District and the initiatives of Ranchhodlal Chhotlal to start a glass manufactory without government support. W. V. Schudamore's (1907), *Iron and Steel Work in the Bombay Presidency*, Bombay informs us about the changes incorporated in the iron manufactures in Gujarat and he also refers to Surat centres emerged as leading iron hub in Gujarat.

The leather industry received some encouragement for its improvement as per the international demands, but the natives were still confident with their traditional mode of leather manufacture. A. Guthrie's (1910), *Report on Leather*

Industries of the Bombay Presidency, Bombay discusses about the methods of obtaining raw material for leather products; tools used; centres and communities associated in this industry. J. R. Martin's (1903), *A Monograph on Tanning and Working in Leather in the Bombay Presidency*, Bombay especially refers to Ahmedabad known for leather manufacture with different techniques used in the making of leather products. Paper industry witnessed change under the policy introduced by the government to encourage machine made paper. R. T. F. Kirk's (1908), *A Monograph on Paper Making in the Bombay Presidency*, Bombay refers to the native and the European methods used in the manufacture of paper in Gujarat. Makrand J. Mehta's (1982), "Indigenous Paper Industry and Muslim Entrepreneurship: Case Study of Paper Technology and Trade of Ahmedabad with Special Reference to the 19th Century", *IJHS*, 17 (1) refers to the change witness in traditional paper industry and the initiatives of the natives to adopt the machine made paper.

Gazetteer of the Bombay Presidency (1877), *Surat and Broach* refers to the various pockets exploited for the making of liquor with the traditional methods by the natives. It also discusses about the initiatives of the British government to change the structure of this industry. V. G. Gokhale's (1920), "Palm Gul Manufacture in the Bombay Presidency (Principally Date Palm)", *Bulletin No. 93 of 1919*, Department of Agriculture, Bombay is dealing with the seriousness of the natives for liquor manufacture with hiring experts and providing technical information to the government for increasing the production of liquor manufacture.

Oil pressing industry continued with the traditional fashion and the natives were confident of the utility of the simple instruments used in the extraction of oil from the oil seeds. The urban centres were reported to start mills with the European machines to manufacture oil. Y. G. Pandit's (1910), *Report on the Oil-Pressing Industry of the Bombay Presidency*, Bombay refers to the traditional methods used with details of instrument used. He also discusses about the European methods of oil extraction by using machines and even use of chemicals for oil extraction.

Navigation was the strength of Gujarat's prosperity in terms of its trade volume in the world's markets. Monier Williams's (1855), "Memoir on the *Zilla of Baroche*", *SRBG*, No. 3, Old provides information about the traditional skills used by the sailors and activities of vessel's crew. The government introduced steam vessels which enabled the government to dominate the commercial activities. A. J. Qaiser's (1982), *Indian Response to European Technology and Culture, 1498-1707*, New Delhi: OUP and Satpal Sangwan's (1991), *Science, Technology and Colonisation: An Indian Experience, 1757-1857*, Delhi establish the superiority of the natives in the field of ship construction. K. S. Vaidya's (1935), *The Sailing Vessels Traffic on the Coast of Western India and its Future*, Bombay: Popular Book Depot let us know about the limitation of steam vessels in Gujarat as natives were still carried their trade with country made vessels.

Research Methodology

The steps in research methodology include the recording of the changes registered in the means of production in both the agrarian and non-agrarian sectors in British districts of Northern Division of the Bombay Presidency. The basic assumption for the understanding of the transformation is largely understood through the 'technological diffusion and its assimilation' in the existing structures in *Gujarati* society.

The arena of my investigation is extended to the dissemination of knowledge through established educational structures, experimental farms and traditional modes in existence. My enquiry also looks into the subject matter pertains to both humanities and pure sciences; British government's intervention; and the responses of the natives regarding the adoption and rejection of imported European technology.

A brief survey of the published references available in the various repositories in India has cultivated an understanding on the history of science, technology and transformation and guided me to explore British Gujarat sub-regions during the nineteenth and the twentieth century. The peep into the primary published sources like Correspondences, *Monographs*, *Gazetteers*, *Revised Revenue Survey Settlement Reports*, *Annual Reports of the Department of Agriculture*, etc., and unpublished

sources traced at National Archives of India, New Delhi; Maharashtra State Archives, Mumbai; Gujarat State Archives, Gandhinagar, Gujarat; Baroda Record Office, Vadodara; and libraries suggest that the establishment of the British rule in Gujarat led to the significant change in the society with the implementation of imported technology. For instance, organised attempt for creating infrastructure in imparting education in science and technology, application of new imported technology and its acceptance by *Gujarati* population are clearly registered in agrarian and non-agrarian sector.

In this way, I have documented the process of development of “Science, Technology and Transformation in the Means of Production in British Gujarat, c.1750-c.1950”. The writing of the thesis begins with the Introduction.

Chapter two, ‘Background to Science and Technology during Pre-Colonial Times in British Gujarat’ is an appraisal of both scientific and technological development of the agrarian and non-agrarian activities for the medieval centuries. The usage of *Atlases* and administrative history of Gujarat region has helped in the writing on the establishment of British Gujarat districts. In brief, physical features of the sub-regions are discussed. In agrarian fields, an analysis of available sources is done to make an understanding of existing set-up. Both food and cash crops cultivation continued. This chapter deals with the contemporary scenario of cash crops like cotton, indigo, sugarcane and tobacco. The references to the tools and implements in use are also explained. The native’s skills to maintain the soil fertility, working skills employed to understand the nature of seasons, rainfall and climates are also discussed at length. Animal husbandry knowledge is also documented. The third section of this chapter deals with vibrant and non-agrarian environment. Cotton textile manufacture, dyeing industry, paper manufactures, liquor making, etc., are systematically highlighted. Besides these, activities like leather, iron, oil pressing, navigation, etc., are discussed in order to understand their contribution in the emergence of dynamic social set-up. The background is essential to understand the native skills and the emerging importance of imported technology under the British rule. This chapter updates about the colonial writings on native knowledge on the means of production of variety of commodities.

Chapter three, 'Scientific and Technological Base to the Agrarian Activity in British Gujarat', analyses the changes in the food and cash crops pattern in the various districts of British Gujarat. The British government was interested more in cash crops and the motive was purely commercial needs of Industrial Revolution in England. The introduction of exotic seeds to increase the output and requirement of specific quality in cash crops were highlighted. The Britishers were impressed by the native's skills used in preserving the soil fertility. Use of indigenous tools and implements by the natives is next important query. Analysing the use of rivers, wells, tanks and canals by the natives will focus the study of irrigation and the British intervention in this field. Animals constitute important element in Indian agriculture and therefore, a brief account will be provided along with the initiatives taken by the British. The last section deals with the organisational structure established to promote agriculture beginning in the first quarter of the 20th century.

The chapter four, 'Scientific and Technological Base to the Non- Agrarian Activity in British Gujarat', a close survey is registered on how natives technology witnessed changes by the influence of colonial technology introduced in the sub-region in British Gujarat. The first section of study in this chapter is on cotton, silk and woollen textile manufactures with traditional methods and how these got affected and registered changes with the introduction of the European pattern of manufacture based on machine culture. The dyeing industry and impact of cheap imported artificial dye is also addressed. There were other sectors also which forced the government to accept the native's skills and these continued largely unaffected. The manufacture of salt, saltpeter, wood and ivory carving, leather products, stone and pottery, etc., will support this assumption. The traditional mode of producing glass, iron and other metals continued along with assimilation of imported knowledge at least in the urban sub-regions. The natives showed their seriousness about the utility of the imported technology and if it was found suitable, it was adopted. The following observation can be traced in the study of liquor making, paper manufacturer, oil extracting and navigation. The chapter is important to challenge the myth of the European superiority in the field of science and

technology. India had always a rich heritage of scientific knowledge, but these could not emerge on a wider scale and later superseded by the Western Europe.

In chapter five, 'Response of the Natives to the Colonial Science and Technology in British Gujarat', the reaction of the native is noticed in the form of acceptance and rejection of the colonial technology. The section is very important for the scholars and readers to understand the reasons for the success / failure associated with imported technologies. The chapter depicts that the European technologies were adopted by the natives even under great constrain of colonial rule. The analysis of the chapter will make the reader to highlight the rich heritage and even advanced stage of the Indian agriculture as compared to England. The historical context of the agriculture technology can surely be useful to the modern context also. In the age of increasing pollution and harmful effects of pesticides, fertilisers, etc., the old knowledge will be of great importance.

Chapter six draws inferences based on the findings in chapters two, three, four and five.

Glossary, illustrations, maps, appendices and bibliography will support this study. The information of my research investigation is based on primary and secondary sources. Archival documents are available in the form of Correspondences, Letters, *Memoirs*, *Bulletins*, *Revised Revenue Survey Settlement Reports*, *Gazetteers*, *Monographs*, etc. The primary source information is available at the National Archives of India, New Delhi; Maharashtra State Archives, Mumbai; Central Record Office, Vadodara; Libraries at New Delhi, Mumbai, Ahmedabad and Vadodara. The same repositories are also consulted for the secondary sources available in the form of *Books*, *Reports*, *Survey works*, articles published in different *Journals*. J-STOR and other internet based archives are consulted in the writing of this thesis. I am also grateful to the Department of History, The M. S. University of Baroda for allowing me to access 19th century Hari-Bhakti and Shaymal Bechar rare documents besides rich collection of Bombay Presidency records.