Economies of Scope: Context of Agriculture, Smallholder Farmers and Sustainability

Amar KJR Nayak
Professor of Strategy & Chair Professor, National Bank for Agriculture and Rural Development,
Xavier Institute of Management, Xavier University, Bhubaneswar, India. June 2016
Email: amar@ximb.ac.in

Abstract

Tracing the evolution of theory and practice of '*economies of scale'* during the last three centuries of industrial revolution, the paper shows the irony of adopting *economies of scale* time and again only to face greater economic recession, market failures, climate changes, food crisis and growing un-sustainability of our ecosystem. The article analyzes the significance of '*economies of scope'* in the context of (a) basis of efficiency in agriculture versus industry, (b) operational dynamics of scope and scale across sectors in agriculture (c) organizational design and institutional architecture with the logic of scope. Further, through empirical evidences from smallholder farmers and farmer producer organizations from across India, the paper highlights that '*economies of scope*' in agriculture is not only more efficient for nutritious food production, wellbeing in farmers and their communities, and local climate healing but also for the sustainability of agricultural ecosystems and the overall socio-economic-environment. Based on the analysis and empirical observations from action research during the last eight years, the article provides three tracks viz., science of economies of scope in agriculture, optimal organizational design in the light of economies of scope, and optimal institutional architecture for stable relationship among producer organizations and markets.

Key Words

Economies of scope, economies of scale, climate healing agriculture, open systems, smallholder farmers, organizational design, institutional architecture and sustainability

Introduction

In the last three hundred years of industrial revolution, the theory and practice of '***economies of scale'*** has greatly snowballed. Scale has been the basis of efficiency and growth in industrial production. Accordingly the industrial enterprises and their shareholders in the secondary and tertiary economic activities across the globe have grown and prospered. More often than not, the governments across geographies have tried to resolve the problems of inefficiency in industry and economy through scale and technology. So has been the quest for scale under the aegis of globalization.

In the context of increasing mainstreaming of the ideas of ***economies of scale*** in agricultural production and its associated features across the value chain in agriculture; this paper explores into

whether this mainstream thought and action lead to sustainability of agriculture, and wellbeing of small farmers and retail consumers of agricultural produce. Empirical evidences from a transitional economy like India from the domain of agricultural production, enterprises of smallholder farmers, purchase preference of retail consumers seem to suggest otherwise.

In the above light, this paper analyses the relevance and significance of '***economies of scope***' in the context of agriculture and smallholder farmers from efficiency, wellbeing of rural communities and sustainability perspective. The comparative analysis of industry and agriculture for respective efficiency shall be on three key dimensions viz., (a) basis of efficiency, (b) dynamics of scale and scope in industry and agriculture and (c) organizational design and institutional architecture to fit the logic of scope.

Wellbeing of rural areas; in this paper, means efficiency of smallholder farms, nutritional security of farmer families, increase in net incomes to smallholder farmers, local ecological balance and overall sustainability of local ecosystem including agricultural system, farmer organization, institutional architecture and environment at a district level.

Economies of Scale: Evolution of Practice & Theory

'Economies of scope' has been a powerful idea for achieving operational efficiency across the commercial and industrial enterprises. Over the years, the logic of economies of scale has also impacted agricultural production globally. The revolution of agriculture probably occurred in the Middle East about ten millennia years ago and independently developed in other parts of the world. People lived in small communities and cultivated for their own consumption. To avert risks of famines and floods, people tried to grow more than required for consumption and stored them for potential natural calamities. However, the nature of agriculture remained to be small, ecosystem specific and largely self-sufficient especially in geographies like the Indian sub-continent in the temperate zone with abundant flora and fauna.

With the development of science and technology, came the Industrial Revolution in the eighteenth century. This second revolution of mankind has indeed greatly impacted the lives of human beings. It has not only transformed the nature and quality of human life but has also transformed the first revolution of agriculture and our ecosystems as a whole. From an open production system in agriculture, industrial revolution adopted the closed production system by way of factory production. Factories were owned by the rich and wealthy individuals, where operational efficiency became the major concern of factory managers as would be desired by the owners of these factories. Unlike in an open system, many of the variables of production could be controlled in a closed factory production system and hence the efficiency of operations surely improved in such systems.

Since the factors of production could be controlled, there was scope for individual owners and their managers to better manage the variables and hence be more efficient. Increase in scale of

production led to lowering costs and hence was a natural logic for greater efficiency. Greater efficiency in production attracted more entrepreneurs to invest in the factory system of large production. Scale lowers cost of production (Dobrev & Carrol, 2003) and helps in several ways such as (a) purchase and make use of specialized manufacturing equipment, (b) derive saving from operational expansion and quicker pay back of investments in production facilities and capacity expansion, (c) promote in-depth employee specialization based on an intricate division of labour, (d) extract rent from experiential learning and benefits of high frequency with which same tasks are carried out, and (e) reduce per unit overhead cost. Scale also facilitate gain substantial market share in a competitive market. This helps large scaled firms to force customers and suppliers to become price takers as well as to review their own strategies in light of their dependency on local firm. Scale also serves as a strong barrier to entry.

These obvious advantages of scale in industrial production have caught the imagination of the economists from the time of Adam Smith in the 1770s; from the beginning of industrial revolution. While the idea of '*economies of scale'* has been the mainstay of discussion and research among the economists since 1770s, the idea of '*economies of scope'* have appeared intermittently within the history of economic thoughts. In his book Wealth of Nations, Adam Smith (1776) discusses the notion of *economies of scope* in the light of how division of labor is limited by the extent of the market for a product or service. He observed that a person needs to engage in multiple activities because the product or service that a person offers is limited to the nearby smaller market and cannot be sold in far off and large markets. In other words, scope limited growth and for one to reach his product or service in far off larger markets, he has to specialize on a particular product or service. In the context of industrial culture and production economics, Adam Smith and the other leading economists were indeed right and rightly so, they buried the idea of *economies of scope*.

As the industrial enterprises grew with the growth in industrial production and trade, several social, cultural, and environmental issues emerged. Marx (1927) described the problems of value appropriate of labor by the owners of the enterprise and the alienation of man from his life and culture due to over mechanization and industrialization. Joseph Schumpeter (1942), on the other hand argued that capitalistic model of production led to creative destruction and loss of value for the society; which may therefore ultimately collapse from its own internal contradiction and weight. However, the idea of *economies of scale* as propounded by Smith and others along with the industrialists who had a great appetite for growth; kept the idea of scale to grow. That the division of labor is limited to the extent of market; proposed by Smith was reiterated by Stigler (1951).

With markets becoming more competitive for the industrial products during the first 200 years of industrial revolution, the idea of *economies of scope* reemerged in 1970s. Panzar & Willig (1977) brought it back to the discourse of economic thinking by arguing for *economies of scope* in multi-output production. David Teece (1980) extended this idea by his empirical observations of scope for diversification to multi-output from single input especially in the petroleum industry in USA. *Economies of scope* in business and product diversification were seen as ways to open new avenues

of growth in highly competitive industries and markets. The ideas of scale and scope were however applied essentially to industrial production systems, at the secondary level production.

To the broader arguments of Marx on Capitalism, North (1984) argued instead that the core problems of both capitalism and communism lay in *specialization* and *division of labor*. Further, explaining the limitations of transaction cost analysis, North(1984) argued that the *economies of scale* built on the basis of specialization and division of labor that was supposed to reduce the transaction costs neglected to recognize the significant increase (nearly 50%) indirect transaction costs.

Despite the observations on the limitations of industrialization and mass scale production; the clear benefit of greater efficiency of production through scale led to formation of large enterprises. In the United States of America, firms followed a three pronged investment strategy to invest in production, managerial pool, and distribution to grow ahead of the European firms (Chandler, 1990). Europe and Japan soon caught on with this strategy of growth.

With larger scale of production, supply often overtook demand. This would occur because scale based production is a step function due to indivisibility of production technologies. With greater competition, the local markets in these industrial economies saturated gradually and hence the surplus production had to be exported out to other markets. Hence, the logical step to scale was expansion of markets through geographic expansion; with which began the globalization of business. From the 1880s, international trade and business grew uninterrupted till around the 1920s. War & economic recession in 1920s favored state intervention in the economy. Keynes (1936) argued for welfare state through his book, General Theory of Employment, Interest and Money. These arguments supported the government investments in large scale state owned enterprises during 1930s to 1970s.

Despite the argument for smaller production and implementation of the New Economic Policy under Lenin in USSR by Kondratiev (1921), Stalin followed the large scale production through the large state run enterprises. Many of the European countries including United Kingdom, Germany and France also promoted several large state owned enterprises in the 19th century. Following the global trends, countries like China and India promoted large scale state owned enterprises since they became independent in 1950s.

To facilitate global trade and business arising out of the surplus production and recession in the western industrial economies during the inter-war period, 1919-1939, the Bretton Woods Conference (July, 1944) chaired by Keynes proposed formation of the international agencies viz., World Bank, International Monetary Fund (IMF) and International Trade Organization. The basis for these global institutions fitted the idea of managing scale through global expansion of markets. While World Bank and International Monetary Fund was approved by the 44 Allied Nations that attend the conference, International Trade Organization was approved only as a milder version as General Agreement on Tariffs and Trade (GATT).

However, expansion of markets in the developing countries by the large enterprises from the western countries was stalled during 1950-1970 by the protective mechanisms imposed by the countries like India and China the former colonies of the western countries and which became independent after the Second World War (Jones, 1996, Nayak 2008). As a result, the large enterprises from the western countries could not offload their surplus production in developing countries; resulting in greater competition within and among the industrial economies. From scale, the source of competitive advantage became technological innovations. As a result of market saturation and very high competition based on technological innovations, many of the large enterprise, especially the state owned enterprise became unviable. This led to the beginning of privatization of state owned enterprises in the western countries.

Despite international political maneuvering for global expansion of markets, the industrial economies could not balance their production capacity with the expanded global markets. Observing the problems of scale in industrial production; its negative impacts across the countries, a wave of thought emerged in 1970s. Schumacher (1973), argued for appropriate technology that could be small and hence sustainable. Scholars working on multinational corporations that operated on scale and the trends of global trade and investments had also begun to perceive the dangers of the large corporations. Vernon (1971, 1977) argued that the large corporation through their scale of operations could undermine the sovereignty of other small countries and societies.

However, as the global trade and business picked up in the 1970s (Jones, 1996, Nayak, 2008), the industry magnates, policy makers and international agents of trade and commerce pushed forward the ideas of large scale operations. The excitement of growth and prosperity through large scale production' although for a few in the industrial economy, was blissfully ignored by the scholars and academia for any deeper analysis. In addition, by the 1990s, with maturing of practices and theories of private property rights, commercialization and control of innovations in product and process technologies, and coercive opening up of global markets; the market competition intensified globally. To cope up with the intense competition, a wave of strategic mergers and acquisitions in USA and Europe began in 1998. Accordingly, countries across the world had begun to relax the clause to restrict monopolies in order to protect private corporations of their respective countries, as it otherwise threatened the business and employment of key stakeholders of their respective national polity.

The scholarship in management science since the 1990s had more observations and ammunition to argue for specialization at the firm level to be competitive in the global markets. Prahalad & Hamel (1990) argued for focusing on core competence and Porter (1991) argued for strategically managing the external forces to keep the barometer of profits of the business entities. True to their allegiance to the idea of corporate growth and private wealth creation, the management scholars took great pride in spreading these ideas of economies of scale in the classrooms of business schools where the future managers of corporations were to be groomed. Chandler (1990) observed that enterprises across America, Britain and Germany had pursued scale to expand their business. Multinational enterprises that were perceived to be the engines of growth (Jones, 1996) by some business

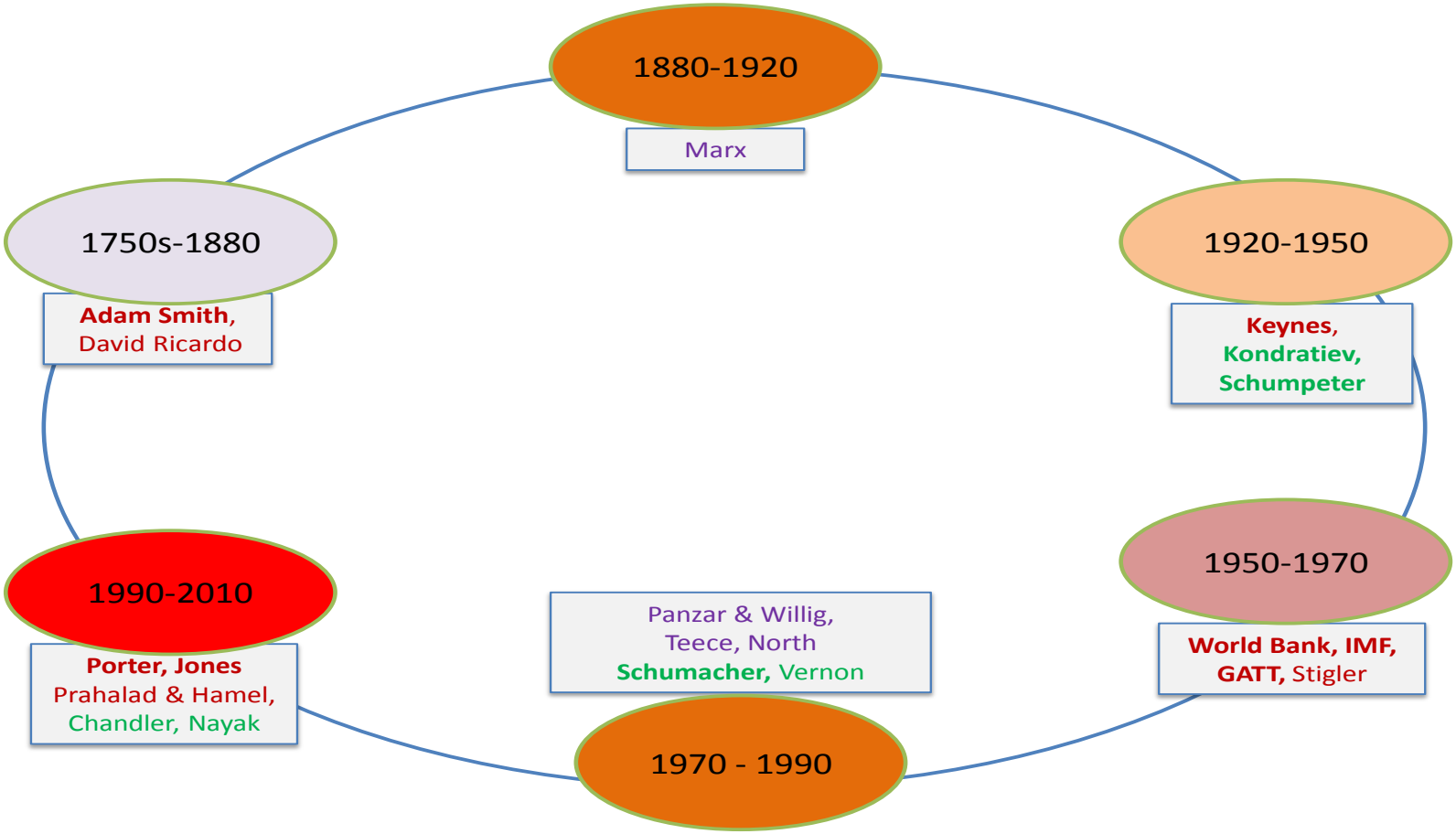
historians, was being deemed as leviathans of the global society by other set of business historians (Chandler & Mazlish, 1995). The explosive growth of Indian multinational enterprises during 1991-2010, in the post liberalization, privatization and globalization period has largely been an outcome of maneuvering capacity of the owners of large enterprises over the various political, industry, social, and knowledge networks (Nayak, 2011).

After 50 years of its inception; GATT finally in 1995 culminated as the World Trade Organization to regulate the international trade and business. World Bank, IMF, and WTO systematically argued for liberalization, privatization and globalization in the developing countries and even in the erstwhile USSR. Since the 1990s, there has been a great momentum in the expansion of global trade and business. Subsequent intensive global competition has lead to large scale mergers and acquisition across industries and across the globe furthering the idea of economies of scale.

During these three centuries, industrial economies have faced several business cycles, economic slowdown and recession, battle over currencies, economic war, political war, and alarming climate changes. Ironically, the problems of one business cycle are attempted to be resolved by applying more of the ideas of *economies of scale*. It appears that economies and industries are locked into scale and specialization for survival. Whether the outcomes of the policies based on scale and specialization led to the global economy moving from bad to worse over these business cycles is yet to be analyzed and recognized. The summary of the evolution and spread of the idea of economies of scale with some brief interjections by the ideas of *economies of scope* to the mainstream discourse of economics during the last three centuries is shown in **Figure 1.0**.

Figure 1.0

Evolution of *Economies of Scale* under the aegis of *Industrial Revolution*, 1700s-2000s



I. Basis of Efficiency in Agriculture versus Industry

It is increasingly being pointed out that sustainability of agriculture shall depend on systematic and scientific management of soil, seed, moisture, diversity in farms, and local ecology. More than the external industrial inputs of fertilizers, chemicals, pesticides, healthy soil management have been explained to be the key to high yield and sustainable production (Howard 1943, 2013). Soil health is linked to the overall management of other dimensions of moisture management, seed, cropping pattern, and integration of agriculture with livestock and forestry. All these improve the micro ecosystem that enhances the condition for better plant protection and better agriculture (Collette & Kenmore et al 2011, Rupela 2011).

Similarly, the scientific experiments in the recent years in India prove the above points (Gopalakrishnan & Rupela et al 2012, Pannerselvam 2013). A large number of research studies across India also lead to the same conclusion that productivity and efficiency in agriculture lay in sustainable agriculture practices (Shiva.1993, Alvares 2009, Nayak 2012, CRIDA 2012, and Nayak 2014).

International research and studies across the world by different agencies are also building up the argument that agriculture has to adopt sustainable methods by following the basic principles of bringing back life to the soil through integrated agro ecological agricultural practices (IAASTD 2009, Third World Network 2012, and UNCTAD 2013). Several research reports from across the world indeed argue for small scale diversified and integrated methods of agriculture. These studies essentially suggest that it would be logically flawed if '*economies of scale'* were applied in agricultural ecosystem unlike the logic of scale in industrial production.

The core contextual difference between agriculture and industry is on the nature of production system. On the one hand, high bio-diversity in the life systems, deep interconnections and high levels of interdependence characterizes the open system of agricultural production. On the other hand single product specialization, sequential, linear and uni-directional relationships are the characteristics of a closed industrial production systems.

Contrary to the basis of efficiency in a closed system, the basis of efficiency in an open system is the high degree of interdependence and cooperation. The high frequency of interactions and high degree of relationships among the various actors and actants are the sources of efficiency in production. The network of relationships is often of dense and complex in nature. Bio-diversity is the essence of life in such networks. In other words, *economies of scope* seem to provide a coherent logic of agricultural ecosystems and the basis of efficiency and sustainability in agriculture.

Characteristics of Owners in Agriculture versus Industry

It is also important to understand the characteristics of the owners of production in agriculture and industry. On the one hand, over 80% of the owners of production in agriculture are the smallholder farmers. Their resource base in terms of assets, capital, technology, information,

modern equipments and associated skills are rather weak. Their capabilities are more on indigenous knowledge and techniques of production and most of their resources are in the form of common resources. On the other hand, the owners of industrial production comparatively have greater asset, capital and technology base that are governed by private property rights. Given the different levels of factors of productions and the principles that govern them, mechanism to achieve efficiency could be quite different for these two diverse groups of producers. Further, while the purpose of an investor/owner in an industrial production system is to rotate capital for generate greater return on capital invested; over 80% of the owners involved in agriculture are into subsistence agriculture with a purpose to ensure food and nutritional security of their families.

II. Operational dynamics of scale and scope across sectors in Agriculture

In the first stage of evolution of an economy, agriculture; the primary sector typically is the main driver of an economy. In the second stage of evolution, the secondary or manufacturing sector including the value adding activities of agricultural produce drives the economy. As the economy matures, the tertiary or service sector which includes retailing of food products drives the economy.

As the value chain of primary, secondary and tertiary economic activities of agriculture evolves and matures, the point of gravity moves from the community of farmers to secondary level processing factory. For some period of time, the processing factory becomes the centre of gravity in the value chain that balances both the farming community and the retail outlets/chains (intermediate market place). As the retail outlet/chain grows larger, develops good hold over the final consumers, and grows in its size of business, it becomes the centre of control on the other actors of the value chain. The direction of control over time gradually shifts from the farmer to the marketer and finally the direction of control of what is to be produced and at what price is reversed.

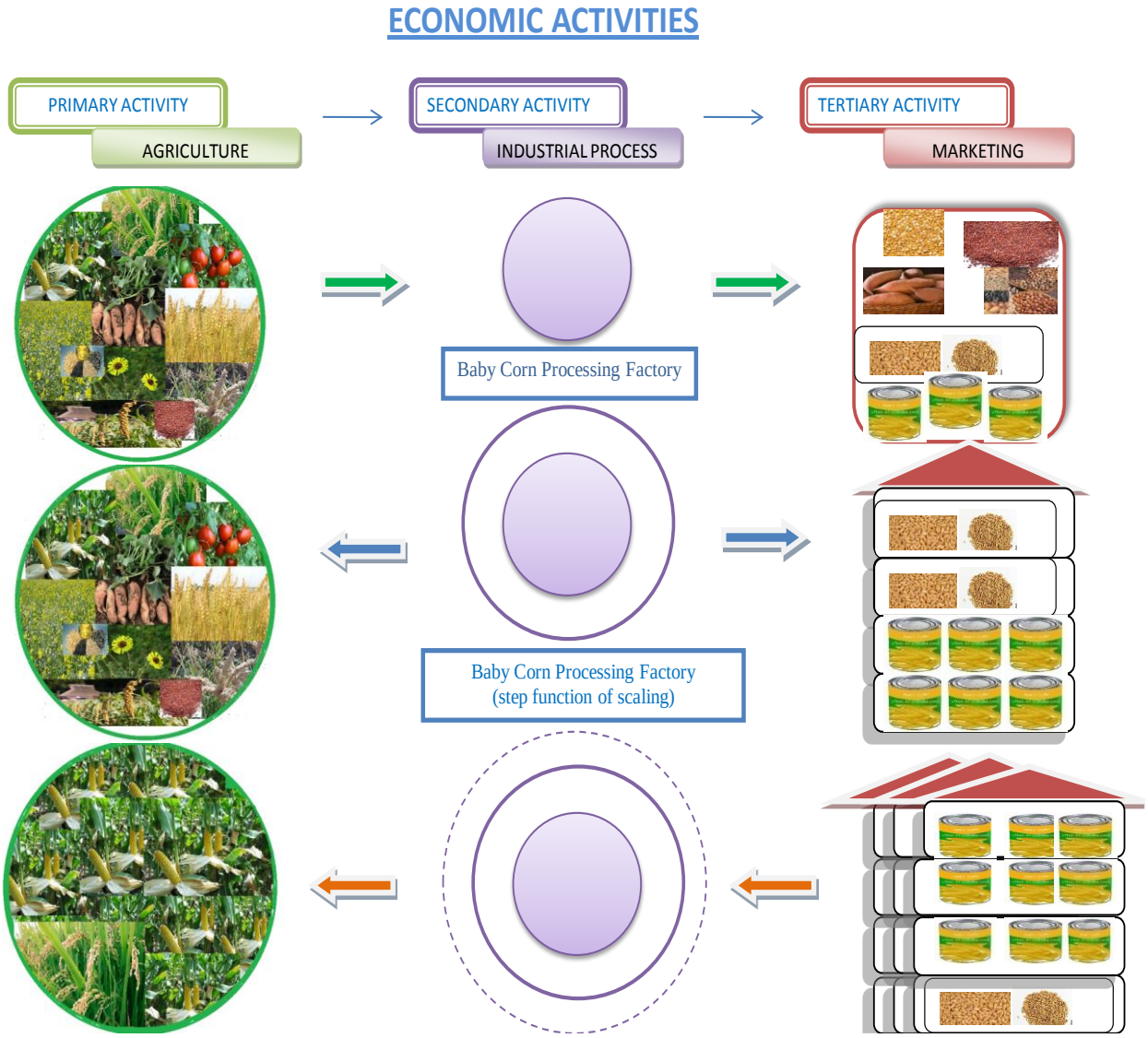
As the focus of control shifts to the manufacturer / food processor, who is preoccupied with the efficiency of the capital employed in the factory, the processor will naturally adopt ***economies of scale.*** In return the manufacturer / factory processing unit will promote production of a single crop (say baby corn) that his factory specializes in processing and packaging. In the subsequent stage, the tertiary economic agent, the owner of a large retail chain or a large exporter of processed food may emerge to be centre of gravity or the point of control in the value chain. The primary concern of this tertiary actor, efficiency of capital employed for marketing shall be best with economies of scale.

Accordingly, the demand and price mechanism for the single product (say baby corn) at both the secondary level and tertiary level of this value chain tends to alter the cropping pattern of the farming community and make them largely a baby corn producing community. **Figure 1** represents the different stages of an economy and the associated centre of gravity and how the

direction of control shifts; transforming the cropping pattern at the farmers' level and reduction in choice of products at the final consumer level.

Figure 1:

Direction and Point of Control at different of evolution of a Value Chain



Scale of operation of individual enterprise in the value chain appears to determine the power of control. Among the three actors in the value chain, the capacity to engage in large scale operations is available with either the owner of the food processing unit or the owner of the large retail chain / processed food exporter. Given the limited resource base, it is unlikely that the smallholder farmers become the centre of gravity in the evolved value chain under the industrial product-market economy. Hence the smallholder farmer is bound by the demands of the secondary and tertiary sectors that are driven by the logic of mono-cropping or ***economies of scale.*** The tensions across these three sectors arise out of multiple perspectives, viz., moral, technical, and systems perspectives. **Table 1** provides the details of the three perspectives under different stage of economic activity.

Table 1:

Moral, Technical & Systems Perspective at different levels of economic activity

Perspective	Primary Economic Activity	Secondary Economic Activity	Tertiary Economic Activity
Moral Perspective: Primary Stakeholders	• Smallholder Farmers • Rural Youth • Rural Resource Poor	• Industrialists • Investors in Manufacturing • Technical professionals	• Banks & Financiers • Large Wholesalers, Distributors & Retail Chains • MBAs/Professionals • Neo classical Economists
Technical Perspective: Efficiency Criterion	• Economies of Scope (*Nutritional Efficiency*)	• Economies of Scale (*Production Efficiency*)	• Economies of Scale (*Operational Efficiency*)
Systems Perspective: Institutional Architecture & their relationship	• Interconnections • Interdependence • Higher frequency of interactions • Bio-diverse and networked relationship • Greater depth of relationships that not only facilitate efficiency but sustainability	• Relationships are more linear as in a chain • Relationships are contractual in nature • Institutional architecture is a top-down design • Chain, contractual, arms length relationship is preoccupied with achieving efficiency	• Relationships are more linear in design • Relationships are contractual with institutional buyers and need to be contractual as well as personal with retail buyers. • Institutional architecture is a top-down design

III. Organizational Design & Institutional Architecture with logic of Scope

Depending on the logic of efficiency adopted, whether scope or scale, the associated organization design variables viz., size, technology, ownership, and management would vary. The deep seated logic, language and values will be different for each of these paradigms (Nayak, 2014). The institutional architecture could vary from being top-down under scale economies to bottom up under scope economies. Further, under scope economies, there would be optimal lower and upper limit to the institutional architecture unlike the borderless view under scale economies.

Empirical observations however suggest the policies and practices on the ground do not seem to observe these differences. The performance of farmers and farmer producer organizations that do not distinguish these differences also show varying performance. Like in industrial production, the institutional architecture for agriculture is top-down. Policies and programmes flow down from the central and state governments to the farmers. These programmes are also controlled from the top making the local institutions very weak. There is very little research on whether there exist an optimal lower limit and upper limit for institutional architecture for agricultural systems to be sustainable.

Observations & Empirical Evidences across India

Performance of smallholder Farmers adopting Scale versus Scope

India has had a rich bio-diversity and highly productive low cost integrated agriculture systems, as applicable to local soil and agro climatic conditions and over many millenniums of agriculture in India. However, over the last two hundred years, the low cost producer oriented agriculture has been converted to the high cost market oriented plantation and mono crop system (*conventional – green revolution*). The usage of industrially produced fertilizers, chemicals and pesticides has gradually transformed the characteristics of agriculture during the past 5 decades across India.

Smallholder farmers adopting precision agriculture adopting mono-cultures with large external industrial inputs are becoming unviable across India. Farmers in Punjab, where external input intensive agriculture was undertaken through green revolution about 40 years ago, today have an average debt of about 42,000 INR as compared to the national average of 20,000 INR. In one of the so called agriculturally better off districts (Balasore) in Odisha, of over 4000 farmers revealed that about 30% of farmers are making loses across the six major crops from cereals, pulses, and oil seeds and nearly 50 % of the farmers are financially unviable in their farm production practices (Nayak, 2013).

The realization of negative impacts of industrial inputs in agriculture, pesticide residues in food, especially in respect of small holder producer communities, has led to a resurgence of various low cost smallholder farmer and consumer friendly alternatives, replacing the high risk and cost

(including environmental and human costs) of external input based agriculture. Some of the major variants of sustainable practices and concepts have been agro ecology, sustainable food systems, ecological agriculture, sustainable agriculture, integrated agriculture, low external input sustainable agriculture, organic farming, natural farming, natueco farming, bio-dynamic farming, permaculture, zero budget Farming, indigenous micro organism based farming, effective micro-organism based farming, etc. Farmers adopting any of the above sustainable practices using the principle of economies of scope in agriculture that is multiple cropping patterns and integrated agriculture are found across India to be much more productive (Nayak, 2014).

Performance of Farmer Producer Organizations adopting Scale versus Scope

Empirical evidences on the performances of different forms of farmer producer organizations across India show that most of these organizations are unviable. Interestingly, most of these organizations including the better known dairy cooperatives in India are either designed or have the intent to be modeled around the designs of an industrial organizations; that is on the principles of *economies of scale* (Nayak, 2014). In summary, the performance of the producer organizations on different sustainable performance indicators viz., (a) social capital formation, (b) financial capital formation, (c) capability enhancement of the producers, (d) external networks with markets and financial institutions, and (e) engagement of producer organization with diverse needs of the community have been low.

Among the dairy cooperatives based on single input of milk, a sector that has received much technical and financial support during the last about 40 years, the above performance indicators have begun to decline. For instance, the average income for dairy famers across different dairy cooperative is around Rs. 2500 per month. The trends from AMUL, the largest and well known dairy cooperative is indeed revealing. Empirical evidences on dairy based farmers suggest that a farmer family can be viable with five or more number of milking cattle. However, currently about 73% of 3.2 million farmer members of AMUL have less than five cattle. Despite, 85% of every rupee earned by GCMMF (marketing wing of AMUL) being given back to the members; the average net income earned by the members is only **INR 3405** per month.

On the contrary, the performance of a few farmer producer organizations that have stayed small but operated on multiple scope have provided more value to the farmer members. AMALSAD, a primary agricultural cooperative society in Gujurat is one such example. The membership of this cooperative has been around 3000 from a cluster of 17 villages. It annual turnover is about INR 420 million. Since its beginning (1941) its engagement has been determined by the needs of its members; whether it were micro-credit, retail supplies, farm inputs, marketing of surplus produce of different crops, etc. Today, it also runs a hospital and petrol pump to meet the needs of its community. The average monthly income of its members is around INR 12,000 per month and the net income will be over INR 7000 per month. Action research on establishing sustainable community enterprise system through the experiment of Nava Jyoti PC

(www.navajyoti.org) shows that there can be significant performance improvements on all the sustainable indicators by following the sustainable design principles.

Summary and Research ahead:

The discussion on the ideas of scope and scale, the key pillars of two major revolutions of human history viz., agriculture and industrial revolution is indeed a discussion of the ongoing battle between these two revolutions is indeed unnecessary, uncreative and disastrous. The idea of *economies of scope* and its *science* with regard to agricultural ecosystems has not been sufficiently explored by scholarship and hence the policy on agriculture across the world has grievously gone against the nature and poses serious challenges to our sustainability.

The science of interconnectedness and interdependence of sunlight, moisture, air, soil, plant/crop bio-diversity, micro-organisms, livestock and seeds seems to hold the key to efficient, sustainable production at the primary food production level and overall wellbeing of agricultural communities. In other words, '*economies of scope'* and '*systems thinking'* rather than '*economies of scale'* and '*linear thinking*' better explain the dynamics of production in nature.

Empirical evidences on performance of integrated agricultural practices at the farmer level and the performance of farmer producer organization in terms of total benefit to the small producers across India strongly support the logic of ***economies of scope*** for greater efficiency, overall sustainability of agro-ecological systems and wellbeing of rural agricultural communities.

In the above context; first, serious research and scholarship on the *science of economies of scop*e in agro-ecological systems is required today to sensibly guide the policy on agriculture across the world before we further undermine and destroy our food production and ecosystem. Second, there is a huge research need and opportunity to determine optimal farmer organizational design on specific design variables viz., size, technology, governance and ownership with reference to scope. Third, research on optimal institutional architecture to ensure stable relationships among these farmer producer organizations is rather crucial to ensure sustainable global food production and supply system.

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Acknowledgements:

I would like to thank all the farmers practicing sustainable agriculture across India who gave me the confidence to explore this idea. Mr. Subash Sharma and Mr. Deepak Suchde are few such farmers. I would like to thank the scientists, researchers, environmentalists, and activists and especially to Dr. Om Rupela, Dr. Peter Kenmore, Mr. Subhash Mehta, Dr. Claude Alvares & Dr. Bharatendu Prakash for providing me the lead to the subject of sustainable agriculture.