Perspectives and Policies of Technological Self-Reliance in India: Examining the contributions of Gandhi, Nehru and Tagore

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DECLARATION

I declare that the dissertation entitled **"Perspectives and Policies of Technological Self-Reliance in India: Examining the contributions of Gandhi, Nehru and Tagore"** submitted by me for the award of the degree of **Master of Philosophy** of Jawaharlal Nehru University is my own work. The dissertation has not been submitted for any other degree of this university or any other university.

Noklenyangla

CERTIFICATE

We recommend that this dissertation be placed before the examiners for evaluation

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Acknowledgement

(Pelaba Metetdaktsur)

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Contents

Chapter 1

Introduction

1.1 Background and Motivation

A growing body of research seems to suggest that rules and institutions are influenced by informal norms and ideological traditions of a society.[1] In the present study we make an endeavour to analyse how the ideological tradition in India has influenced its policies, with a particular focus on the policies on Technological Self-Reliance. It is well known that Technological Self-Reliance had occupied a centre stage in India's policies for a long time, and that there was always an attempt to strive for Technological Self-Reliance.

However, even today, in the so called era of globalization we find evidence of high emphasis being given to factors like indigenous knowledge, local knowledge and grassroot innovations[2] along with a strong focus on developing indigenous R&D capability in the national technology policies of many countries. Fransman (1995) argues that national technology policies hold importance even in a globalised world, citing example of Japan's attempt to blend international orientations with national objectives.[3] In other words, the process of globalization has not stopped policymakers to focus on national level capabilities and objectives, suggesting, perhaps, that self-reliance, in some form or other, remains a key driver of policy making in many areas.

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[1] nobelprize.org/nobel_prizes/economics/laureates/.../north-lecture.ht. [Accessed on 17-07-2011].

[2] *"The term grassroot refers to individual innovators, who often undertake innovative efforts to solve localised problems, and generally work outside the realm of formal organisations like business firms or research institutes."* Bhaduri, S. and Kumar, H. (2011). Extrinsic and intrinsic motivations to innovate: tracing the motivation of 'grassroot' innovators in India. *Mind and Society.* 10:pp. 27-55.

[3] Fransman, M. (1995). Is national technology policy obsolete in a globalised world? The Japenese response. *Cambridge Journal of Economics.*

1.2 Policies of Technological Self-Reliance in India

Let us examine some of the policies that laid importance to Technological Self-Reliance in India, National Committee on Science and Technology, in its January 1973 document *'An Approach to the Science and Technology Plan'* elaborated:

> *"Self-reliance implies an inherent strength in the community for growth and development and, for the economy as a whole, a long term equilibrium in the balance of payments, including payments for technology in all aspects. In other words, our legitimate concern to be independent of external financial assistance should not lead us to become even more dependent on external technological assistance. A continuation of our present state of our present state of technological dependence will lead to significant financial lost in both domestic and foreign currency; perpetuate the fragmentation of our industrial system which foreign collaboration has brought about; continue to deny challenging employment to our engineers and scientists and compromise what is perhaps even more important than production per se- the capability to produce. In sum, the nation has to recognise that technology is a major national resource and a vital element in the task of achieving self-reliance[4]".*

The Government of India Technology Policy Statement -1983, a section on Self-Reliance; the lines of which runs like these,

> *"In a country of India's size and endowments, self- reliance is inescapable and must be at the very heart of technological development. We must aim at major technological break-through in the shortest possible time for the development of indigenous technology appropriate to national priorities and resources. For this the role of different agencies will be identified, responsibilities assigned and the necessarylinkages established"[5].*

From the above statements we get a picture that the ways to achieve Technological Self-Reliance[6] had always occupied a focal point in India's policies.

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[4] See Department of Science and Technology's *An Approach to the Science and Technology Plan* [January 1973].

[5] See section 2.2 of Government of India Technology Policy Statement-1983 [January 1983].

[6] Technological Self Reliance as an entity has been proposed to be achieved through the development of indigenous technology. Apart from self reliance, indigenous technology was proposed as a way to

1.3 Objectives

In this context, the present study makes an attempt to examine the nuances of Technological Self Reliance and examine how the three great thinkers of the 20th Century India, M.K Gandhi, Jawaharlal Nehru, and Rabindranath Tagore have reflected on this notion of self-reliance in science and technologies, and how their thoughts had shaped the policies of independent India.

For instance, Gandhi believed that Khadi (small scale industry) stood for economic freedom and equality, which could eradicate poverty and unemployment problem[7] and Tagore's idea of overcoming the obstacles of development through a process of self-reliance and collective action[8] comes into consideration while debating on Technological Self-Reliance; as for Nehru development could be brought about mainly by big scale industrialization[9], the research will focus on how Technological Self-Reliance was formulated in policies through the thoughts of these thinkers.

The main objectives of this research are:

1. Examine the concept of Technological Self-Reliance followed and preached by Gandhi, Nehru and Tagore.

2. Examine the way the thoughts of Gandhi, Nehru and Tagore had integrated in the policy documents of India.

1.4 Chapterisation

The dissertation has five chapters. Chapter 2 has been divided into two parts, first sections of it will cover the gamut of definitions and debates surrounding Technological Self-Reliance, the second section will attempt to highlight the historical evolutionary

reduce the dependence on foreign inputs, mainly in critical and vulnerable areas and in high value-added items in which the domestic base is strong. Strengthening and diversifying the domestic technology base were considered as necessary to reduce imports and to expand exports for which international competitiveness was to be ensured. See section 4.1 of Government of India Technology Policy Statement-1983[January 1983].

[7] Gandhi, M.K.. (1944). *Constructive Programme: Its Meaning and Place*, Navajivan Publishing House, p.10.

[8] Gupta. U.D.(2004). *Rabindranath Tagore- A Biography*. New Delhi: Oxford University Press.

[9] Zachariah, B. (2005).*Developing India: An Intellectual and Social History, c. 1930-50,*Oxford University Press, New Delhi.

process and experiences of/with Technological Self-Reliance of Japan and China, which would help us to pose our research questions. Chapter 3 will focus on how Gandhi. Nehru and Tagore's approach of Technological Self-Reliance was similar and different from one another. The way how the thoughts of Gandhi, Nehru and Tagore shaped the Technological Self-Reliance as a policy which was integrated in Science and Technology Policy documents, plans and policies will be analyzed in Chapter 4. Chapter 5 will be the comprehensive conclusion of the research.

Chapter 2

Technological Self-Reliance: Definitions, Debates and Practices

The objective of this chapter is to examine various definitions and debates surrounding Technological Self-Reliance and present an overview of Technological Self-Reliance to help us understand its nuances and treatment in policy making. The chapter has been divided into two parts, the first part carry definitions and explanations and explores the arguments between Technological Self-Reliance and Technological Dependence as put forward by the scholars, besides this it analyses the changing notion of Technological Self-Reliance. The second part underlines China and Japan's experiences with Technological Self-Reliance; the prime focus of this discussion is to help us understandhow these two countries with different ideologies carried out Technological Self-Reliance policy, in a way it will highlight the differences in approaching Technological Self Reliance in a country level and may offer a useful insight in comparing India's own approach towards Technological Self-Reliance. Lastly, the chapter makes an attempt to clip in all the details and puts forward the research questions which have been synthesized from the former sections.

2.1 Technology: Concepts and Perspectives

Jacob Bigelow, a medical doctor and Harvard professor, is often credited for coining the term 'Technology' in his book *Elements of Technology*[1] (1832). In the recent years it has come into notice that the word "technology" has emerged as a contestedterm. It will be

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[1]Bigelow.J. (1832).*Elements of Technology*.(2^{nd}ed.)Boston, Mass: Hilliard, Gray, Little and Wilkins. Originally published 1829.

unjust to its maturity as a disciplinary subject if we explain and understand it with one perspective definition. One of the layman definitions was put forward by economist Galbraith (1967) who defined technology as *"the systematic application of scientific or other knowledge to practical tasks."*[2]

Technology has been understood and analysed from diverse perspectives. For scholars of political sciences, technology means state power. Li-Hua[3] (2009) states the importance of technology; by stating that it isan essential tool in getting through economic goals like generation of wealth and prosperity in the developing countries, in developed countries it is like a vehicle for promotion of profits. He is of the opinion that the effective use of technology's is the most vital issue faced by both the developed and the developing countries and become even more critical in years to come.If we have to examine the following definitions, scholars from Realism[4] school views the importance of technology in a brighter way, for instance Robert Gilpin (1981) states, *"The economy that breaks through the apparent technological stagnation of the present will undoubtedly become the technological innovator and global power of the future."*[5] Same view is held by Buzan and Little (1984), *"Without advances in the technologies of transportation, communication, production, and war, international systems would not exist in the first place."*[6] So, we can say from the above definition that Technology promotes political and economic gain.

Technology gets a gendered orientation in the writings of the feminist school, Ruth Oldenziel (1999) sees the emergence of gender coding in technology, when she explains, *"Technology was male oriented.... earlier terms such as "the applied arts" or the "the industrial arts" could be associated with equally with the products of women's work as with*

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[2]Galbraith, J.K. (1967). *The Industrial State*. Princeton University Press.

[3]Extracted from the chapter titled '*Definitions of Technology*' by Li-Hua, R. (2009) in Olsen, J.K.B., S.A. Pedersen and V.F. Hendricks (Ed.). *A Companion to the Philosophy of Technology*. Blackwell Publishing Ltd.

[4]Extracted from "www.mtholyoke.edu/acad/intrel/pol116/realism.htm."*Realism is an approach to the study and practice of international politics. It emphasizes the role of the national interests. or, at best, national interests disguised as moral concerns.*"

[5]Gilpin, R. (1981). War and Change in World Politics. Cambridge: Cambridge University Press.

[6]Quote extracted from '*The Politics of Technological Change: International Relations versus Domestic Institutions*', (Mark Zachary Taylor Paper prepared for the Massachusetts Institute of Technology Department of Political Science Work in Progress Colloquia April 1. 2005 Boston, Massachusetts) as extracted from Buzan. Barry and Richard Little "The Idea of International System: Theory Meets History" *International Political Science Review* 15(3). (1994) pp. 231-56.

men's but "technology" as after 1865 increasingly came to signify male-oriented machines and industrial processes."[7] Similarly for Judy Wajcman (2004), *"In developing a theory of the gendered character of technology, there is inevitably a danger of adopting an essentialist position which sees technology as inherently patriarchal. Early feminist studies of gender and technology tended to theorize gender as a fixed, unitary phenomena, which exists prior to and independently of technology, and then becomes embedded within it."*[8]

Through these multiple perspectives, the definitions of technology has also become more nuanced and complex. For Val Dusek (2006) Technology can be defined under three categories, hardware (tools/machines), rules (techniques/organisations); and system (consists of people who use, maintain and repair technology).[9] If we go by Dusek's understanding of technology then technology does not only comprises of hardware, but also of organisation and human skills and agencies in a society. A very similar approach has been advocated by the scholars of "actor network theory"[10] who propose that technology *"...consists of either the tools/hardware or the rules/software approach."*[11]

2.2 The notion of Self-Reliance

Like Technology, Self Reliance too has emerged as a contested term. Ralph Waldo Emerson in his collection of essays published in the year 1841 under the title '*Essays: First Series*', had an essay on Self- Reliance, where, he continually provokes the readers to 'thrust thyself'. When interpreted, it is a glorification of individualism. Below is an extract of the prose:

> "*There is a time in every man's education when he arrives at. the conviction that envy is ignorance; that imitation is suicide; that he must take himself for better for worse as his portion; that though the wide universe is full of good, no kernel of nourishing corn can come to him but through his toil bestowed on that plot of ground which is given to him to till. The power which resides in him is new in*

[7]Ruth, O. (1990). *Making Technology Masculine: Men, Women, and Modern Machines in America, 1870-1945'.* Chicago University Press.

[8]Wajcman, J.(2004). *Technofeminism.* Polity Press.

[9]Dusek, V., (2006*). Philosophy of Technology.* Blackwell Publishing Ltd.

[10]Latour. B. (2005). *Reassembling the Social: An Introduction to Actor-Network-Theory.* Oxford: Oxford University Press.

[11]Kline, S.J.(1985) What is technology? *Bulletin of Science. Technology and Society,*1, 215-18.

nature, and none but he knows what that is which he can do, nor does he know until he has tried.[12]

Quiet similarly to Emerson's understanding of Self-Reliance, is of Johan Galtung (1976) when he enclosed:

"Self-reliance cannot be at the expense of the self-reliance of others; and it implies the autonomy to set one's own goals and realise them as far as possible through one's own efforts, using one's own factors."[13]

Self-Reliance as a philosophical notion has been made wide by the fact that it is used for highlighting concept like individualism.If for Ralph Waldo Emerson individualism exhorts self-reliance then for Tagore self-reliance means harmony and cooperation, for he values individualism through establishing relationship and welfare with others, an extract from his essay reads:

"Individuality is precious, because only through it we can realise the universal. If it were a prison house to shut us in forever within a very narrow range of truth or convention, devoid of movement or growth, then our existence itself could become an insult to us who have a living soul, just as a cage is to winged creatures. Individuality is there for us to be able to extend our relationship to the rest of the world."[14]

Self-Reliance was not only used to encompass concepts like individuality but also other profound concept like development. According to Benjamin Zachariah (2005), by 1930s, along with other words (like rural reconstruction, social reform, constructive work and technical education and science), self-reliance was incorporated with the word 'development'.[15] Self-Reliance is a key ingredient in policy making; as:

"In order to be economically sound and independent, a State has to follow the path which fulfills its needs and is in accordance with its basic resources and values. It was strongly felt by the Indian planners and policy makers that

[12] grammar.about.com/od/60essays/a/selfrelianessay.htm[Accessed 10-6-2011].

[13] Galtung,J. (1976). Trade or Development- Some Reflections on Self Reliance.*Economic and Political Weekly*, Vol.11, No.5/7, pp.297-209.

[14] Ghosh, N. (Ed.) (2007). *The English Writings of Rabindranath Tagore*, Vol.4, SahityaAkademi, New Delhi.

[15] Zachariah,B. (2005).*Developing India: An Intellectual and Social History, c. 1930-50*,Oxford University Press, New Delhi. p. 44.

attaining for self-reliance, the focus has been on: diversification of domestic production; less dependence on foreign aid, reduction in imports for each and everything, imports for only critical commodities, and exports promotion to earn foreign currency for the commodities imported. The purpose for being self-reliant was to have relationship on equal footing with the outside nations and to bring reduction in pressures being exercised on the country for the purpose of depending much upon them. [16]

Along, these lines,the Government of India Technology Policy Statement- 1983, had a section on Self-Reliance as one of its aims and objectives, wherein the importance of Self-Reliance was defined as,

"In a country of India's size and endowments, self-reliance is inescapable and must be at the very heart of technological development. We must aim at major technological break-throughs in the shortest possible time for the development of indigenous technology appropriate to national priorities and resources. For this, the role of different agencies will be identified, responsibilities assigned and the necessary linkages established." [17]

Similarly, National Committee on Science and Technology, in its January 1973 document 'An Approach to the Science and Technology Plan' brought out a comprehensive view to achieve self-reliance; it opined that,

"The basic thrust of the scientific and technological strategy must be the achievement of self-reliance. This means the utilization of a mix of imported and indigenous scientific and technological resources; a mix in which the proportion of the indigenous component will steadily increase both in quantity and, more importantly, in the number of critical national projects that are based upon indigenous technology." [18]

To put it differently, the goal of technological strategy should be of achieving self-reliance as a consequence the resources used should be a blend of imported and indigenously produced. In the words of Jalan (1972) Self-Reliance, or a step towards Self

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[16] www.egyankosh.ac.in/bitstream/123456789/31383/1/Unit3.pdf. [Accessed on 10-6-2011]

[17] See Section 2.2 of Government of India Technology Policy Statement-1983

[18] National Committee on Science and Technology (January, 1973) 'An Approach to the Science and Technology Plan'. New Delhi.

Reliance, speaks of communities which grow their own vegetables and basic needs.[19] This implies that Self- Reliance may reflect the objective of national or intra-national self-sufficiency or the reduction of the country's external or internal trade.

Apart from the usage of Self-Reliance in policy making frontiers, Self-Reliance has democratic virtues, for instance Sclove (1995) explains that largerself-reliance implies promotion of more expandedlocal economy, with more flexible working hours; which could result in opportunities to realize one's full creative potential; which in turn could help in knowing one another holistically through various interaction.[20] Thus, we can say that Self-Reliance is not used only as a philosophical notion; it is treated as a value in itself.

2.3 The Concept of Technological Self-Reliance

For United Nations Industrial Development Organisation (1981) Technological Self-Reliance means the independent capacity to make and execute decisions and to exercise choice and control over the areas of partial technological dependence or over a nation's relations with other nations.[21] In this sense, Technological Self-Reliance means building up technological capacity locally, nationally and collectively on such a level that the country would not lose its independence in technical decision–making.[22]

In the words of R. Chidambaram, *"The context of today's rapid globalization, self-reliance does not mean avoidance of international scientific and technological cooperation. In fact, the latter is a must, and today's India must take and give in equal measure in international cooperation."*[23] So, it can mean that Technological Self-Reliance does not exclude co-operation with others, there may be selection but there is no delinking when it comes to participation among the States.

[19]Jalan. B. (1972). A Policy Frame for Self Reliance.*Economic and Political Weekly*, Vol.7, No. 15, pp.757-759.

[20]Sclove, Richard.E. (1995).*Democracy and Technology*.The Guilford Press. New York.

[21]V.M. Gumaste (1988). *Technological Self-Reliance in the Automobile and Ancillary Industries in India*.Institute for Financial Management and Research. Nungambakkan: Madras.p.5.

[22]National Committee on Science and Technology (January, 1973) '*An Approach to the Science and Technology Plan*'. New Delhi.

[23]Extracted from the journal'*Global Tour on Innovation Policy*'. Article titled, Indian Innovation: Action on Many Fronts. http://www.issues.org/24.1/chidambaram.html [Accessed 29-2-2011].

If we have to understand why Technological Self Reliance was given importance in the policy strategies of India thenthe introductory paragraph of Sanjaya Baru's (1983) article *Self-Reliance to Dependencein Indian Economic Development*, can de aptly referred, he explains why self-reliance was taken as guiding light for India's development: it was just to get ridof the curse of dependence. He writes:

"Self-reliance, therefore, became an integral part of that pledge and a jealously guarded principle of independence. It was for this very reason that there in fact emerged a national consensus on the goal of self-reliance. As early as 1940 the National Planning Committee of the Indian National Congress stressed the importance of self-reliance and of "planning" in the context of independent economic development in India."[24]

From the above lines we can picture that Self-Reliance was a goal and also a guarded principle which was used for national unity in the various economic development policies.

We can see that different scholars and organisations take different views in defining Technological Self-Reliance. These views ranged from seeing it as a strategy to reduce imports of technology to see it as an objective to relocate technological decision making; to establish domestic technology. Still others have a pragmatic view of Technological Self Reliance; this is to say that co-operation should not be avoided in the process.

Furthermore, some of the underlying indicators of Technological Self –Reliance are: the country should be able to achieve balance of payment and potential to adopt and assimilate technological advances, there should be institutional link between the scientific organisations and the decision making bodies of the country, and above all the state should take up initiatives for enhancing motivations and attitudes which will enhance the means of production and control through indigenous capabilities.[25] However, on many occasions Self-Reliance has been confused with self-sufficiency, but Qureshi, Malik and Sharma (1971) apprehends, *"Total self- sufficiency may not be a practically desirable goal.*

[24] Sanjay Baru (1983). Self Reliance to Dependence in Indian Economic Development.Social Scientist, Vol.11, No.11.
[25] Qureshi, Malik and Sharma. (1971). Science, Technology and Self-Reliance. *Lok Udyog.* p.702.

Self-reliance is very much desirable and is a necessary condition for development." [26] The other contrasted term with Technological Self Reliance is Technological Dependence; the following section will bring out the distinction between Technological Self-Reliance and Technological Dependence.

2.4 Distinction between Technological Self-Reliance and Technological Dependence

The phrase which is orthogonal to Technological Self Reliance is Technological Dependence. In the words of Prabir Purkayastha (2003) the distinction between them can be elaborated as:

> "*Technological self-reliance, in my sense, is the opposite of technological dependence: a country that is self-reliant enters the exchange in technology on equal terms. They are able to do it as they can produce some of the new technologies locally while importing other technologies. No country can hope to develop the whole gamut of technologies that are required today. However, if they are only recipients of advances made elsewhere, these countries then enter into dependent technological relationships. However, if they a part of the ongoing international exchange of technology - both as suppliers and recipients of technology - then they have the potential of emerging as equals. The quanta of such transfers are not relevant: the question here is of the symmetrical nature or the asymmetrical nature of this exchange. An asymmetrical set of transfers is a reflection of technological dependence; a symmetrical set of transfers reflects self-reliant economies.*"[27]

If we have to understand the meaning of Technological Dependence then we have to first look into how the 'Dependency'[28] theorist has defined it. To understand the relationship between the developed and developing countries scholars like Andre Gunter Frank, Immanuel Wallerstein and Samir Amin had come up with the concept of 'core'

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[26] Ibid.p.702.

[27] Purkayastha.P. (2003). TechnologySelf–reliance and Public Domain Science.*Social Scientist.*Vol.31, No.11/12. Nov-Dec 2003.

[28] Ferraro, V. (1996) in his essay '*Dependency Theory: An Introduction*' (July, 1996) explains, "*Dependency theory or dependencia theory is a body of social science theories predicated on the notion that resources flow from a "periphery" of poor and underdeveloped states to a "core" of wealthy states, enriching the latter at the expense of the former. It is a central contention of dependency theory that poor states are impoverished and rich ones enriched by the way poor states are integrated into the "world system."*"

and 'periphery'. They explained that, as the periphery (developing countries) is dependent on the core (the developed countries) an autarkic (self-sufficiency) system cannot achieve a complete autonomous, independent and indigenous development in the periphery. As long as the link continues so will be dependency; leaving no hope of economic development in the peripheral countries. Furthermore, the Dependency theorists are of the view that elimination of the underdevelopment of the periphery will be achieved only when it is liberated from the connection of the core. Till then,as Frank puts it, *"There is simply no possibility of nondependent auto-centric, self-perpetuating development in the periphery."*[29]

V.M.Gumaste (1988) in his book '*Technological Self-Reliance in the Automobile andAncillary Industries in India* ', highlighted the differences between the hard/rigid view and the soft view under technological dependence, he points out that Cardoso takes a rigid view:

> *"Basically the dependence situation is maintained because, in addition to the already stated factors of direct control by the multinationals and dependence on the external markets, the industrial sector develops in an incomplete form. The production goods sector, which is the centre- pin of accumulation in a central economy, does not develop fully. Ordinarily economists refer to technological dependency and it means the economy has to import machines and industrial inputs, and consequently has to stimulate exports especially of primary goods to generate the necessary exchange."* [30]

Gumaste mentions that Amartya Sen takes a 'soft' view of technological dependence as:

> *"The technological dependence of the developing countries onthe developed areas has received a great deal of attention in recent years. The peculiar feature of this dependence is its asymmetry. An inter-dependence that operates mutually does not entail subservient role for either side. However, the technological dependence that exists currently is not of that kind and reflects the dominant role*

[29] V.M. Gumaste (1988). *Technological Self Reliance in the Automobile and Ancillary Industries in India.* Institute for Financial Management and Research. Nungambakkan: Madras .

[30] Ibid.,p.18.

of one group of countries as suppliers of modern technology and the dominant role of another group as mere receivers."[31]

So, the rigid view holds Technological Dependence as in terms of importing machines to stimulate export relations, and the relation of a supplier and of a mere receiver, while soft view propagates for symmetric exchange.

If we have to look for the difference between a Dependent and Self-Reliant economy then Kelkar's (1980) journal article titled '*India and World Economy: Search forSelf-Reliance*' is worth taking into consideration. He made an attempt to evaluate India's achievement through the barometer of economic dependence, as understood in the context of development of the Latin American countries. He quoted, Theotonio dos Santos who opined:

"By dependence we mean a situation in which the economy of certain countries is conditioned by the development and expansion of another economy and to which the former is subjected. The relation of interdependence assumes the form of dependence when some countries' expansion is self-sustaining ('dominant' ones) while others can do so only as reflection of that expansion"[32]

In addition, self-reliance should not be mistaken with self-sufficiency as they are different terms. For instance, in sectors, like foodgrains, defence, etc. self-sufficiency is required; whereas self-reliance is sought in the areas where normally the demand is fulfilled from the domestic source and only in acute cases the imports of few things from other countries is done on the basis of foreign exchange earned through exports.[33]

Scholars like Frances Stewart (1977) views technology dependence as both advantage and as a disadvantage, when she says:

"The transfer of technology from advanced countries has enabled countries in the Third World to benefit from the manifold developments of science and

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[31] Ibid.,p.19.
[32] Ibid.,p.246.
[33] www.egyankosh.ac.in/bitstream/123456789/31383/1/Unit3.pdf. [Accessed on 10-6-2011]

technology in the industrialized countries... without themselves going through the difficult and costly process developing it".[34]

In a way we can conclude that the debate on Technological Self-Reliance consists of whether import of technology will crumple the concept's foundation, and whether or not Technological Self- Reliance will enhance technological capability of a country. For a comprehensive understanding let us look into how Technological Self-Reliance has been conceptualized and made operational in China and Japan.

2.5 Experimenting with Technological Self Reliance: The case of China and Japan

2.5.1 China

As we have seen in the preceding sections that Technological Self Reliance has economic implications. So while discussing China's policy on Technological Self Reliance, it will be worth understanding side by side about the Great Leap Forward, for according to Stephen Andors (1977) it was an economic and social campaign of the Communist Chinese which reflected the planning decisions; it was an event that ended by shaping China's modernization and the strength of its political conflict. It was designed in response to the economic and political problems that had surfaced during the chaotic years of reconstruction.[35]Likewise, Self-Reliance owes something to China's long tradition of cultural self-containment. Objective facts of China's enormous size and agricultural economy have made Self-Reliance a necessity.[36] Oldom (1973) explains as to how self-reliance became a vital factor in China's technological policies, he writes:

> "*The call for self-reliance led to a boost in indigenous research and revived the prestige of research workers and the expert, but it did not mean that China became autarkic. Although cut off from Soviet technology, China began to import*

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[34]Ibid.,p. 19. But, for further reference see, Stewart (1977). *Technology and Underdevelopment.* London: Macmillan Press.

[35]Andors. S. (1977). *China's Industrial Revolution- Politics. Planning and Management, 1949 to the Present.* New York: Pantheon Book.

[36]Wu. F. W. (1981). *From Self-Reliance to Interdependence?: Developmental Strategy and Foreign Economic Policy in Post-Mao China.* Sage Journal, Vol. 7, No. 4.

modern technology from Japan and Western Europe. Orders were placed not only for equipment and machinery, but also for entire plants.[37]

In recent past, China's model of Technological Self Reliance has been scrutinized by scholars for instance Wu (1981) in a journal article named *'From Self-Reliance to Interdependence? : DevelopmentalStrategy and Foreign Economic Policy in Post-Mao China'* writes:

> *"Although over time, within and outside China, the concept of self-reliance has been given different interpretations, there seems to be a fundamental agreement that self-reliance is not to be confused with autarky. While the latter may be construed as an extreme form of self-isolationism, self-reliance by no means precludes international exchanges or the acceptance of external assistance. However, it does mean that a country committed to a policy of self-reliant development will not engage in the type of transactions that would undermine its goal of national independence or violate its own unique developmental vision. It follows that the most contentious issue regarding self-reliance is how and at what level a country should set its threshold of participation in international exchanges and allow external involvement in its domestic economy."*[38]

So, if we have to go by this approximation then China for the sake of Self-Reliance was not engage in self-isolation, and that they opted for international assistance when required.

In late 1992 a debate among leaders changed the route of science and technology in China, for everyone recognized that without strong science and technology China's development would go nowhere. The issue was not whether to promote science and technology but how best to do it. The traditional approach was to stress large, State-Owned Enterprises (SOEs), leveraging China's industrial strength.[39] In present years we see that China's leaders, especially President Hu and former President Jiang, have hold

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[37]Oldom, C.H.G..(1973).*Science and Technology Policies*. Reprinted from: "China's Development Experience," (ed.)Micheal Oksenberg, *Proceedings of the Academy of Political Science*, 31 (March 1973).p.89.

[38] Wu, F. W. (1981). *From Self-Reliance to Interdependence? : Developmental Strategy and Foreign Economic Policy in Post-Mao China*. Sage Journal, Vol. 7,No. 4.

[39] Kuhn, R. L. (2010). *'How China's Leaders Think- the inside Story of China's Reform and what this means for the Future '*. Singapore: John Wiley&Sons (Asia).

on to science not only because of what it can achieve in practical terms, but also because of what it means intrinsically.[40]

In this respect, it is interesting to quote President Jiang, he said:

"The advancement of science in China is essential not only for China's welfare but also for that of the whole world. Chinese scientists look forward to joining with their counterparts in other countries in contributing to humankind's common cause. It is our solemn commitment that China's scientific development shall benefit all peoples."[41]

It can be interpreted that China's technological progress does not imply that only its people will be benefitted but the humanity as a whole; and in that process she looks ahead to work with scientist of other countries.We can presume with what Oldham (1973) had stated some years ago; the goal of self–reliance means that Mao's determination to use science and technology to build a modern China has not faltered.[42]

2.5.2 Japan

Regardless of the era, in Japan there was an internal discourse in which indigenous technologies were transformed to suit local resources, needs and sensibilities.[43] Gann and Dodgson (2010) describe that in the post war era Japan continues to follow the pattern of technological development which had sustained since the earliest times. Japan followed a synchronized policy of technological assimilation and industrial development. Apart from other things, these agencies encouraged the licensing and dissemination of foreign technologies in Japan. As in earlier eras, Japanese industries modified foreign technologies, often through a series of incremental innovations, such a miniaturization or artifact recombination, Japanese engineers created and patented indigenous variants of formerly foreign technologies.[44]

[40] Ibid., p.286
[41] Ibid., p.285
[42] Oldom, C.H.G. (1973). *Science and Technology Policies.* Reprinted from: " China's Development Experience," ed. Micheal Oksenberg. *Proceedings of the Academy of Political Science,* 31 (March 1973).
[43] Dodgson and Gann (2010). *Innovation: A Very Short Introduction.*. New York: Oxford University Press.
[44] Ibid.

As for Wittner (2007) much of the Japanese's technological history can be described as a dialogue. Initially it was a dialogue between Japan and its East Asian neighbors, especially China and Russia. Later it was an exchange between Japan and Western world. By the mid-nineteenth century and beyond there was an increaseduse of foreign technical knowledge in Japan which was supported by the government and the private sector.[45]From the writings of Tagore on Japan we can notice the kind of dialogue that took place between Japan and the Western world:

> "*The genius of Europe has given her people the power of organisation, which has specially made itself manifest in politics and commerce and in coordinating scientific knowledge. The genius of Japan has given you the vision of beauty in nature and the power of realising it in your life. And, because of this fact, the power of organisation has come so easily to your help when you needed it. For the rhythm of beauty is the inner spirit, whose outer body is organisation.*"[46]

So to say; that the union of beauty and organisation made the interaction sustainable. While explaining the technology policy of Japan, Uchinda[47] (1986) divides it into four periods from 1825 to 1935. The first stage was that of the Meiji Restoration (1825-1868), the second period (1868-1885) was characterized by Westernization, in the third period (1885-1910), there was an important policy change: for the first time bureaucratic management of state-run factories gave way to private management. Self-reliance in technology was achieved midway through the fourth period (1910-1935). At this time, the minimal linkages among technologies had been established on a national scale and a new stage of development then began. Though in the past military technology and science had been strictly in the hands of the government, in this period, further technological development required the participation of the private sector. The military's policies aimed at Japan becoming a superpower corresponded with the government's goal of making the country a first-class industrial nation. However, for Uchida although Japan has achieved Technological Self Reliance, it is not playing a lead role in all the

[45]Wittner, D. (2007). *A Companion to the Philosophy of Technology*. West Sussex. UK: Wiley-Blackwell.
[46]Tagore, R. (1916). *The Spirit of Japan*. The Indo-Japanese Association. Tokyo, p.4.
[47]archive.unu.edu/unupress/unupbooks/uu36je/uu36je00.htm [Accessed on 10-5-2011]

technological development, and that there is no reason she should, for any attempt to monopolize the potentials of development in technology would be dangerous.[48]

Ozawa (1974) states that the reasons for Japan's participation in international technological exchanges and allowance of external involvement in its domestic economy maybe because Japan is/was a resource-scarce and labour abundant country, its post-war economic policy was, as it had been in the prewar years, aimed at reconstructing its economy as a workshop for the world, importing raw materials and exporting finished goods. "Export or perish" was a national slogan- not an explicit government affirmation, but a generally agreed-upon mode of industrial orientation of the Japanese who were more or less aware of their country's dependence on overseas raw materials. Furthermore, export performance, once it had become successful, began to serve as a psychological motivator for economic performance, as did GNP statistics, recording in a reassuring manner Japan's rising status in the international economic community.[49] For Asim Sen (1983) writes that Japan avoided the brain drain which other developing countries were facing by utilization of highly trained workers by coordinating the training of scientists and technicians with domestic demand for their services. Japan has also presented the example of a nation that passed from being an exporter of labor-intensive products to being a seller of technologically more sophisticated goods. In part she had done this by constantly training managers at every level and encouraging technicians and workers to increase their productivity and diversification into the many different industries.[50]

It is increasingly argued whether national technology policy is obsolete in a globalize world or not, referring to Japan's technology policy has been a central component of industrial policy. But the Japanese economy, like that of the major Western countries, has also become significantly more globalised over the last two decades. Throughout the modern era, Japanese corporations, engineers and entrepreneurs have a consistent record of innovation that complements foreign achievement. Some Japanese

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[48]archive.unu.edu/unupress/unupbooks/uu36je/uu36je00.htm [Accessed 10-5-2011]

[49]Ozawa, T. (1974).*Japan's Technological Challenge to the West: at a new crossroads.* University of California Press, Vol. 14, No. 6.

[50]Sen, A. (1983). *Lessons for Development from the Japanese Experience.*Association for Evolutionary Economics, Vol. 17, No. 2.

innovations were based on foreign knowledge; others were more thoroughly indigenous developments. Because of the close ties between major Japanese corporations and small and medium-size enterprise that serve as subcontractors, technologies originally introduced as the highest levels of Japanese industry are rapidly disseminated throughout the country. Japanese corporations also tend to invest a significant portion of their profits in research and development (R&D). Specifically they look to find innovative new applications for existing foreign and indigenous technologies. Although the trend had changed somewhat in the last decade, much R&D investment has been in applied technology rather than in basic in basic research.[51] We can hence conclude that Japan does not follow a policy of isolation, there is State intervention of the economy but intervention does not in any sense imply exclusion.

2.6 Observations

Technological Self-reliance as a term has different economic and political contexts. in terms of nations pursuing objective planning for self-sustaining growth. In terms of national planning, it was an explicit objective of all normal planning exercises and development strategies, and conventionally in terms of political economy meant a progressive reduction of external dependence or aid. Technological Self-Reliance, if interpreted as a way of technological decision- making then decision- making with regard to technology should rest within the country because it is very powerful tool of economic and social development.

China's Technological Self-Reliance was spontaneous whereas Japan's approach to Technological Self-Reliance was gradual. China had taken Self-Reliance as a policy for achieving its economic goal, technologies were characterised by equalitarian ideology, in a rather isolationistic framework; however there is a change in the contextual understanding of China's Technological Self-Reliance from isolation to co-operation in recent decades. In the present era of globalization countries like Japan does not follow a policy of isolation, there is State intervention of the economy and State intervention does not imply exclusion. Also, the Chinese path of self-reliance was characterized by

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[51] See. p- 42. Jan Kyrre Berg Olsen. S. A. P.. and Vicent F. Hendricks (Ed.). (2009). *A Companion toThe Philosophy of Technology*. West Sussex, UK: Wiley-Blackwell.

dominant role of state enterprises. Japan, on the other hand, did not mind involving large private enterprises in its endeavour to achieve technological self-reliance.

2.7 The Research Questions

1. How has the various understanding and notions of Technological Self-Reliance helped in shaping the debates surrounding Technological Self-Reliance in India's Post-Independence era?

2. What was the dominant ideological environment with regard to self-reliance in India? Specifically, how the debate took place between Nehru, Gandhi and Tagore, the three great thinkers of 20th century Indiaon the issue of Technological Self Reliance?

3. How far Nehru, Gandhi and Tagore's thought have influenced the formation of the conceptual framework of Technological Self Reliance policies in India?

From the pre-independence period it was a need whether in terms of Swadeshi or other way synonymous terms. Thus in one sense, self-reliance may refer to the objective of national or intra-national self-sufficiency or the minimization of the country's external and internal trade – the sense in which the word is used when one speaks of communities which grow their own vegetables and basic needs; as being Technological Self-Reliant as a step towards national self-sufficiency in food and certain other basic commodities (e g, steel and fertilizers) is considered as being synonymous with national self-reliance.[52] It was in fact the development consensus of the time and the objectives were clear; to catch up with the industrialized world and to improve the living conditions of the people. However, the objective of this research being the attempt to see how the thoughts (pre and post-Independence) of 'Technological Self-Reliance' were incorporated in R&D policies of our country, the economic angle along with its terminologies has been avoided to a large extend. The next chapter will try to specify in a more concrete and quantifiable way how Gandhi, Nehru and Tagore's thoughts have contributed in the shaping of Technological Self-Reliance as a policy objective.

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[52] Jalan, B. (1972). 'A Policy Frame for Self-Reliance', *Economic and Political Weekly*, Vol. 7, No.15 (Apr. 8, 1972). p. 757.
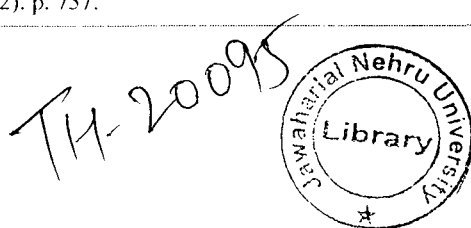
Chapter 3

The Quest for Technological Self-Reliance in Indian Thought: An exploration

The objective of this chapter is to explore the thoughts on'Technological Self-Reliance' in India. We attempt to understand the thoughts of Jawaharlal Nehru, Mahatma Gandhi and Rabindranath Tagore, who are considered as three main figures of 20th Century India to influence the origin of modern and independent India in a significant manner. An integral part of Nehru's vision was to attain the same through rapid industrialization and agricultural growth. As we have quoted in the previous chapter that a national consensus was emerging on the goal of 'self-reliance', and as early as 1940, the National Planning Commission of the Indian National Congress stressed the importance of 'self- reliance' and of 'planning' in the context of the independent economic development. It recognized the infancy of the Indian industry and the need to protect it from the external competition, and thus the role of the state was in providing the ability and the means for industrial and agricultural growth.[1] This meant that the state had to play a key role, to pursue the economic development programme, based on 'self-reliance', on the twin features of 'self-reliance' and 'mixed economy', with the emphasis on rapid industrialization and agricultural growth. Such thoughts were not shared by Gandhi and Tagore whose priorities were village development and industries. So, in this chapter we will see the divergence of Gandhi and Tagore from that of Nehru's idea of self-reliant economy.

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[1]Baru. S. (1983) 'Self-Reliance to Dependence in Indian Economic Development', *Social Scientist*. Vol. 11, No. 11, (Nov.), p. 34-35.

However, apart from many similarities Gandhi and Tagore's had their own points of difference in their approach to Technological Self-Reliance, which we have attempted to integrate in this chapter.

3.1 Nehru: Technological Self-Reliance for socio-political-economic progress

Ramachandra Guha (2007) writes:

> "*Once, Gandhian protesters had burnt foreign cloth to encourage the growth of indigenous textiles; now Nehruvians technocrats would make their own steel and machine tools rather than buy them from outside. As the second plan argued, underdevelopment was 'essentially a consequence of insufficient technological progress'. Self Reliance, from this perspective, became the index of development and progress. From soap to steel, cashew to cars, Indians would meet materials and, above all, Indian technology.*"[2]

A new generation of the Congress leadership, led by Pandit Jawaharlal Nehru, articulated a position that gained world's attention. Nehru stood for socialism, modern science, and heavy industrialization. Both heavy industrialization and socialism acted as the foundation for modern science and technology. "*Nehru fully realized that modern science and technology were necessary for development.*"[3] In Nehru's vision, modern life depended so much on science and technology that we must seize hold on them, understand and apply them.

Nehru was clearly impressed by the need to embrace modernity and progress possible only through science-based technology, and though socialism was an ideal, a version of democratic socialism with a mixed economy was generally accepted by the National Planning Commission as the basis for future development.[4] Nehru later became more associated with scientists like S.S. Bhatnagar and H.J. Bhabha, this led to more government controlled industrial and defence research. A more conscious decision by 1945 was taken by the political leadership to take the path of modernization through

[2] Guha, R. (2007). *India after Gandhi*. Macmillan. p- 209.
[3] Mallick, S., Haribabu, E. and Kulkarni, S.G.(2005). Debates on Science and Technology in India, *Social Scientist*, 33 (11-12), p- 57.
[4] Kumar, D. (2007).'Reconstructing India: Disunity in the Science and Technology for Development Discourse, 1900-47', *Social history of Science in Colonial India*. Oxford University Press. New Delhi, 2007, p. 360.

science and technology.[5] Thus, the stage was set for more heavy industrialization to be propagated and endorsed in the post-Independence scenario; Nehru's glorification of dams as the modern temples of India only emphasized that point.

Nehru became scientifically attached to the socialist model of planning, which was inspired from the former Soviet Union, but sought to achieve development through State led capitalism. Nehru's vision was based on a historical and international perspective. Development was seen as the index of a desired modernity, it was throughout drawn in a political discourse of national statism. In all location, development came to be marked by the specific combinations of state projects aimed at growth, achievement of cultural unity and coherent political forms.[6]

Ramachandra Guha (2007) puts that, for Nehru development in India could be brought only by the tool of planning. Planning was considered as a mighty cooperative effort of all the people of India. Nehru hoped that the new projects would be solvent to dissolve the division of caste and religion, community and region, and also believed that the projects could dealwith the separatism, provincialism and sectarianism that India longed to combat.[7]

Planning to Nehru meant, "*Laying down a scheme of a planned economy for the nation comprising all its activities and their proper co-ordination for the common good. Planning does not mean concentration on a few industries, and ignoring the other aspects of the problem, including the human aspect.*"[8]

Nehru admired the way Russia's economy was progressing, so much so that he adopted socialist model of Planning giving emphasis to economic justice and establishment of an egalitarian society.[9] The *Nehru-Mahalanobis model* of Planning emphasized heavy industrialization, state control and ultimately, a subsidiary role for the private sector.

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[5] Ibid.

[6] Zachariah, B. (2005). *Developing India: An Intellectual and Social History*, Oxford University Press..

[7] Guha, R. (2007).*India after Gandhi'*, Macmillan.

[8] Chakrabarty, B. (1992). Jawaharlal Nehru and Planning, 1938-41: India at the Crossroads. *Modern AsianStudies. Vol.26 No.2*

[9] Ibid.

The Planning Commission established in 1950 had P C Mahalanobis[10] from the very beginning as member with special responsibility for science. However, the Planning Commission had a very limited role and was more concerned with the process of allocation of finances on the basis of plans charted out by the various scientific agencies and organizations, rather than with establishment of priorities or co-ordination of scientific work.

Centralization of power, after having assigned the state a far greater authority and responsibility, was to become the feature of the scientific establishment in post-independent India. S.S. Bhatnagar, under the patronage of Nehru, initiated building a chain of eleven national laboratories from 1947-54 and twenty more would follow. All these measures (and many more) accelerated the process of industrialization and the planning process became one where these means became increasingly emphasized upon. This understanding of Nehruvian science, rationalized and legitimized by the socio-political and historical context of pre-independence India, also provided the beginnings of 'big science' in India.[11,12]

> *"The connection between 'development' and science was an obvious one if 'development' was intended to privilege industrialization and increased agricultural production; but 'science' also carried wider connotations of 'rational', and 'progressive' activity." These connotations were self-evident for many of the personnel who came to be closely associated with the planning of such industrialization, men who were closely involved in the practice of science."[13]*

[10] "Mahalanobis was, among other things, the man who brought modern statistics in India. In 1931 he set up the Indian Statistical Institute (ISI) in Calcutta. Within a decade, he had made the ISI a world-class centre of training and research. He was also a pioneer of inter-disciplinary research, innovatively applying his statistical techniques in the fields of anthropology, agronomy and meteorology." Guha, Ramachandra, *'India after Gandhi'*, Macmillan, 2007. pp-206-207.

[11] Kumar,D. (2007). 'Reconstructing India: Disunity in the Science and Technology for Development Discourse, 1900-47', *Social history of Science in Colonial India*, Oxford University Press, New Delhi.

[12] Another crucial factor was the circumstance of the availability of a science leadership with vision, dynamism and dedication in the person of scientists like P C Mahalanobis, Meghnad Saha and H J Bhaba who also had the requisite organisational and managerial leadership.

[13] Zachariah, B. (2005). *Developing India: An Intellectual and Social History'*. Oxford University Press, p.236.

In a way, while the political leadership provided administrative and material support, it was the task of the scientific leadership to bring into being the scientific and technological infrastructure. Due to the absence of any sizeable basic or other industrial infrastructure, there could be no worthwhile linkages with industry to interact with, stimulate and strengthen industrial research. It was the political linkage and support that promoted scientific development.While the politician-scientist linkage ensured support for science in India, it also helped to generally bring scientific policies and programmes in line with the socio-economic and political objectives.[14]

With the believe that *"evenmore than the present, the future belongs to science and to thosewho make friends with science and seek its help for the advancement of humanity"*[15] The political leadership approached the problem of scientific development on the basis of 'state organization of research'. It took the form of Governmental establishment of research institutes and laboratories based on plans and proposals already formulated in the pre- independence period, and initiating new ones in promising areas of development and defence. The emphasis was on the following areas: (i) Scientific and industrial research, (ii) Atomic energy, (iii) Scientific and technical manpower, and (iv) Defence science.[16]

3.2 Gandhi, machinery and self-reliance

In *Hind Swaraj*[17], Gandhi as the Editor argues that machinery has impoverished India, and the terminology which Gandhi used for technology was what meant in the nineteenth century as "machinery".[18]He states *"It is difficult to measure the harm that Manchester has done to us. It is due to Manchester that Indian handicrafts has all but disappeared."*[19] Furthermore, in the process of argument he adds, *"Machinery is the chief*

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[14]Parthasarathi, A. and Singh ,B. (1992). Science in India: The First Ten Years. *Economic and Political Weekly* .Vol. 27, No.35. pp. 1852-1858.

[15]Jawaharlal Nehru's message to the Silver Jubilee Session of the *Indian Science Congress* Calcutta in 1938.

[16]Parthasarathi, A. and Singh , B. (1992). Science in India: The First Ten Years. *Economic and Political Weekly* .Vol. 27, No.35. pp. 1852-1858.

[17]Gandhi, M.K., (1938). *Hind Swaraj*. Navajivan Publishing House.

[18]Parel, A. (2006).*Gandhi's Philosophy and the Quest for Harmony'*, Cambridge University Press, 2006,p-81.

[19] Gandhi, M.K., (1938). *Hind Swaraj*. Navajivan Publishing House, p.81.

symbol of modern civilisation: it represents a great sin. Machinery is like a snake-hole which may contain from one to a hundred snakes. Where there is machinery there are large cities; and where there are large cities, there are tram cars and railways; and there only does one see electric light. [20]

According to Anthony J. Parel (2006):

"Gandhi identified three dangers in the unrestrained alignment of modern technology to modern economics. The first was the economic exploitation of the less technically advanced nations by the technically more advanced nations. This was a problem of justice. The second was the negative impact that an economy driven by modern technology and profit motive had on the natural environment, affecting the quality of the water, soil, air, and atmosphere. This was an ecological problem. The third was the potential threat to human freedom, especially to the freedom of choice, it was promoting compulsive consumption of unnecessary things." [21]

Another understanding is that 'Gandhian economic thought' was not against all machinery, but rather against the 'craze' for labour saving devices while men went about unemployed. [22] He agreed that some key industries were necessary, and he preferred the industries to be under state ownership, though he did not specify it, provided the state professed non-violence. [23] He declared that he was not opposed to science but wanted to put limits 'upon scientific research and the uses of science' and did not object to industrialization as long as it remained humanitarian and added to the productive capacity of the nation. So, to say Gandhi had advocated a sense of social accountability in scientific endeavours; laid great emphasis on nonviolence and was concerned more with issues of distribution rather than production. [24]

For Gandhi (1941) *Khadi* was a symbol of unity of Indian humanity, of its economic freedom and equality. Moreover, *Khadi* mentality means decentralization of the production and distribution of the necessaries of life. Therefore, he promoted that

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[20] Ibid.

[21] Parel, A. J. (2006), *'Gandhi's Philosophy and the Quest for Harmony'*, Cambridge University Press, .p-81

[22] Zachariah, B. (2005). *Developing India: An Intellectual and Social History, c. 1930-50*. Oxford University Press, New Delhi, 2005, p. 157.

[23] Kumar,D. (2007). p. 357-358.

[24] Ibid.

every village should produce all its requirements. He believed that heavy industries need to be centralized and nationalized, but they should occupy the least part of the vast national activities which could be held in the villages. Production of *Khadi* included cotton growing, picking, ginning, cleaning, carding, slivering, spinning, sizing, dyeing, preparing the warp and the woof, weaving, and washing.[25] Gandhi wrote in *'Constructive Programme: Its Meaning and Place'* (1941) that each industry would take the labour from only a certain number of hands, and that they cannot exist without *Khadi*, and *Khadi* will be robbed of its dignity without them. Furthermore, for Gandhi village economy cannot be completed without the essential village industries such as hand-grinding, hand-pounding, soap-making, paper-making, match-making, tanning, oil-pressing, etc.[26]

The strive for self- reliance was seen in the way his Tolstoy Farm[27] functioned. Surendra Bhana (1975) writes:

> *"Self-reliance extended to other aspects of communal living. There was a "tailoring department" responsible for producing clothes generally suitable for outdoor life: trousers, and shirts made up of coarse blue cloth."*[28]

From the above views we can agree that Gandhi's idea of village self-rule with resources at the control of the local population seemed to be an ideal which sought to oppose 'western' modernity as represented by industrialization and embrace tradition based on constructive programmes the centre of national economic life. He supported need-based local-community-centric approach towards technological activities, epitomized in the form of the 'charkha', and thus stresses on the concept of 'swadeshi' which referred to local self-reliance and the use of local knowledge and abilities.

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[25] Gandhi. M.K., *'Constructive Programme: Its Meaning and Place'*, Navajivan Publishing House, 1941, p-10.

[26] Ibid.

[27] The Tolstoy Farm was the second of its kind of experiments established by Gandhi. He devotes a considerable number of pages in Satyagraha in South Africa to the discussion of the day-to-day activities on the farm as the experiment appeared important to him, even though it had not enjoyed much "limelight". (Surendra Bhana., *'The Tolstoy Farm: Gandhi's Experiment in "Cooperative Commonwealth'*, South African History Journal, No.7, 1975.).

[28] Bhana.S. (1975). 'The Tolstoy Farm: Gandhi's Experiment in "Cooperative Commonwealth', *South African History Journal*, No.7.

Gandhian philosophy of technology and social development by the common people symbolized a process of empowerment through self-help and swadeshi.[29]

3.3 Tagore and his idea of Technological Self-Reliance through rural reconstruction

Tagore experimented with co-operative based collective self-development, through people's self-initiatives and self-reliant village development activities which were not only economic but social as well.He saw the meaning of India's independence struggle as one to primarily liberate the creative energies of its people, rather than mere constitutional independence, and which he saw not as an end in itself but also as a means for creating space for the flowering of people's creativity[30], with the attainment of self-strength (*atmoshakti*) as the driving philosophy of nationhood. The concept of 'nation' according to Tagore, was a mental concept, to be gained by people by applying their atmoshakti (self-strength) together to fulfill common needs, and uniting in such a process in the sense of nationhood.[31]In a way, Tagore asserted India's right to be independent without denying the importance of what India could learn— freely and profitably—from abroad.

He was however against dependence on foreign assistance for a nation's development, and regarded receiving favours from others as "*true sign of a pessimist who does not believe in one's own strength, and in this mental sense, a sign of hopeless poverty*". Such dependence, according to him, was self-defeating.[32] He desired the exercise of national 'self-strength' and independence, to be rooted in collective self-initiatives of people at the grassroots community level, and fervently advocated self-reliant collective village development initiatives to meet village needs for economic, cultural and social upliftment. For him communities exercising self-rule, was the 'independence of India in its truest sense'.[33]

[29]Bakker. JI (Hans) (1990). 'The Gandhian Approach to Swadeshi or Appropriate Technology: A Conceptualization in Terms of Basic Needs and Equity', *Journal of Agricultural Ethics*. 3 (1), pp. 50-88.

[30] Md. Anisur Rahman, (2006). Roots of action research and self-reliance thinking in Rabindranath Tagore', Action Research 2006, Sage Publications, p. 236-237.

[31] Ibid.

[32]Ibid. p. 237-238.

[33] Ibid.

Tagore established a close contact with the villager and village life which lead him to experiment a self reliant village economy. So, to say the motto of Sriniketan[34] ran like these "...*we shall do our own work ourselves, we shall not wait upon others to do things for ourselves, self reliance and co-operative work are the two mantras of our life. We belong to the village and the village belongs to us, our good is in the good of the village. We shall develop our village; this is not the task of any one alone, this is a task for all of us. We are taking charge ourselves of advancement of our agriculture, our industries, our business, our health, our education, our joy, everything.*"[35] Tagore insisted on mass contact for knowledge dissemination; he gave emphasis to the need for cooperative activities for the solution of India' grave economic problem, and supported people to utilize traditional rural institutions like fairs and open air opera performance for rousing popular consciousness and mass entertainment.[36] He turned again and again in various contexts to this theme of local self-reliance, local initiatives, local leadership and local self- government centring on co-operatives ways of life.[37]

His viewson science was, "*Science is a passenger in a railway train of generalization, their reasoning minds from all directions come to make their journey together in a similar conveyance. Art is a solitary pedestrian, who walks alone among the multitude, continually assimilating various experiences, unclassifiable and uncatalogued.*"[38] Tagore wanted science to be taught along with India's own philosophical and spiritual knowledge at Indian Universities. However, he was of the opinion that science without the constraint of self knowledge, without appreciating the quest for knowledge- which is the most important aim of human existence, leads to an endless desire for material goods and well-being, and

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[34]"*The Institute of Rural Reconstruction was founded in 1922 at Surul at a distance of about three kilometres from Santiniketan. It was formally inaugurated on February 6, 1922 with Leonard Elmhirst as its first Director. Thus the second but contiguous campus of Visva-Bharati came to be located in 1923 at a site which assumed the name of Sriniketan. The chief object was to help villagers and people to solve their own problems instead of a solution being imposed on them from outside.*" (www.visva-bharati.ac.in/Heritage/Contents/Sriniketan.html)

[35]Rahman,Md. A. (2006).'*Roots of action research and self-reliance thinking in Rabindranath Tagore*', action Research 2006, Sage Publications.

[36] Ibid.

[37]Extracted from the article. '*Celebrating the 150th birth anniversary of Gurudev Rabindranath Tagore*'. Statement by Hans d' Orville, UNESCO Deputy Director-General a.i. and Assistant Director-General for Strategic Planning at the joint commemoration by India and UNESCO Maison del l'Inde, Paris. 12 May 2010.)

[38] Kenneth R. Stunkel. (2003). Rabindranath Tagore and the Aesthetics of Post Modernism, *International Journal of Politics, Culture and Society*, Vol.17. No.2 (Winter).pp.237-259.

the meaningless pursuit of the instruments of war and power, which are often results in conflict between nations and ultimately ends in the suppression of the weaker by the stronger. That is why both spiritual and scientific knowledge are considered by Tagore as equally important.[39]

He was not against the use of technology as such, as he wrote, "*I have no reason to change my opinion now, that they were essential to our physical well- being; and in as much as nothing could stop these improvements, we should seek to use wisely what man's ingenuity had created out of his necessity. For we had reached that degree of civilization when we could no longer search with our fingers; we were using our intelligence to overcome through machinery the weakness of our limbs.*"[40] But, he opposed disequilibrium in distribution of profit brought about by the technological advancement which hampers the harmonious growth of society, "*Such a state of things has come to pass because, with the help of science, the possibilities of profit have suddenly become immoderate. The whole of the human world, throughout its length and breadth, has felt the gravitational pull of a giant planet of greed, with concentric rings of innumerable satellites, causing in our society a marked deviation from moral orbit.*"[41]

Tagore as an internationalist stood for the cooperation of various nations, he did not believe in the confinement of a nation with itself. His international experience gave him a new idea, that he must bring his country into contact with the world at large. He felt that over emphasis on narrow nationalism led men and countries into paths of conflict. There should be an institution that emphasized the unity of the world's culture and streams of knowledge. He considered Santiniketan[42] to be that institution. Uma Das Gupta (2004) Tagore knew there was not a lot he could do on his own, given his less resources and enormous need. But he was firm at least to establish an ideal with the work. He has two objectives in his village work, to educate the villager in self- reliance and to

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[39]Extracted from the article' *Rabindranath Tagore 1861-1941-* 'Narmadeshwar Jha. The following text was originally published in prospects: the quarterly review of education (Paris. UNESCO: International Bureau of Education), Vol. XXIV. no.3/4, 1994, p.603-19.

[40] Uma Das Gupta.(2004). '*Rabindranath Tagore: A Biography'*, Oxford University Press, Emphasis added.

[41] Rabindranath Tagore: Selected Essays. Rupa & Co, 2004. p-58.

[42]Rabindranath Tagore 1861-1941- Narmadeshwar Jha (1994), The following text was originally published in prospects: the quarterly review of education (Paris, UNESCO: International Bureau of Education), Vol. XXIV, no.3/4. pp.603-19.

bring back to the villages 'life in its completeness' with 'music and readings from the epics' as 'in the past'. He declared he would be content even if that could be done realistically only in 'one or two villages'. The outcome could then serve as an ideal for the whole country.[43] Hence, we can interpret that Tagore's idea of technological Self Reliance was inherent in his basic premise scheme of rural reconstruction.

3.4 Nehru and Gandhi and Tagore: The differences in their approach to Technological Self-Reliance

The Joachim Zweynert (2006) had laid out the ideological differences between two groups within a country in regard to modernisation, when he says, "*The tensions between traditional values and the modernization of social reality in developing countries regularly make themselves felt in an ideological division within the educated elite: One group speaks out in favour of the modernization of the country to overcome political and economic backwardness. A second group strictly opposes the idea that the society should enter the Western path of social differentiation and speaks out for a 'national' path of development that aims at maintaining the traditional structure of society which is characterized by a lower degree of social differentiation*".[44] In this light let us try to examine the differences between Nehru, Gandhi and Tagore from the following sections.

3.4.1 The Scientific Temper: Contrasting Gandhi and Nehru

Zachariah (2005) states that, 'Development' has been one of the most powerful quests shaping the social and economic structures in India. The tools for development were large and varied but the basic criteria for measuring it was whether India could stand face to face with the developed countries of the West in the line of scientific and technological progress. In relation to the Western science as knowledge system in Indian, culture influenced the perspectives on modern science and technology that the Indian intelligentsia developed. There rose two paradigms of thought as to question the implementation of modern science and technology in India. One was led by no less a

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[43]Gupta,U. D. (2004). *Rabindranath Tagore: A Biography.* Oxford University Press.
[44] Zweynert, J. (2006). Shared mantel models, catch-up development and economic policy making: The case of Germany after World War II and its significance for contemporary. Russia, *The Eastern Economic Journal.* 32(3), pp.457-478, pp.462-463.

person than Gandhi with his vision of *Khadi*,[45] and the other by Nehru who believed that the solution to India's problem would be solved by the applications of science, he averred:

> "*The applications of science are inevitable and unavoidable for all countries and people today. But something more than its application is necessary. It is the scientific approach, the adventures and yet critical temper of science, the search for truth and new knowledge, the refusal to accept anything without testing and trial, the capacity to change previous conclusions in the face of new evidence, the reliance on observed facts and not on preconceived theory, the hard discipline of the mind and all this is necessary, not merely for the application of science but for life and the solution of many of its population.*"[46]

Both Nehru and Gandhi had the common objective of creating employment, removal of poverty and developing India; and both emphasised the need for developing traditional and modern industries through the use of science and technology[47]. However, it can be observe that for Nehru, Technological Self Reliance could be achieve through heavy industrialization in various sectors, which was not the approach adopted by Gandhi. The following sub sections will show the divergence between Nehru and Gandhi in regard to Technological Self Reliance.

A. **Dams**:While Nehru called dams as, '*the temples of India*,'[48] for its power and irrigation facilities to millions of Indian states. They served as the emancipator of agriculture from the tyranny of monsoon and on the other hand, provided the electric power to run the new industries mandated by the five year plans[49]. In contrary to it, Shiv Visvananthan writes that for Gandhi a dam was '*only a reified expression of modern economics and modern science.* ' He states, "*Gandhi would have become a pilgrim, doing a parikrama of the river. By retracting its course, one*

[45] Zachariah, B. (2005). *Developing India: An Intellectual and Social History, c.1930-50.*New Delhi: Oxford University Press.

[46] V. Indiresan, V., M.L.Gulrajani (Ed.).(1989). Development through Technology- a symposium on nehru's vision. New Delhi: Indian Institute of Technology, HauzKhas. p. 6.*Science and PublicPolicy.*Vol 28, number 3.p.1-17.

[47]Krishna,V.V.(2001). Changing policy cultures, phases and trends in science and technology in India.

[48]Guha, Ramachandra (2007).*India after Gandhi.* Macmillan.

[49] Ibid.

remembers the worlds existing side by side. It is this sense of the river that Nehruvian development had destroyed. The story of the river shrinks to the moment of the dam.[50]

B. **Agriculture:** Visvesvaraya[51], one of the Nehruvians tried to convince of a balanced relationship between the development of agriculture, industry and education. He identified six blockages that hampered the growth of Indian agriculture:

    a. *"The high population pressure on the land,*

    b. *The repeated fragmentation of land holdings,*

    c. *The primitive methods of cultivation,*

    d. *The waste use of farm manure,*

    e. *The poor utilization of women in the workforce, and*

    f. *The rural indebtedness of the framer."*[52]

Nehru wanted to bring *science and technology* in the arena of agriculture, as he was of the view that the high agricultural productivity in other countries was because of the advancement of the two cited reasons. Whereas, being an environmentalist of his time, Gandhi was skeptical of the use of fertilizers and pesticides if it harmed the land and the natural vegetations. Unlike Nehru who believed in the relationship between economics and science, Gandhi stood for the sustainability of resources in nature.[53]

C. **Medicine and longevity:** Apart from the Indian Nationalist movement, foreign policies, non alignment and the Cold War, Nehru as a Statesman was knew that India's huge population could act as a resource for economic productivity; however during the 1930 and 1940s the mortality rate was high. There was meager of good medical infrastructure and the sources to advocate the importance

[50] Visvananthan, S., (1997).*Carnival For Science: Essays on Science, Technology and Development.* Oxford University Press: New Delhi, p-238.

[51] "Sir M. Visvesvaraya, a man generally acknowledged in the official genealogies of development planning in India as an influential early pioneer, and a man who was in 1938 considered an automatic choice for the NPC. Visvesvaraya was also an extremely influential public voice. In large measure as a result of his career and earlier success, he commanded a ready audience on matters related to economic life, national regeneration, industrialization and nation building- his every publication and public statement would receive extensive coverage in regional and national newspapers, political journals, and specialist literature." Zachariah, Benjamin., *Developing India: An Intellectual and Social History*, Oxford University Press, 2005, p- 244.

[52] Sambit, M., E.Haribabu and S.G.Kulkarni., *'Debates on Science and Technology in India'*, Social Scientist, 33 (11-12), p-61

[53] Zachariah, B. (2005). *Developing India- An Intellectual and Social History. c.1930-50.* New Delhi: Oxford Uni. Press.

of health science lacking. As a result he gave importance to science and technology in the field of medicine and healthcare. and wrote on issues of public health.[54]

For Gandhi, the life follows a natural law, however the modern patients have hand over their bodies to the physicians whom they believe will cure them completely. Further, he is of the opinion that what matters most are the way the life is lived based on truth and renunciation and not merely a healthy life depending on modern physicians. The following lines which is extracted from Shiv Visvananthan's chapter 'ModernMedicines and its Non-Modern Critics' draws a light to the argument:

> "Gandhi's critique, on other hand, was a more down –to- earth attempt to represent both the dissenting traditions of the West and the surviving traditions of medicine in his own society. Because he linked his theory of politics with on the one hand and the politics of culture on the other, his resistance to medicalization was necessarily part of a lager theory of resistance."[55]

D. **Big industries vs. Small Scale Cottage Industries:** While Gandhi embodied the eastern quest of emancipation and illumination, Nehru represented the search for freedom, social justice and equality. Gandhi represented the values and the traditions whereas Nehru was western in its outlook. Gandhi was a staunch critic of western civilization based on technology. He wanted to preserve his country from the curse of commercialization, the horror of machine exploitation and production, the slavery of the wage labour, the whole black systems of capitalist life. He favored small scale and cottage industries including Khadi. His intention was to provide employment to all and thereby solve the problem of poverty and unemployment. Nehru was captivated by western science and technology. He supported heavy and large scale industrialization.

Gandhi, who is synonymous with the Khadi movement, had used this term 'science' to a great extend; over the top of it he felt that the workers should summoned themselves on the values of science. The following lines suggest it:

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[54] Iyengar, U. (Ed.) (2007). The Oxford India Nehru by Jawaharlal Nehru. Oxford University Press.
[55] Visvananthan. S. (1997). 'Carnival For Science: Essays on Science, Technology and Development', OxfordUniversity Press: New Delhi, pp-135-136.

"He urged the Khadi workers to acquire thorough knowledge of Khadi as it was critical for the success of the movement. He prescribed very rigorous technical criteria for the Khadi workers to imbibe the true spirit of science. He wanted the Khadi workers to be well versed in all aspects of cloth making."[56]

Anthony Parel (1969) writes that *Khadi* as a symbol for *"economic regeneration, mastery over machinery, empathy between the rich and the poor, it stood for the production, distribution, and wearing of Khadi: ceremonial spinning. And its relevant action was to improve villages, burning of foreign cloth, boycott of foreign cloth."*[57]

Gandhi was of the view that understanding the science of rural crafts and practice could help the rural people; which would change their lives for better, henceforth he wanted scientist for the every crafts practised by the villagers. He wanted the scientist to come out from their laboratories and contribute their knowledge and skills in uplifting the lives of the poor villagers, by enhancing the ways of production through the proper means which were to be adopted. The importance of scientific knowledge was taken into consideration by Gandhi, and that it could improve the lives of the rural people economically. But he limited the way the scientific community used science as an 'improved means' to achieve 'unimproved goals' and that Technological Self-Reliance could be disseminated from micro level i.e. village.[58]

Gandhi insisted that use of any technologies can be tolerated as long as the people control the whole chain of productive process and their lives.

"It was not only the blind application of science that disturbed Gandhi but also the method it resorted to for acquiring knowledge which, according to him, was questionable. In order to explicate his critique of science it is important to examine the method adopted by science and to compare it with Gandhi's method of acquiring knowledge and arriving at truth."[59]

Vepa (1975) was of the opinion that Gandhi sought to resolve the dichotomy between the new technology and employment generation in his own unique manner. He

[56]Govind. Madhav (2009). Science, Truth and Gandhi: Divergence and Convergence. Gandhi Marg: Quarterly Journal of the Gandhi Peace Foundation, 31(1), pp. 57-82.

[57] Parel, A. (1969). Symbolism in Gandhian Politics.*Canadian Journal of Political Science, Vol.2, No.4.*p.516.

[58] www.scribd.com/doc/11145910/gandhicollected-works-vol-77 [Accessed 17-6-2011].

[59] Ibid.,p.66.

stood for a revival of village industries and handicrafts but was wise enough to realise that without promoting their technology they were hardly likely to survive in the competition with mass produced goods. He therefore sought to improve the technology of these industries but in such a manner so as to cause any dislocation of the existing pattern in the villages. He regarded these industries as essential in the conditions obtaining in the rural areas.[60]

3.4.2 The divergence between Gandhi and Tagore

On the other hand, Tagore and Gandhi's ideals were similar in many ways like they both agreed that violence was a path which was unworthy of humanity[61], *"They both agreed that India could regenerate itself to face the challenges ahead by seeking out those belief, values, knowledge, system, and technologies, which had organically grown from her local communities."*[62] However, they had their own differences in their approach to Swadeshi, charka, co-operation, ideas of nationhood. Tagore's celebrated novel *'Ghare Baire'*[63], which was set on the backdrop of Swadeshi movement in Bengal throws a light to how the author perceive the movement, and the contradictions he had with Gandhi.[64]

Anthony J. Parel (2006) in the *'The Cult of Charkha'*[65], there are two significant grounds on which Tagore complained about the non-cooperation movement[66], firstly from him it was a political asceticism, where students were asked to leave their books and lawyers their courtrooms, effecting the normal lives. Secondly, it was widening the

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[60]K.Vepa, R. (1975). New Technology: A Gandhian Concept. New Delhi: Gandhi Book House.p.207.

[61] Tagore, R. (1994). 1861-1941- Narmadeshwar Jha. The following text was originally published in prospects: the quarterly review of education (Paris, UNESCO: International Bureau of Education), Vol. XXIV. no.3/4, p.603-19.

[62]http://www.swaraj.org/shikshantar/newpoetschallenge.pdf [Accessed on 10 January 2009] , as quoted in Saradindu Bhaduri and Hemant Kumar, 'Tracing the Motivation to Innovate: A Study of 'Grassroot' Innovators in India', ISSN, 1430-4716

[63] One of the three celebrated novels of Tagore, the other two being *Gora* and *Char Adhyay*, which has the nationalistic theme. It was published in 1916, and was Tagore's eight novel. (Ashis Nandy, *'Bonfires of Creed: TheEssential Ashis Nandy*, Oxford University Press. 2004.)

[64]Ashis Nandy cites that Lukacs evaluated *Ghare Baire*, and believe that Sandip was Gandhi himself, who is rabble-rouser, seducing India in the form of Bimala from a gentle colonial figure Nikhil (Bimala's husband), who is keen to introduce her to the modern world.Ashis Nandy. *'Bonfires of Creed: TheEssential Ashis Nandy*, Oxford University Press, 2004.p.167

[65] Parel, Anthony (2006). *'Gandhi's Philosophy and the Quest for Harmony'*, Cambridge University Press.

[66] It was an essay by Tagore which appeared in *Modern Review* on September 192.

distance between East and the West. What India needed was cooperation with the West, just as what West needed was a deeper understanding of India.

An elaborated debate took place between Gandhi and Tagore in between 1915-1941 regarding charkha and its practicability, an extract of it was as follows:

Tagore: *"We cannot get rid of the conviction that we can safely cheat our inner self of its claims, if we can but bribe some outside agency. This reliance on outward help is a symptom of slavishness, for no habit can more easily destroy all reliance on self. Only to such a country can more the charkha as the emblem of her deliverance and the people dazed into obedience by some spacious temptation go on turning their charkha in the seclusion of their corners, dreaming all the while that the car of swaraj of itself rolls onward in triumphal progress at every turn of their wheel."*[67]

Gandhi: *"The Poet thinks that the charkha is calculated to bring about the deathlike sameness in the nation and thus imagining he would shun it if he could. The truth is that charkha is intended to realise the essential and living oneness of interest among India's myriads. Behind the magnificent and kaleidoscopic variety, one discovers in nature a unity of purpose, design and form which is equally unmistakable."*[68]

We can conclude that Tagore believed in voluntary action whether it was inclusion or seclusion in the exchange of knowledge; voluntariness and creativity, and what he feared most was charkha although a means for self- help could became a symbol monotonous action which could kill the creative spirit of the people. He saw the role of leadership as integrating with the people and inspiring and mobilizing them to engage in fresh creative tasks exercising their atmoshakti. He had hoped that Gandhi as a leader with extraordinary ability to integrate with the people would fulfillthis role; but he was disappointed to see Gandhi give the call to all only to spin the *charkha* (spinning wheel), a mechanical repetitive act that he considered to be unworthy of creative humans.[69]

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[67] *'The Mahatma and the Poet: Letters and Debates between Gandhi and Tagore (1915- 1941) '* Compiled and Edited by Sabyasachi Bhattacharya, National Book Trust (2005)
[68] Ibid.
[69] Parel. A. (2006). *'Gandhi's Philosophy and the Quest for Harmony'*, Cambridge University Press.

3.5 Conclusion

In the above sections we have analyzed the dichotomy between Nehru's idea of 'economic development' through 'self- reliance' and the philosophy as understood from Gandhi's and Tagore's views. The philosophical and ideological 'paradigm shift' from the normative understanding of Gandhi's and Tagore's has been made apparent through a comparative understanding of Nehru's conception (as well as of the political elites of that time who were a part of the planning process) of 'self-reliance' and economic self sufficiency, which became a political motivation through which the political economy of the period was shaped by notions of 'development' and 'growth', understood in terms of industrialization and industrial progress; which was different from Gandhi's and Tagore's conception of 'progress' and 'nationalism', represented in the emancipation and self-realization of the masses as a means to attain it.

In India, as we have seen that Self-Reliance as an ideology became a guarded principle of independence after independence. Blackett[70] understood early how the decline in India's foreign exchange reserves would influence major strategic programs, determine the level of imports, influence relations with rich countries, and lower the volume of subsidies sought by the Indian government, This reinforced an attitude of "self-reliance" in circulation before the 1940s, articulated by Indian scientists (among others) long before any real prospect of independence for India. This attitude of self-reliance in science and technology traded on the fading memory of Gandhi's idea of self-reliant industry, made-at-home goods (swadeshi), and independent- minded politics. The argument for "self-reliance" became stronger, although ironically it was increasingly difficult to put into practice because powerful new forms of economic and technological dependence were steadily building up. While Gandhi would not have imagined his idea applied to military and industrial development, Nehru and his political advisers learned

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[70] "On Nehru's simple invitation, Blackett became the prime minister's advisor on military and scientificdevelopment. In the interstices of that relationship they also debated foreign policy because scientificrelations and foreign relations were connected in almost all strategic questions, and the connectionbetween these relations were Blackett's passion.". Extracted from Anderson, R. S. (2010). Nucleus andNation: Scientists, International Networks, and Power in India.Chicago and London: The University ofChicago Press.p.208.

that it would be necessity because they could see few alternatives.[71] The strategy of economic development was shaped by the colonial past and the nationalist present. For one there was a conscious attempt to limit the degree of openness and of integration with the world economy, in pursuit of a more autonomous, if not self-reliant development, and the state was assigned a strategic role in development because the market, by itself, was not perceived as sufficient to meet the aspirations of a latecomer to industrialization; an approach which represented a consensus in thinking about the most appropriate strategy for industrialization.[72] Tagore on the other hand, asserted India's right to be independent without denying the importance of what India could learn – freely and profitably – from abroad. He was however against dependence on foreign assistance for a nation's development, and regarded receiving favours from others as 'the true sign of a pessimist who does not believe in one's own strength, and in this mental sense, a sign of hopeless poverty', and such dependence, according to him, would be a self-defeating exercise.[73]

The succeeding chapter will map out in what way Gandhi, Nehru and Tagore's approach to Technological Self Reliance were integrated in the scientific and technological policies of our country, beginning with the India's Five Year Plans and Scientific Policy Resolution of 1958.

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[71]Ibid.

[72]Nayyar, D. (1998). 'Economic Development and Political Democracy: Interaction of Economics and Politics in Independent India', *Economic and Political Weekly*, Vol. 33, No. 49 (Dec. 5-11), p. 3123.

[73]Md. Anisur Rahman. p. 237-238.

Chapter 4

Integrating Technological Self-Reliance: Reflections of Thoughts in India's R&D Policy

The objective of this chapter is to focus on how the policies and trends for Technological Self- Reliance bear the influence from Gandhi, Nehru and Tagore's thoughts. Conceptual setting in framing policy will be the first section of this chapter, which will be followed by a brief review of the India's Five Year Plans and Scientific Plan/ Policy documents as to see how far the thoughts were constituted while formulating above cited policies and plans; the section on Village and Small scale industries and Large scale industries will dwell on the subject of these industries' existence, performance and strive towards Technological Self Reliance entwining towards the thoughts of Gandhi, Nehru and Tagore for the support these industries had got ever since its conception, till today's present goal of attaining self-reliance. The last section will have a short note on how the war over technological self-reliance had circled among the technocrats and scientist since Nehruvian era; and finally it will compile all the sections of this chapter to come into a concrete observation forming a strong base for the research.

4.1 Conceptual setting in framing policy

According to the system theory[1], it is arduous to understand the process of policy making and its dynamism in any given set-up without taking into consideration the environment

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[1] As extracted from, www.auburn.edu/~johnspm/gloss/systems_theory, *"Systems theory of decision-making in human groups and organizations emphasize their interaction with "outside" actors and organizations and concentrate on identifying the particular elements in the environment of the group or organization that significantly affect the outcomes of its decision-making. To understand what an organization did, try to find out what threat or opportunity it was responding to and how its pre-existing response mechanisms worked to do this."*

in which it takes place. While framing policy for a country three things are taken into consideration: the given system, a set-up, and environment, all of which collectively could be termed as the contextual setting of the policy. So to say, the limitations and the strength of the system, the values, ethics and morals existing in a political system have distinct bearing on the policies formulated and implemented in the system. Henceforth, contextual setting is the surrounding conditions within which any policy or the system operates. Under its gamut it includes human and non-human factors, both concrete and intangible, geographical factors, customs and values, ideologies, institutions etc. and all of it may be features of said contextual set-up. The governmental agencies cannot overlook the contextual environmental factors at the time of making policies; rather the policies are framed in accordance with these factors. The culture, traditions, customs, social factors, economic considerations, ethnic issues and factors all need to keep in consideration at the time of making policy decisions.[2]

To get a nuance understanding of how cultures, ideologies, thoughts shaped the policy framework; it is important to explain how the institutions and shared mental model[3] forms the basis for the conceptual framework, wherein institutions consists of formal[4] and informal[5] entities. Bhaduri and Chandra (2008) explain as to how this shared mental model shaped the technological policy framework of Japan. It provided guidelines with respect to the nature of technological change (incremental innovations), directing the paths of technological activities through the promotion of aesthetic value of miniaturisation, establishing harmony with nature, and maintenance of social fabric have been given due care in technology policy making in Japan.[6] We get the detail picture of

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[2] www.egyankosh.ac.in/bitstream/123456789/31383/1/Unit3.pdf [Accessed on 10-6-2011].

[3] Shared mental model are the representation of the environment, and are constructed through diverse experience, observations and cognitively mediated learning. Such mental models develop into a shared mental model through communication between people, and help perceive the solutions to problems of social interaction in a similar way; factors like language, social values, and intellectual tradition are important in this regard. www.nobelprize.org/nobel_prizes/economics/laureates/.../north-lecture.ht. [Accessed on 17-07-2011].

[4] Formal institutions refers to rules, laws, and the constitutional framework of a country.

[5] Informal institutions, on the other hand, refer to the existing norms of behavior, conventions and self-imposed codes of conduct in a society.

[6] Bhaduri, S and Chandra, J. (2008). Informal Values and Formal Policies: A study of Japanese Technology Policy and Significance for India. *Indian Council for Research on International Economic Relations. Working Paper No.219*

how technological policies pervade almost all the aspects of the interaction between technology, economy and society.

So, to say the thoughts of Gandhi and Tagore in understanding the self-reliance, labour, employment, and industrilisation cannot be underestimated though most of the programmes adopted for Technological Self-Reliance were in line with Nehru's vision of industrialisation which required a widespread science base. The setting up of small scale village industries and its utilization for specific requirements and programmes for contingencies and opportunities arising out of development plans, which was supposed to be determined in due course by the Five-year plans can be held in the line of Gandhian thought.

4.2 Self-Reliance in India's Five Year Plans: an overview

Chakrabarty (1992) states that, there were three different sources from which Nehru seems to have derived the idea of planning.

> "First, the national democratic ideology-to protect India's economic future after the termination of alien rule- was an influence on Nehru's ideology. Secondly, Nehru's extreme faith in planning as the only available tool to ensure a rapid and massive economic development seems to strengthen by the remarkable success of planning by the Soviet Union. The third source seems to be the Congress resolutions supporting planned economic development."[7]

Quite different from Gandhi's believes, the Congress party showed enormous interest in socialist means, including planning and heavy industrialization, as 'essential to make revolutionary changes in the present economic and social structure of society and to remove the gross inequalities' since 1929.[8]

Nehru in his public speeches emphasised on "Self-Reliance", as a goal common to both science policy research and the industrialisation strategy for building up a modern nation. The first step towards self-reliance was to set up modern industries in India, especially heavy industries, which was meant to be generated through engineering and

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[7] Chakrabarty, B. (1992). Jawaharlal Nehru and Planning, 1938-41: India at the Crossroads. *Modern Asian Studies. Vol.26 No.2.*

[8] Ibid.

technical skills. The research institutes that were set up under the science policy research structure at that point of time could not be created indigenously. However, the course of research and development effort of these research institutes was to be conducted in such a manner that, in due course, they could produce relevant technologies for modern industry through the application of science. It is, therefore, not unexpected that emphasis on application of science to the specific needs of housing, water, artisan and cottage and small scale industries came much later, around the seventies. Even in terms of technical skills, modern industries required engineers and technician to be trained under formal institutional structures rather than in the informal sector.[9]

Let's us have a look at the some of the Five Year Plans that emphasised on self-reliance at various levels which in turn could act as a ground for the promotion of Technological Self-Reliance.

The Second Five Year Plan (1956-61) prepared by P.C. Mahalanobis, had the following characteristics features:

> *(a) "Emphasis on heavy industry,*
>
> *(b) Establishment of scientific institutions,*
>
> *(c) Setting up of infrastructure of power and transport, and*
>
> *(d) Selective disengagement of Indian economy from world economy."*[10]

It can be said from the above features that emphasis was given to heavy industry.

The Fourth Five Year Plan (1969-1974) some of the objectives were:

> *"a) to attain self-sufficiency in agriculture and industrial production. (In agriculture, growth rate of 5% per annum and in industrial production growth rate of 8% to 10% per annum were targeted, b) to achieve a growth rate of 7% per annum in exports, c) to establish economic equality and justice in society."*[11]

About the Fourth Five Year Plan, Bimal Jalan (1972) writes, *"It formulated the objective of self-reliance in terms of elimination of net (rather than gross) aid by 1980-81. This*

[9]Indiresan, P.V. and Gulrajani, M.L. (Eds.). (1989). *Development through Technology-a symposium on nehru's vision.* New Delhi: Indian Institute of Technology, Hauz Khas.

[10] Ibid. pp.181-82.

[11] Sikka, D. P. (2008).*Science Policy- New Strategies for India's Modernization.* New Delhi: Uppal Publishing House.

meant that even if the objective were fully achieved, the country would have continued to receive aid, at least for some time, up to the limit of its own debt servicing obligations."[12]So, we can say this plan too emphasised on attaining self-reliance through industrialization in agricultural and production sectors.

The Fifth Five- Year Plan (1974-1979) some of this plan's objectives were:

"a) stress on development of Agriculture and the Industries producing the commodities of general use, b) adequate collection and distribution system in order to provide the commodities of necessary consumption to the poor people on reasonable and stable prices, and c) stress on Export Promotion and Import Substitution".[13]

Tendulkar (1974) in his journal article *'Planning for Growth, Redistribution and Self-Reliance in the Fifth Five Year Plan-1'* opines that the main objectives of the plan were to achieve annual growth rate of 5.5 percent of gross domestic product, and to achieve self-reliance and eradication of poverty over the plan period. However, with thorough empirical scrutiny through various models and numerical results he states that the practicability of self-reliance in this plan was unstable and prejudiced. Further, he concludes that while taking into consideration the problem of a policy framework, the pressure imposed by conditions as that of socio-political environment and the mixed economy's (like that of India) institutional set up should be brought into consideration.[14]

Bhatt (1982) is of the opinion that the Fifth Plan detected the problem of technology policy but it does not discuss with adequate precision and cared about the crucial elements of a sound technological policy. It did not identify, for example, that the three problems: relevant research, adapting modern technology, and upgrading traditional technology were interrelated and their solution crucially depends on the existence of

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[12] Jalan, B. (1972). A Policy Frame for Self-Reliance. *Economic and Political Weekly, Vol.7, No.15.*

[13] Sikka, D. P. (2008).*Science Policy- New Strategies for India's Modernization.* New Delhi: Uppal Publishing House.p.73.

[14] Tendulkar, S. D. (1974). Planning for Growth, Redistribution and Self Reliance in the Fifth Five- Plan II. *Economic and Political Weekly. Vol.9, No.3.*

adequate machinery to identify actual project problems in concrete terms- a machinery that vitally links the production and the technology systems.[15]

Rajiv Gandhi's foreword of the Seventh Five Year Plan runs:

"Planning has given us a strong base for building a modern, self-reliant, industrial economy. Indian industry today is highly diversified, producing a wide range of products, many embodying a high level of technology. We have a broad entrepreneurial base and ample technology and managerial manpower. But some weaknesses have also become evident. Much of our industry suffers from high cost. Inadequate attention is paid to quality. In many areas we are working with technology that is obsolete. We have reached a watershed in our industrial development and in the next phase we must concentrate on overcoming these problems. Our emphasis must be on greater efficiency, reduction of costs and improvement in quality. This calls for the absorption of new technologies, greater attention to the economies of scale and greater competition." [16]

This plan began on April 1, 1985. The term of this plan was up to March 31, 1990. This plan emphasised policies and programmes for rapid growth in food grains production, increased employment opportunities and productivity within the framework of basic tenants of planning i.e. 'growth, modernisation, self-reliance and social justice.'[17] We can observed that apart from other objects in the plan, the objectives that hinted towards self-reliance were; establishing of an independent, self-sufficient economy, and encouraging self-reliance by export promotion and import substitution.

The Ninth Five–Year Plan (1997-2002) emphasised on self-reliance in the backdrop of growing global restrictions on high-technology movement, and on the requirement to make science and the practitioner of science essential to all planning and operations in the country. The major focus of the S&T programme was aimed to encourage and strengthen interaction among R&D institutions and the users. Considering the meagre resources available the proposal was to develop the central strengths and

[15] Bhatt, V.V. (1982). Development Problem. Strategy. and Technology Choice: Sarvodaya and Socialist Approaches in India. *Economic. Development and Cultural Change, Vol.31, No.7.*
[16] www.scribd.com/doc/16472926/Seventh-Five-Year-Plan [Accessed 30-5-2011]
[17] Sikka, D. P. (2008).*Science Policy- New Strategies for India's Modernization.* New Delhi: Uppal Publishing House.p.75.

ponder on areas where competitive strengths could be built so that technological skills could be summoned into commercial strength.[18] This plan emphasis on industrialization, and it clearly indicated that the wealth and prosperity of a nation depends on the efficient use of its human and material resources through industrialization. The use of human material for industrialization demands its education in science and training in technical skills. It was considered that India's enormous resources of manpower cab only become an asset in the modern world when trained and educated, and industry opened possibilities of greater fulfillment for the individual.[19]

As a conclusion, we have scrutinized that the Five Year Plans had the central importance of removing poverty and attainment of self-reliance which were to be accomplished. It also relates to the recognition of the need for a technology policy: "*The Science and Technology plan, as an integral part of the Fifth Plan, is one of the major policy instruments for achieving the objective of self-reliance*"[20] After the First Plan, the technology question was put up for the first time in the chapter on plan policies, under the label 'Science and Technology Policy'.

4.3 Self-reliance in India's technology policy documents

4.3.1 Government of India Scientific Policy Resolution: 1958

Apart from the enthusiasm of the people, Nehru knew that apart for a nation in the modern age, requires the effective combination of three factors and those were technology, raw materials and capital, of which technology was perhaps the most essential, since the creation and adaption of new scientific techniques can, in fact, make up for a shortage in natural resources, and reduce the demands of capital. But, technology can grow only through the study of science and its applications.[21] The below lines of the Policy underline the above meaning,

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[18] Ibid; p.78.

[19] Ibid; p.153.

[20] Bhatt, V.V. (1982). Development Problem, Strategy. and Technology Choice: Sarvodaya and Socialist Approaches in India. *Economic, Development and Cultural Change. Vol.31, No.7.*

[21] Indiresan,P.V. and Gulrajani,V.M.L. (Ed.). (1989). *Development through Technology- a symposium on nehru's vision.* New Delhi: Indian Institute of Technology. HauzKhas.p.56.

"Science and Technology can make up for deficiencies in raw materials by providing substitutes or indeed by providing skills which can be exported in return for raw materials. In industrializing a country, a heavy price has to be paid in importing science and technology in the form of plant and machinery, highly paid personnel and technical consultants. An early and large scale development of science and technology could therefore greatly reduce the drain on capital during the early and critical stages of industrialisation."[22]

Additionally, *"Science has developed at an ever increasing pace since the beginning of the century, so that the gap between the advanced and backward countries have widened more and more. It is only by adopting the most vigorous measures and by putting forward out utmost effort into the development of science that we can bridge the gap. It is an inherent obligation of a great country like India with its tradition of scholarship and original thinking and its great cultural heritage, to participate fully in the march of science, which is probably mankind's greatest enterprise today."*[23]

Furthermore, we find a hint of persistence towards technological self-reliance, when Bhabha states, *"The relative role of indigenous science and technology and foreign collaboration can be highlighted through an analogy. Indigenous science and technology plays the part of an engine in an aircraft, while foreign collaboration can play the part of a booster."*[24] And further quotes the lines from the Scientific Policy Resolution of 1958, *"A booster in the form of foreign collaboration can give a plane assisted take-off, but it will be incapable of independent flight unless powered by engines of its own. If Indian industry is to take off and be capable of independent flight, it must be powered by science and technology, based in the country."*[25]

If we have to interpret these objectives then it reflects the confidence that Nehru had in Science and Technology in for India's development. The resolution defined the aims of the government's scientific policy which included promotion, adopting and sustaining the cultivation of sciences and scientific research in all its aspects; ensuring an sufficient supply within the country of research scientists of the highest quality;

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[22] www.dst.gov.in/stsysindia/spr1958.htm [Accessed on 30-5-2011]
[23] Ibid.
[24] books.google.co.in/books?isbn=8173710074[Accessed on 30-5-2011]
[25] Ibid.

encouraging and initiating with all possible speed programmes for the training of scientific and technical personnel, on a scale adequate to fulfil the country's needs in science and education, agriculture, industry and defence; and in general securing for the people of the country all the benefits that can add from the acquisition and application of scientific knowledge.[26]

4.3.2 Science and Technology Plan of 1973

A central argument for S&T Plan was in the following quotation from the 1973 document *"without a national plan for Science and Technology, we run the risk of a fragmented efforts by different agencies with possibilities of duplication and waste. At the same time scientific and technological tasks crucial to the economy cannot be left unattended to for want of planning and coordination."* [27]

The three important features of the first S& T Plan in India were:

1. *"Laying as much of emphasis on the development of engineering, design and fabrication skill as on the development of product/process technology.*

2. *Making the existing science and technology infrastructure more effective through the provision of additional facilities rather than creating new organizations, and*

3. *Emphasizing on rural development.* "[28]

In this Plan attention was centered on improvement of science and technology inputs in areas like *Khadi* and Village Industries, energy exploration and exploitation of natural resources, agriculture, fertilizers and chemicals, coal, steel and mines. In addition, a number of research programmes were commenced in-specialized areas like atomic energy, space, electronics and medical research.[29]

4.3.3 Government of India Technology Policy Statement (January, 1983)

"The basic objectives of the Technology Policy will be the development of indigenous technology and efficient absorption and adaption of imported technology appropriate to national priorities and resources. Its aims are to:

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[26] Indiresan, P.V. and Gulrajani,V.M.L. (Ed.). (1989). *Development through Technology- a symposium on nehru's vision*. New Delhi: Indian Institute of Technology, Hauz Khas. p.57.

[27] Ibid:p.81.

[28] Ibid.

[29] V.V.Bhatt. (1982). Development Problem, Strategy, and Technology Choice: Sarvodaya and Socialist Approaches in India. *Economic, Development and Cultural Change. Vol.31, No.7.*

Attain technological competence and self- reliance, to reduce vulnerability, particularly in strategic and critical areas, making the maximum use of indigenous resources."[30]

This Policy Statement gave emphasis to the use and development of technology relate to the people's aspirations. It also gave attention to the immediate needs in India which was the attainment of self-reliance, a substantial improvement in the conditions of the poorest sections of the population and the speedy development of backward region. Technology was viewed in the broadest sense, covering the agricultural and the service sector along with the manufacturing sector; which stretched over a wide spectrum ranging from village, small-scale and cottage industries (often based on traditional skills) to medium, heavy and sophisticated industries.[31]

In the Policy it was also laid out. *"Importance of Technology Development- Fullest support will be given to the development of indigenous technology to achieve technological self-reliance and reduce the dependence on foreign inputs, particularly in critical and vulnerable areas and in high value – added items in which the domestic technology base are necessary to reduce and to expand exports for which international competitiveness must be ensured"*[32] This could mean framing a policy directed towards technological self-reliance, which does not imply technological self- sufficiency.

The criterion for this Policy was national interest, which was directed towards reducing technological dependence in key areas. Proper advantages were taken of technological developments, which were believed to be achieved through well-defined collaborative provision in research and developments. Space was also created for a blend of indigenous and imported technology, however, technology acquisition from outside was not meant to be at the expense of national interest. Indigenous initiative was given recognition and support. In the acquisition of technology, consideration was given to the choice and sources of technology, alternative measures of acquiring it, its role in meeting a major felt need, selection and relevance of the products, costs, and related conditions.[33]

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[30] Sikka, D. P. (2008). *Science Policy- New Strategies for India's Modernization.* New Delhi: Uppal Publishing House.p.157.

[31] Ibid;p.156.

[32] Ibid;p.161.

[33] Ibid;p.165.

4.3.4 Government of India Science and Technology Policy: 2003

In the words of Indra Gandhi, "*Self- reliance does not mean an inward looking or isolationist approach, but a policy which ensures that the decision making on key aspects of the pattern and content of development will remain firmly in national hands. A country of our size and potential cannot aim at self- reliance.*"[34]

Under this Policy there was an objective for 'International Science and Technology Cooperation'. This in a sense meant that scientific research and technology development could benefit out of the mutual international cooperation and collaboration. Common targets could be effectively addressed by sharing both material and intellectual resources. International collaborative programmes, especially those contributing directly to our scientific development and security objectives, was to be encouraged between academic institutions and national laboratories in India and in all parts of the world, including participation in mega science projects as equal partners. Special attention was being placed on collaborations with other developing countries and with the neighbouring countries with which India shared many common problems. International collaboration in science and technology was aimed to fully use for further national interest as an important component of foreign policy initiatives.[35]

From the above Policies and Plans we can draw a rough conclusion that Nehruvian model of development through big industrialization was given more importance. So, to say depicting on their respective ideological leanings, Nehru praised industrialism while Gandhi opposed it since he felt that instead of contributing to the general welfare, machine civilization would not only expose Indians to a worse kind of exploitation but also lead to a general degradation of human life. Although Nehru and Gandhi were poles apart on occasions, and despite the adverse ideological implication of aligning with Gandhi, Nehru as a pragmatist participated thoroughly in the Gandhi-led freedom struggle for he knew that the attainment of independence was prior to ideology. So, the controversy involving Gandhi and Nehru in relation to planning and industrialisation was just a signpost indicating the tension which was most likely in view

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[34]Ibid;p.49.
[35]Ibid;p.203.

of the Congress effort to create an anti-British multi-class platform incorporating even contradictory ideologies.

Tagore in the matter of big industrialization was more like Gandhi, to quote his own words:

> "*Today the profit that the machine brings to our door is too big and we do not hesitate to scramble for it even at the cost of our humanity. The shrinking of the man in us is concealed by the augmentation of things outside and we lack the time to grieve over the loss. We can only hope that science herself will help us to bring back sanity to the human world by lessening the opportunity to gamble with our fortune. The means of production constructed by science in her attempts to gain access into nature's storehouse are tremendously complex which only proves her own immaturity just as simplicity is wanting in the movement of a swimmer who is inexpert.*"[36]

Whatever the crux of the contraction between Nehru, Gandhi and Tagore was, we can assume that Nehru, by making a case for planning and industrialization, ushered in a new era in the Indian technological advancement.

4.4 Policies on Technological Self-Reliance in India: Understanding the contributions of Gandhi, Nehru and Tagore

Much of Nehru's effort was aimed to convince Gandhi about the practicability of planning and industrialisation in poverty-stricken India. Planning was the focal point of Nehru-Gandhi rivalry. The moment Planning Commission began its operation, differences of opinion between Nehru and Gandhi surfaced. Nehru argued for large scale industry as long as it did not come into conflict with the cottage industry. For Nehru, planning did not mean industrialisation alone; on the other hand, it embraces the entire national life. There was no contradiction between the large-scale and cottage industries, and planning was an effective tool to get the best out of both. He thought that it could be hazardous for India if she ignored industrialisation altogether, and he believed that for a country to turn its face against industrialization was to render itself to the industrialized

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[36] See.,p.665. *The English Writings of Rabindranath Tagore: plays, stories and essays*. Vol. II. New Delhi Sahitya Akademi.

countries. Unlike Gandhi, Nehru never believed that machinery was an evil in itself; instead, it was the capitalist structure of society where so many vested interests intervene which made the way for inhuman exploitation and disturbance of equilibrium in society. To Nehru, Congress support for cottage industry seemed justified since 'the Charka and Khaddar created self-reliance and utilized the wasted manpower of India'.[37]

"*These stand on a different from Khadi. There is not much scope for voluntary labour in them. Each industry will take the labour of only a certain number of hands. These industries come in as a handmaid to Khadi. They cannot exist without Khadi, and Khadi will be robbed of its dignity without them. Village economy cannot be complete without the essential village industries such as hand-grinding, hand-pounding, soap-making match-making, tanning, oil-pressing etc. Congressmen can interest themselves in these and, they are villagers or will settle down in villages, they will grow these industries a new life and a new dress. All should make it a point of honour to use only village articles whenever and wherever available. Given the demand there is no doubt that most of our wants can be supplied from our villages. When we have become village-minded, we will not want imitations of the West or machine- made products, but we will develop a true national taste in keeping with the vision of a new India in which pauperism, starvation and idleness will be unknown.*"[38]

On the other hand, for Gandhi the immediate problem was poverty, and it had to be handled directly, through the provision of full employment in traditional sectors which were agriculture and cottage industries. Thus the emphasis was upgrading traditional and on adapting modern technology in a manner that was in accordance with the local situation and the development objectives. The major instruments for this purpose were education and scientific- technological research that was originally related to the identification and solution of concrete socioeconomic problems. He believed that large-industries-whether owned by state or by individuals cannot be developed without wage labor; and this meant exploitation and lack of freedom; he was of the notion that unless the means of production for basic necessities are owned by families or a cooperative of

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[37] Bhatt,V.V. (1982). Development Problem, Strategy, and Technology Choice: Sarvodaya and Socialist Approaches in India. *Economic, Development and Cultural Change, Vol.31, No.7.*
[38] Ibid.

families, no individual can be really free to mold his life. Hence, agriculture and cottage industry were to be owned and operated by families or by cooperatives. This was to be the basis of a nonviolent social order based on willing cooperation and elimination of social conflict. Gandhi recognised the need for some large industries, but they were to be geographically related to the needs and requirements of agriculture and cottage and small industry.[39]

Tagore's view on rural reconstruction were never adopted in a major way outside Tagore's own circles, and although P.C.Mahalanobis, to provide one notable example, had been peripherally involved with Sriniketan, Tagore's idea did not enter the mainstream of 'development' debates in India, although they shared some characteristics, such as the focus on moral uplift. There were, however, significant exceptions: Tagore had warned of the dangers of a combination of 'oppression and patronage' which he felt had destroyed the villagers' self-respect and self-reliance under British rule, and which should not be replicated in Indians' attempts at rural reconstruction.[40] Like Gandhi, Tagore's ideas (Shantinekatan and Srineketan) of new education were founded upon a support and an instinct to create a new type of humanity whose scientific-technological progress and economic development would grow through dialogue and respect for values. That was the persistent basis Tagore's debate on India and the world in his powerful and spirited writings on education, culture, science, nationalism, internationalism. These substantiated his stand against colonialism, discrimination and dehumanization. As an internationalist, Tagore surely would have preferred open trade policies. For example, he always opposed boycotts of foreign goods whenever such proposals came up, whether from Gandhi or from others. His approach in dealing with poverty was through the spread of basic education with the goal of self-reliance, the application of science and technology to agriculture, the provision of cooperative credit, and the setting up of cottage industries. Most important of all in Tagore's scheme of things was to institute a relationship with the village based on a true attempt to understand its problems, whether in every instance successful or not. He wanted his education to combine with local and

[39] Bhatt, V.V. (1982). Development Problem, Strategy, and Technology Choice: Sarvodaya and Socialist Approaches in India. *Economic, Development and Cultural Change, Vol.31, No.7.*

[40] Benjamin, Z. (2005). Developing *India: An Intellectual and Social History.* Oxford University Press.

indigenous knowledge with modern scientific knowledge from which both sections of Indian society could learn and make progress.[41]

The following sections in brief will explain the workings of the village and small scale industries in India after independence; it will be like a precise analysis of how Gandhi and Tagore's thoughts have been ingrained and how far Technological Self Reliance has been endeavored in this industry.

4.5 Village and Small scale Industries

Socialism was dominant ideology after independence, propounded by the then Prime Minister Nehru himself, who was also the chairman of the Planning Commission until his death in 1964. However, as a mark of respect for Gandhi, his ideology was kept alive by institutions that were set up by the state and by Gandhi's followers for the promotion of cottage industry. It is obvious, that one has to begin with the problem of poverty as Gandhi did and tries to solve it through means (instruments) that are directly related to the problem. As Gandhi realized, it is neither practical nor desirable to provide a decent minimum of physical security to each family without providing it with work for employment. Poverty can be removed only through full employment; which meant the employment of each family.[42]

Gandhi believed that the Independence movement could only achieve success through restoring self-esteem, pride and self-confidence among the poor masses of the country, the majority of whom lived in the rural areas and worked with their hands rather than with machines. Gandhi was convinced that the condition of the Indian masses improved not by an elaborate mechanisation of economic planning at the national level, but only through adoption of decentralization, making the country a centre of craft and the village a primary unit of country's economy. The economic programme for village uplift was not launched through mechanisation but through promotion of handloom and cottage industries. Swaraj, Swadeshi and Industrialisation, faith in modernisation through

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[41] Extracted from; *Rabindranath Tagore and his Contemporary Relevance by* Uma Das Gupta and Anandarup Ray.www.parabaas.com/rabindranath/articles/RT_authors.html. [Accessed on 31-5-2011]

[42]Bhatt, V.V. (1982). Development Problem, Strategy, and Technology Choice: Savodaya and Socialist Approaches in India. *Economic, Development and Cultural Change. Vol.31, No.7.*

industrial development took hold of the Congress party's imagination under Nehru's leadership. Until then, because of the country's primarily agrarian economy, the Congress was fast becoming nationalist with greater attention towards the peasant and the village. Gandhi considered it sinful and unjust to use modern technology, for according to his beliefs, it led to concentration of power and riches in the hands of a few. Nehru, on the other hand, believed that political independence without an economic revolution was at a risk for other industrially developed country could take control of economically weak countries.[43]

Roy (2004) writes, through the reflection of Gandhi's preoccupation with *Khadi* cloth, and his linking of it to rural development in 1957 the government of India established the Khadi and Village Industries Commission[44]. It is a fact that there has been enormous growth of large scale industries, but the small scale and cottage industries had played a very prominent role in the country's economy. Like in other parts of the world in India the small- scale sector has been considered as the channel of growth of national economy and has a vital role, the small scale industries are considered as labour-intensive and provide employment to the country.[45]

The emphasis on Village and Small Scale Industries has always been an integral part of the Indian Industrialist strategy, more so after the Second Five Year Plan. It was taken into consideration that Village and Small Scale Industries would play an important as producer of consumer goods and absorber of surplus labour henceforth solving the problems of poverty and unemployment. Other advantages of small industries was that they ensure a more equitable distribution of national income, enhance balanced regional industrial development, entrepreneurship and support mobilization of local resources and skills which might otherwise remain unutilized. The Government of India had been encouraging and supporting the promotion of Small Scale Industries through deliberate policies such as protection from large scale industries, capital subsidies, differential tax

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[43] Vepa, K. R. (1975). New Technology: A Gandhian Concept. New Delhi: Gandhi Book House.p.22.
[44] Roy, M. L. (2004). Handmade in India: Preliminary Analysis of Crafts Producers and Crafts Production. *Economic and Political Weekly, Vol.38, No.51/52.*
[45] www.tn.gov.in/spc/tenthplan/CH_10_2.PDF [Accessed on 29-6-2011]

treatment, reservation etc.[46] J.C.Sandesara (1988) affirms that the small scale industries have following strength:

"(a) *large industry is very often capital- intensive and accumulative of capital takes time. During the intervening period, small industry which is very often labour-intensive would, therefore be able to stay on. (b) large industry has often access to cheap capital and small industry to cheap labour and these respective advantages and handicaps may keep the cost scale in balance, so that the small industry may not suffer from any special handicap. (c) for minimisation of risk, a new line is opened on a small-scale. (d) where the material to be worked upon is not uniform, where the processes are not suitable or economical, and here small industry thrives on its strength.*"[47]

It can also be understood that the effects of the globalization and regionalization on industrialisation and small industry development stems from the opening up of the economy and stimulation of competitive advantages as exist in human and natural resources and their development.[48] Nanjundan (1994) adds:

"*While the Indian small industry programme from the mid 50s to the mid 60s was based on direct technical assistance in identifying opportunities and markets, in techno-economic viability of the size, in appropriate but efficient technology, and in promotion of new entrepreneurship it soon degenerated into a lobby-like counterpart the private large industry sector- for currying government favours in reservation, tax exemptions, licenses and quotas for scarce materials and foreign exchange, subsidized loans, etc. thus stifling technological change and sheltering sub- quality and superior manufacturing*".[49]

In a way, Nanjundan expresses that rapid globalization and changing domestic preference have brought the handicrafts with a unique set of challenges, the problem being the competition from mechanized industries. On the other hand, the demand for handcrafted goods has the prospective to expand together with growth of domestic tourism, and with spending on interior decoration. However, to sustain the old skills, the

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[46]P. 559_ www.tn.gov.in/spc/tenthplan/CH_10_2.PDF [Accessed on 29-6-2011].

[47]Sandesara. J.C. (1988). Small- Scale Industrialisation: The Indian Experience. *Economic and Political Weekly*, *Vol.23, No.13*.

[48] Nanjundan, S. (1994).Changing Role of Small-Scale Industry: International Influences. Country Experiences and Lessons for India. *Economic and Political Weekly. Vol.29, No.22*.

[49] Ibid; p.46.

small scale industries need to examine, target, and adapt the new buyers.[50] It can be said that the opposition from the Gandhians who disagreed with capitalist strategy of development had been balanced by the setting up of Khadi and Village Commission.[51]

4.6 Big scale Industries

"*The three fundamental requirements of India, if she is to develop industrially and otherwise, are a heavy engineering and machine making industry, scientific research institutes, and electric power. These must be the foundations of all planning.*"[52] Having discussed Nehru's approach to technology, we will now examine policies that were adopted during his period for development of technology. As stated earlier, India adopt the approach that could solve the issues involved in science and technology policies, especially in a developing country like India, it gave preference to explicit and implicit policy instruments that encompassed the following characteristics features.

(i)   "*The role of state in orienting the industrialisation process,*

(ii)   *Reliance on positive or negative control mechanisms*

(iii)   *The mode of state intervention*

(iv)   *Characteristics of the array of policy instruments*

(v)   *Coherence of S& T policy and the degree of integration with industrial policies, and*

(vi)   *Trends and changes in the government industrial or S&T policy.*"[53]

For, India had to attain its place among the free nations of the world; a self-reliant industrial base was essential for national security, removal of poverty and improvement of living standards. Self-reliant development required a sustained long-term effort not to be easily disturbed by external variations. The industrial system was aimed to be built by indigenously developed technology through the application of science but in the absence of a capital-goods base and the nascent science and technology infrastructure, a certain

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[50]Nanjundan, S. (1994). Changing Role of Small-Scale Industry: International Influences, Country Experiences and Lessons for India.*Economic and Political Weekly, Vol.29, No.22.*

[51]Tyabji, N. (1984). Nature of Small Enterprise Development: Political Aims and Socio-Economic Reality. *Economic and Political Weekly. Vol XIX Nos 31, 32& 33.*

[52]See,pp.179 Indiresan, P.V. and Gulrajani, M.L. (Ed.).(1989). Development through Technology-a symposium on nehru's vision. New Delhi: Indian Institute of Technology, Huaz Khas.

[53]Indiresan, P.V.and Gulrajani, M.L. (Ed.).(1989). Development through Technology-a symposium on nehru's vision. New Delhi: Indian Institute of Technology, Huaz Khas.

gestation period had to be accepted. However, the country could not afford to delay the industrialisation process. Accordingly, liberal importation of technology was the only choice. Also give the shortage of resources, consumer goods could be given a lower priority and foreign investment was to be used for heavy industries. But the state had to intervene so that the terms and conditions for the licensed importation of technology and the entry of foreign capital did not shatter India's long term objective of building a self-reliant industrial structure.[54]

Thavaraj (1982) is of the opinion that in India, the government and the leading industrial houses neither had clarity of objective nor the required will and determination towards technological self-reliance, for collaboration agreement have enabled the multinational to get hold of the Indian market and established their monopolistic control. Foreign companies, most of which were contributor of multinational corporations, had better access to modern technology than Indian industrialist. At the same time, the growth of small industries which could have profited from indigenization of foreign technology was hampered. In fact, there has been no systematic attempt by the government towards indigenization and self-reliance in the field of technology. Various technologies have been imported in an unsystematic manner irrespective of the need for standardization and mass production. While platitude about self-reliance has been ran out, the reality is greater reliance upon multinationals. Thavaraj highlights that the Sixth Plan framework of course has coined a quaint formula: 'Strengthening the impulses of modernization for the achievement of economic and technological self-reliance'. However, "modernization" as a word is synonymous with the introduction of technology of multinationals, and that the objective amounts to the following, "greater reliance upon the multinationals for the achievement of self-reliance."[55]

It has been suggested by planners that we can achieve and indeed have achieved food sufficiency in our basic necessities only through modern industrial technology. But this principle has not been validated by our experience of four decades since independence. We have increasingly relied on foreign aid and internal loans to finance

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[54] Ibid; pp.183.
[55] See: pp-57; Technology Policy and Self Reliance- M.J.K. Thavaraj (Social Scientist, Vol.10, No-2, Feb., 1982), pp.56-62, Social Scientist.

our plans, and insofar as self-sufficiency in food production was concerned it may be held that while there was no import of food grains in 1986 and 1987, but heavy import on fertilizers worth crores in 1986-87, in a way the abstract nature of our self-reliance was evident from the data. However, what needs to be emphasized is that, "*it is an inescapable consequence of the culture of the modern industrial technology which arises from its fundamental characteristic of excessive dependence on complex socio-technical support systems (often remotely placed and controlled) for manufacture, use and maintenance of its products.*"[56] The perception has been that the gestation period was over, capabilities have been built and, therefore, an explicit elaboration of technology and its policy instruments become necessary. Over the top, The Technology Policy Statement did not spell out the various facets of technology in details, but some of the policy planners were of the opinion that the three decades of planning, and the Scientific Policy Resolution of 1958, have resulted in agricultural and industrial base and scientific manpower impressive in quality, numbers and range of skills.[57]

Valluri (1993) supports that, if some collective measures are not introduced immediately, a measure of Technological Self-Reliance, at least in some critical areas, will surly become an unobtainable objective in the future, assuming it is still a national objective. It will be a casualty to short term political and economic compulsions, but achieving technological self-reliance requires long term planning. In the absence of such planning bulk of activities in research laborites and academic institutions in the country will continue to be divided from any national requirements. The R&D in the industry at present is not a serious driving force towards Technological Self-Reliance.[58] Further, Valluri adjuncts that the general trend has been to import more and more technologies, and we are passing through a process of modernisation of our industries as the technologies imported during the 1950s and 60s have become obsolete. We have not made any attempt to update these technologies through our own research and development. As a result of which we have to export more goods and services to other countries. So for the purpose of building our export we have to import more up-to-date

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[56]See; pp. 186, Indiresan. P.V. and Gulrajani, M.L. (Ed.).(1989). Development through Technology-a symposium on nehru's vision. New Delhi: Indian Institute of Technology, Huaz Khas.
[57]Ibid.
[58] Valluri, S.R. (1993). CSIR and Technological Self-Reliance. *Economic and Political Weekly*, Vol.28, No.14.

technologies. All these factors have led to a tremendous increase in the foreign collaboration agreement to acquire these technologies and multi-national corporations have been invited and welcomed to participate in the new industries.[59]

Subramaniam (1989) in the article titled, 'Nehru: The Architect of Modern India' ends with the question, "Are we incapable of achieving this self- reliance in science and technology?", and affirms that in certain areas, because of its sensitive nature, imported technologies are not available, so India has been compelled to depend upon indigenous research and development in these areas; with specification of space and nuclear technologies.[60]

As written by Anderson (2010) in his book 'Nucleus and Nation: Scientists, International Networks, and Power in India', C.R. Subramanian argued that:

"self-reliant approach in computers could be interpreted as a failure, namely that India got "indigenous" technologies that were not state of the art and paid higher prices than if import strategies had been used. These were classic issues to those people suspicious of self-reliance via the indigenous route, namely that made-in – India technologies took too long, thus cost India more, and therefore kept India "behind": the result was a technology conceived among and for previous generation."[61]

Anderson (2010) addresses that were was a scientist war over self-reliance, and it was about tactics: between moving quickly or moving gradually, between building medium scale or small scale, between hand-making and automation, between importing turnkey technologies for reverse engineering or adapting, even developing technologies indigenously. The fundamental tension around self-reliance was that the scientist knew that the Indian public had little confidence in Indian technology and saw that few politicians or senior administration had not much confidence either. The result was rhetorical support for indigenous technologies and science, yet a commitment still to import foreign substitutes for these indigenous Indian things as they seemed to take too

[59]Valluri. S.R. (1993). CSIR and Technological Self-Reliance. *Economic and Political Weekly*, Vol.28, No.14.

[60]See: pp-14, Indiresan, P.V. and Gulrajani, M.L. (Eds.) (1989). Development through Technology-a symposium on nehru's vision. New Delhi: Indian Institute of Technology, Huaz Khas.

[61]Anderson. R.S. (2010). *Nucleus and Nation: Scientists, International Networks, and Power in India*. Chicago and London: The University of Chicago Press.

long, were not good enough, or required too much money. Importing was the default position to which people returned time after time, and this was not simply just craze for foreign things, long denied.[62]

4.7 Conclusion

Scientist war over self-reliance can be seen in reviewing the four major sectors of the economy: fertilizer, jet fighters, steel, and petroleum, all of which were energy intensive. The Indian war for self-reliance was shot through with the ambiguous around foreign choice and national choice, permitting and/or forcing individuals and institutions to find a shifting balance point, a place where they would get benefits from both national and foreign strategies. In fact, sometimes the higher cost was to be found not in the imported but in the indigenous technology: where international companies were willing to lower prices of previous year models to get into potential market. This shifting point was hard to find, each case presenting its own opportunities, thus accounting for the intensity of the debate and the sparks of conflict. The debate within the scientific community also resonated with the political economy of national planning policy, and thus was influenced by major interests outside the scientific community. Meghnad Saha's complaint about excessive and unnecessary reliance of foreign capacity was considered inappropriate by many scientists, however years later, reliance seemed less inevitable, even less necessary[63].Indra Gandhi, as leader of the nation had to find a way around this impasse, so, according to an insider observer, "*given the barriers to development of aerospace science and technology, she had no option but to centralize policy-making for the rapid and silent evolution of military missile and civil space launch vehicles.*"[64]

Advocates of self-reliance disagreed, some more and some less, pointing out that developing technologies from scratch in India built up the essential capacity to understand, adapt, or modify state–of-the-art technologies, and then to assimilate with new ideas. The self-reliance advocates pointed out that technology transfer from other countries was costly too; going forward and going backward were focal to the debate

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[62]Anderson, R.S. (2010). *Nucleus and Nation: Scientists, International Networks, and Power in India.* Chicago and London: The University of Chicago Press

[63]Ibid. See; pp.500.

[64] Ibid. See; pp.515.

around the best way to produce and distribute technologies staring from cell batteries to computers, rockets, and reactors. The advocates of the policy too continued with an official duplicity about self-reliance in those projects, urging and supporting indigenous development in science and technology, yet importing when it was expedient or cheaper, or otherwise advantageous.[65]

So, from the above explanations we arrive to an understanding that the debate around Technological Self Reliance is quiet an ambiguous one, the scientist, technocrats, and policy framers has their own fair share of arguments. Anderson states that the two central problems in India's development one which was *"securing national resources and instruments of power, and increasing the economy's self-reliance"*[66] were something which remained unsolved throughout the lives of India's notable scientist like Saha, Bhatnagar and Bhabha, and which we believe that it still continues to do so.

The strategy of economic development was shaped by the colonial past and the nationalist present. For one there was a conscious attempt to limit the degree of openness and of integration with the world economy, in pursuit of a more autonomous, if not self-reliant development, and the state was assigned a strategic role in development because the market, by itself, was not perceived as sufficient to meet the aspirations of a latecomer to industrialization; an approach which represented a consensus in thinking about the most appropriate strategy for industrialization.[67]And, the strategy to achieve it was debated over and again, which concludes that Technological Self Reliance as an ingredient in plans and policy documents have been influenced by intellectual traditions which prevail in India at a particular point of time.

North (1993) states that *"Belief structures get transformed into societal and economic structures by institutions- both formal rules and informal norms of behavior. The relationship between mental models and institutions is an intimate one. Mental models are the internal representations that individual cognitive systems create to interpret the environment; institutions are the external (to the mind) mechanisms individuals create to structure and order the*

[65]Anderson, R.S. (2010). *Nucleus and Nation: Scientists, International Networks, and Power in India*. Chicago and London: The University of Chicago Press

[66] Ibid.

[67] Nayyar, D. (1998). Economic Development and Political Democracy: Interaction of Economics and Politics in Independent India', *Economic and Political Weekly*, Vol. 33, No. 49 (Dec. 5-11), p. 3123.

environment."[68], if so the then the intellectual tradition which comprised of Nehru, Gandhi and Tagore's thoughts shaped Technological Self-Reliance as an ingredient in India's plans and policies.

If one reviews the plans and policies effort of the last two decades in this perspective, one sees many feature in it which are in tune with Nehru, Gandhi and Tagore's thoughts. The encouragement given to small industry development, the recent emphasis on agro- industrial growth pattern, the implementation of rural industrial projects, and the curbing of monopolies and restrictive trade practices in the industrial sector can be cited as definite trends that bear the influence of Gandhi's thinking.[69]Tagore on the other hand, *"wrote supporting the idea of through planning, supporting Nehru in his new role, and urging him to be strong-minded."*[70] He was however against dependence on foreign assistance for a nation's development, and regarded receiving favours from others as 'the true sign of a pessimist who does not believe in one's own strength, and in this mental sense, a sign of hopeless poverty', and such dependence, according to him, would be a self-defeating exercise[71]. He desired the exercise of national self-strength and independence, to be rooted in collective self-initiatives of people at the grassroots community level, and fervently advocated self-reliant collective village development initiatives to meet village needs for economic, cultural and social upliftment. He saw independence of communities proudly exercising self-rule, as the independence of India in its truest sense.[72]

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[68]nobelprize.org/nobel_prizes/economics/laureates/.../north-lecture.ht. [Accessed on 17-07-2011].

[69]Vepa, K., R. (1975).*New Technology: A Gandhian Concept.* New Delhi: Gandhi Book.

[70]Anderson, R.S. (2010). *Nucleus and Nation: Scientists, International Networks, and Power in India.* Chicago and London: The University of Chicago Press.p.111.

[71]Md. Anisur Rahman, 'Roots of action research and self-reliance thinking in Rabindranath Tagore', action Research 2006, Sage Publications, 2006.pp.231–245.

[72]Ibid.pp.236-237.

Chapter 5

Chapter 5

Conclusion

Technological Self-Reliance is not merely a phrase to ornament national policies, but it is the strive for a nation's identity; and if, Technological Self-Reliance is to enable a country to reduce its imports of technology, domestic supply of technology should progressively meet the domestic demand not only in the national but equally at the local level. And as per the discussion in the Chapter 4, of how the institutions, both formal and informal, are responsible for the conceptual setting of policy framework, we held that the thoughts of Nehru, Gandhi and Tagore contributed in shaping the understanding of Technological Self-Reliance in policy making in India.

There were differences between Nehru, Gandhi and Tagore in their approach to Technological Self-Reliance. Nehruvian thoughts have been incorporated in the way India approached development issues through technological policies, which involved explicit and implicit policy measures that encompassed the part of the state in embracing the industrialisation process through state intervention, emphasis on policy instruments were laid down which encouraged the changes and settings of science and technology policies.[1] On the contrary, Gandhi seldom used the terms 'science' and 'technology'; his concern was with civilization and mechanization, and machinery as an ally of capitalism was problematic for Gandhi and but agreed that some key industries were necessary and though he did not professed it, preferred they be under state ownership, provided the state followed non-violence.[2] He declared that he was not opposed to science but wanted to put

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[1] Indiresan. P.V. and Gulrajani, V.M.L. (Ed.). (1989). Development through Technology-a symposium on nehru's vision. New Delhi: Indian Institute of Technology. Huaz Khas.

[2] Kumar, D. (2007). p. 357-358.

limits 'upon scientific research and the uses of science'; he did not object to industrialization as long as it remained humanitarian and added to the productive capacity of the nation; he advocated a sense of social accountability in scientific endeavour and was concerned more with distribution rather than production.[3] Likewise, Tagore saw the meaning of India's independence struggle as one to primarily liberate the creative energies of its people, rather than mere constitutional independence; which he saw not as an end in itself but also as a means of creating space for the flowering of people's creativity.[4]

Nehru found the possibility of economic progress mainly through science-based technology, and though socialism was a model, a version of democratic socialism with a mixed economy was generally accepted by the National Planning Commission as the basis for future development.[5] In an alternate vision for progress, Gandhi's ideology was a contrast to the Nehruvian ideals of progress and development. Gandhi advocated agriculture and cottage industry, village-self-sufficiency model of self-rule, Gandhian thought was not against all machinery, but rather against the 'craze' for labour saving devices while men went about unemployed[6], which Khadi and Village Industries Commission has neutralised. Tagore experimented with co-operative based collective self-development, through people's self-initiatives and self-reliant village development activities which were not only economic but social as well[7].

The thoughts of Nehru, Gandhi and Tagore were taken into consideration in designing the policies on Technological Self-Reliance in a complex way. While setting up of big industries, large scientific laboratories were perhaps in line with Nehru's vision, promotion of cottage industry found its way into the policymaking due to Gandhian insistence. Although, technology policies sought to promote cottage and village level industrialisation, it was not much explicitly mentioned about how these industries would

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[3] Ibid.

[4] Md. Anisur Rahman, 'Roots of action research and self-reliance thinking in Rabindranath Tagore', action Research 2006, Sage Publications, 2006, p. 236-237.

[5] Kumar, D. (2007). 'Reconstructing India: Disunity in the Science and Technology for Development Discourse, 1900-47', *Social history of Science in Colonial India*. Oxford University Press, New Delhi, 2007, p. 360.

[6] Zachariah, B. (2005). *Developing India- An Intellectual and Social History, c.1930-50*. New Delhi: Oxford Uni. Press. p. 157.

[7] Ibid.

promote creative energies of rural people, something Tagore would have liked to see documented. In fact, Gandhi's dream of bringing scientists outside their laboratories to help rural communities also remained largely unspecified.

The new era of globalisation and liberalisation has brought about a new dimension to industry-interaction in the form of sponsored and collaborative research, transfer of technology, import substitution and the issues of intellectual property rights. In this setting Nehru's thoughts which promoted big industries, public sector enterprise, development, international co-operation and limited dependence on other counties, finds renewal. On the other hand, thoughts of Gandhi who championed the cause for the promotion of village/cottage industries grounded in traditional measures, local governance, regional level operation, public sector and employment regeneration; has not mitigated till date; we find relevance of his thinking in the growing importance of grass root innovation and promotion for indigenous technology, where more or less evidences of cooperation in regional level is found. Like Gandhi, Tagore worked for up-gradation of villages, he gave importance to creativity, co-operation, and reconstruction; at the same time like Nehru; he encouraged international cooperation wherein the ideas and skills could be exchanged between countries, for a fruitful conjunction; a cause for which he appreciated Japan's assimilation, adaptability and organisation. It can be stated that he favored soft view of technological transfer which supports symmetrical exchange, rather than a rigid view which stands for self-sufficiency and autarky. And if so then, his idea holds significance to this present day in the area of debates and policies relating with Technological Self-Reliance.

Finally, one may conclude by admitting that "*the connection between ideas and policy is often a tenuous one, after all, the linkages being intangible and difficult to trace, and the relative importance of ideas and practical constraints in the framing and, thereafter, the execution of policy is often impossible to establish*".[8] Nevertheless, we have tried to assimilate the literatures available to arrive at feasible understanding; but for a more established conjectures a thorough research is required in this area.

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[8] Zachariah. B. (2005). *Developing India- An Intellectual and Social History, c.1930-50*. New Delhi: Oxford Uni. Press.p.9.

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