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Economies of Scope: Context of Agricultural Science, Smallholder Farmers, and Sustainability

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Economies of Scope

Context of Agricultural Science, Smallholder Farmers, and Sustainability

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Abstract

The discussion of the ideas of scope and scale, the key pillars of the two major revolutions of human history viz., agriculture and industrial revolution is indeed a discussion of the ongoing **battle between these two revolutions**. The discourse in the mainstream economics has not seriously dealt with the idea and significance of *economies of scope*. Since the industrial revolutions during the last three hundred years, there have been limited and short lived interjections of the ideas of *economies of scope*. These have been limited to exploring the *economies of scope* of production within industrial production systems and focused on multi-product outputs in industrial production units. The idea of '*economies of scope*' and its *science with regard to agricultural ecosystems* has not been sufficiently explored by the scholarship and hence the **policy on agriculture across the world has grievously gone against the nature** and poses serious challenges to our sustainability.

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. It analyzes the significance of '*economies of scope*' in the context of (a) science and dynamics of production in agriculture versus industry, (b) purpose & preference of producers as well as consumers of agricultural produce versus industrial products, and (c) operational dynamics under scale and scope and their sustainability. Further, through empirical evidences from smallholder farmers and farmer producer organizations from across India, the paper argues that '*economies of scope*' in agriculture is not only more **efficient for nutritious food production** and **climate smart** but also for the **sustainability of agricultural ecosystems** and the overall socio-economic-environment.

Key Words

Economies of scope, economies of scale, climate smart agriculture, open systems, biodiversity, organizational design, institutional architecture and sustainability

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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 for industrial production. Accordingly the industrial enterprises and their shareholders in the secondary and tertiary economic activities across the globe have grown and prospered. Time and again across geographies, the economists, bureaucrats, governments and the legislators have tried to resolve the problems of inefficiency in industry and economy through scale and technology. So is the quest for scale in the present times of globalization, market warfare, social unrest, economic recession, climate changes, and impending food crisis.

In the context of increasing mainstreaming of the ideas of economies of scale and industrial corporations as drivers of growth in agriculture; this paper argues the irrelevance of these mainstream thoughts to agriculture, small producers and retail consumers of agricultural products. It attempts to bring back the significance of '*economies of scope*' not only in agricultural ecosystems but also in the context of overall socio-economic-environmental sustainability.

This paper analyses the relevance and significance of '*economies of scope*' in the light of the context of agricultural ecosystem with focus on small and marginal producers, retail consumers, and from the overall perspective of sustainability. The context is analyzed on three key dimensions viz., (a) **science and dynamics of production** in agriculture versus industry, (b) **purpose & preference of producers & consumers**, and (c) **operational dynamics under scale and scope and their sustainability**. The seven questions relating to these three dimensions include:

1. How is the science of agriculture different from industrial production with regard to the dynamics of production and efficiency of production?
2. Does the resource base (landholding) and technical capability base of small and marginal farmers in India fit to the idea of large scale production?

3. How is the prime purpose of producer & owner different in agriculture from that in industrial production?
4. How do consumers' purchase preferences differ with regard to agricultural produce and industrial products?
5. How has the primary, secondary, and tertiary economic activities interconnected with each other?
6. How does the center of gravity in value chain of surplus agricultural produce evolve and create tensions and lead to an unsustainable system?
7. How will the farmer producer organization be governed if economies of scale were adopted?

The above discussions in this paper are followed by analysis of the empirical evidences from smallholder farmers and farmer producer organizations from across India; practicing economies of scale and economies of scope. The efficiency and sustainability performance indicators are assessed from short, medium and long term perspective.

However, before we discuss the relevance of *economies of scope* for sustainability, let us first take a quick look at the evolution of the idea of *economies of scale* since 1770s and the intermittent debates on *economies of scope* in the 1950s and 1970s and subsequent mainstreaming of *economies of scale* and industrial corporations as engines of growth leading to gradual death of the idea of *economies of scope*.

Economies of Scale: Evolution of Theory & Practice

The two key revolutions of human kind have been agriculture and industrialization. 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) as it helps to:

- Purchase and make use of specialized manufacturing equipment
- Derive saving from operational expansion and quicker pay back in investments in production facilities and capacity expansion
- Promote in-depth employee specialization based on an intricate division of labour
- Extract rents from experiential learning and benefits of high frequency with which same tasks are carried out
- Reduce per unit overhead cost

Scale also facilitate gain substantial market share. 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 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 had emerged. Marx (1927) described the problems of value appropriation 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 ideas of economies of scale as propounded by Smith and other along with the growing appetite of the industrialists 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 issues of specialization and division of labor were the core problems of both capitalism and communism. 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. John 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 (Kondratiev, 1921), Stalin followed the large scale production through the large state run enterprises. Many of the European countries including United Kingdom, Germany & 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.

Global trade slowed down during the inter-war period (1919-1939). To facilitate global trade and business arising out of the surplus production and recession in the western industrial economies,

the Bretton Woods Conference (July, 1944) proposed for formation of the international agencies viz., World Bank, International Monetary Fund and International Trade Organization. Interesting John M Keynes facilitated this conference. 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).

Even after the 2nd world war, the surplus production in the industrialized countries could easily find markets in the developing economies. Expansion of markets by the large enterprises from the western countries into the developing countries was stalled during 1950-1970 by the protective mechanisms imposed by the developing countries by the large countries like India and China that were former colonies of the western countries and which became independent after the World War II.

Following the protective measures on imports by the newly independent countries in Asia and Africa, the large enterprises from the western countries could not offload the surplus production in the western industrial economies. This resulted 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.

The three global institutions of World Bank, IMF, and GATT through various negotiations and coercive methods have been able to push the developing countries to gradually open up their markets. Hence after a slow down of global business for about 50 years (1920-1970), it began to revive from the late seventies (Jones, 1996, Nayak, 2008).

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 and sometimes scope of multiple outputs 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 Chandler & Mazlish (1995) by other set of business historians. Nayak (2011) described the explosive growth of Indian multinational enterprises during 1991-2010, in the post liberalization, privatization and

globalization period as a mere outcome of maneuvering capacity of the owners of large enterprises over the various political, industry, social, and knowledge networks.

After 50 years of its inception at the Bretton Woods Conference (1944), GATT finally in 1995 culminated as the World Trade Organization to regulate the international trade and business. These three global institutions could force the idea of 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 markets, global trade and business. Large scale mergers and acquisition across industries and across the globe have been observed.

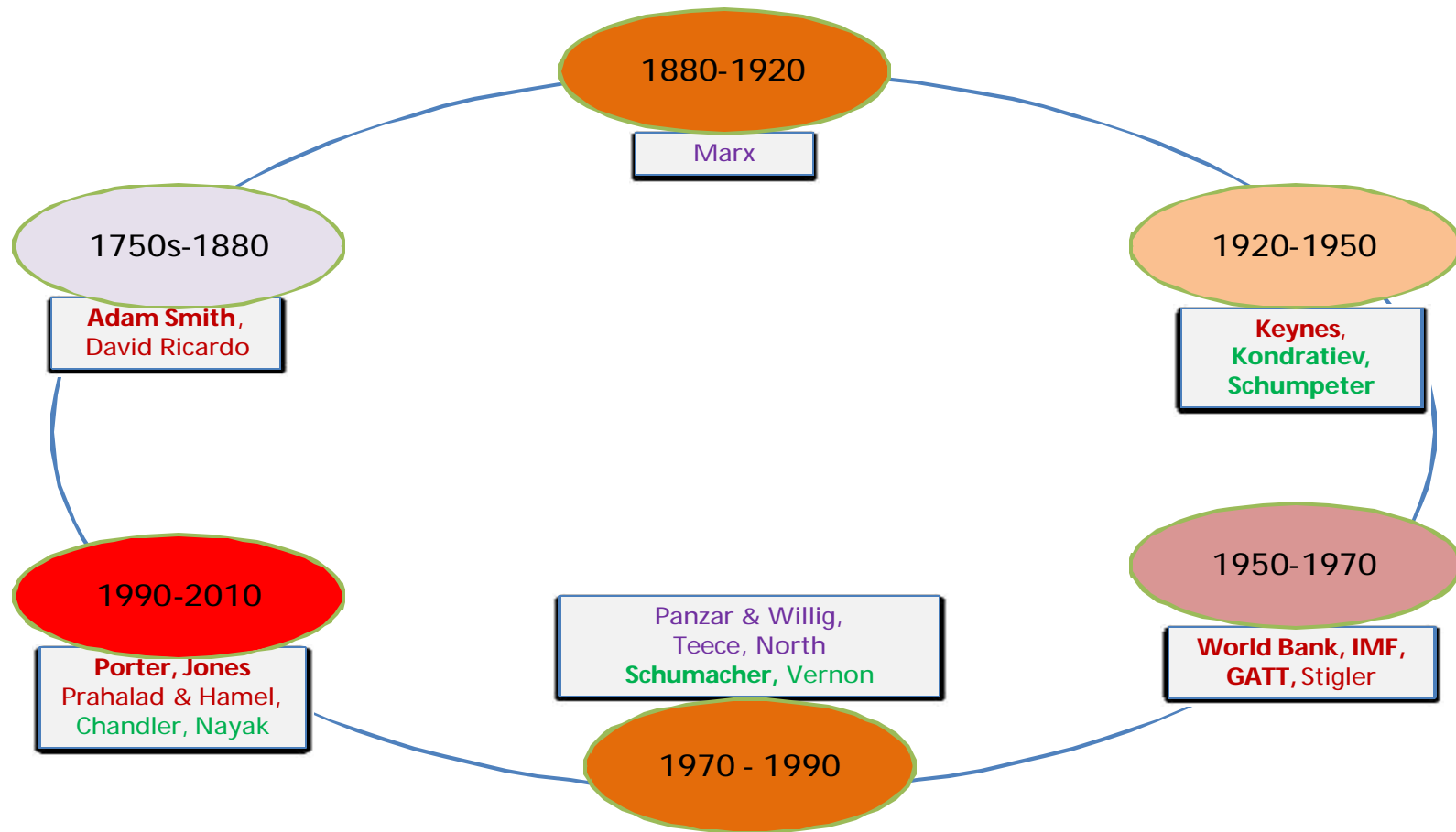
But for some brief interjections by the ideas of economies of scope to the mainstream discourse of economics, the idea of ‘economies of scale’ has ruled the economic thought processes during the last three hundred years. The focus of industrial practice and related scholarship has been the efficiency of industrial enterprises that engage at the secondary level production. So have the private enterprises as the key agents of industrial production, adopted economies of scope in their entrepreneurial ventures.

Although, at the secondary level of production, *economies of scale* appears to be efficient, there have been some strong counter arguments with regard to efficiency from lower transaction costs, alienation of industrial worker due to division of labor and over specialization, greater dependence on far off markets. However, during the last 300 years of industrial revolution we have adopted the economies of scale with specialization and division of labor.

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. However, as a matter of policy in the industrial economies, the problems of one business cycle are attempted to be resolved by applying more of the ideas of *economies of scale*. The outcomes of these policies have resulted in the global economy moving from bad to worse over these business cycles. To resolve the impending crisis of food production and nutritional security, ironically, we are today, in the quest for scale with respect to producer organizations of the small and marginal farmers in the rural/tribal agro ecological settings. The summary of this violence of industrial revolution, market expansion and globalization on the natural systems and agriculture; the first revolution and vicious cycle for global destruction is shown in **Figure 1.0**.

Figure 1.0

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



The Context of Agriculture versus Industry

The context needs to be analyzed on three key dimensions viz., (a) **science and dynamics of production** in agriculture versus industry, (b) **purpose & preference of producers & consumers**, and (c) **operational dynamics under scale and scope and their sustainability**.

The seven questions relating to these three dimensions include:

1. How is the science of agriculture different from industrial production with regard to the dynamics of production and efficiency of production?
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Science and dynamics of production in agriculture versus industry

The core contextual difference between agriculture and industry is on the nature of production system. While industrial production system operates in closed system, agriculture by nature produces in an open system. Accordingly, agriculture has been classified under primary economic activity and industrial production as secondary economic activity.

Efficiency in an open system is an outcome of 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. Intuitively, *economies of scope* make more sense than *economies of scale* both in terms of efficiency and sustainability in such settings. **Table 1.0** shows the difference between agricultural production and industrial production.

Table 1.0: Dynamics of Agricultural Production & Industrial Production

Agricultural Production	Industrial Production
Primary Economic Activity	Secondary Economic Activity
Open System	Closed System
Deep Interconnections & Interdependence	Lesser interconnections & interdependence
Network of Relationship	Linear Relationship
Complex Relationships that is only partially codified	Simpler Relationship that is fully codified
Higher Bio-diversity	Little diversity
Economies of Scope	Economies of Scale

The idea of scope can be appreciated by analyzing the relevance of ‘*economies of scope*’ at the base of our production system (plant-process-person) viz., plant as a source of converting the solar energy to plant biomass and food items, the dynamic interrelationship of sunlight, moisture, air, soil, plant/crop bio-diversity, micro-organisms, livestock and seeds for sustainable production in an open agricultural ecosystem.

It is increasingly being pointed out that sustainability of agriculture shall depend on systematic and scientific management of soil, seed, moisture, plant protection and integration of agriculture. 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, 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, UNCTAD 2013).

There are indeed several research reports from across the world that argue for small scale diversified and integrated methods of agriculture. Use of industrial external inputs destroys the life in soil and the ecosystem that make the production system inefficient in the medium to long term. In other words, the science of agriculture lay in economies of scope and not in scale.

It is also important to understand the characteristics of the owners of production in agriculture and industry. Over 70% of the owners of production in agriculture are the small and marginal farmers/producers with minimal or no landholding. Other resource base in terms of capital, technology, modern equipments, assets, etc is weak. Instead, most of their resources are common resources of the nature. The capability of the small producers in terms of external information, external knowledge, and modern technologies is similarly weak. Their capabilities are more on indigenous knowledge and techniques of production. These characteristics are contrary to those of the owners of industrial production.

Accordingly, economies of scope explain the coherent logic of agricultural ecosystems. Indeed, it would be logically flawed if '*economies of scale*' were to be applied in agricultural ecosystem. The last part of this paper provides several empirical evidences of farmers and their ecosystems across India where the practices of '*economies of scope*' has been resilient in adverse environment of industrial market economy thereby showing the ways forward for sustainability.

Purpose and Preference of Producers & Consumers

To be able to properly assess the applicability of the industrial logic of scale, it is important to understand the purpose of production by the owners of production in the domain of agriculture and in industry.

As very well understood, the primary purpose of agricultural production of the small and marginal farmers/producers is to provide food and nutritional security to his family. The surplus is to be exchanged in the market to meet the other needs of the family. Contrary to this purpose of the farmer, the industrial owners' primary purpose of engaging in a business and production activity is based on return on investment. In other words, the purpose of industry owner is to rotate capital (money) as fast as possible and create more capital out of this process. The surplus capital created out of this exchange process is then exchanged in the market system to meet the needs of the industrial owner.

Accordingly, while the industrial owners could adopt economies of scale in his production methods, the small and marginal producers cannot adopt this to meet his purpose of life. Given the production base, resource base, capability base, and purpose of production; *economies of scope* as the principle of production makes more sense to the small and marginal farmers / producers.

At this stage it may also be useful to analyze the consumers' purchase preferences with regard to agricultural products and industrial products. The typical examples of agricultural produce could be; cereals, millets, pulses, spices, vegetables, etc and the typical industrial products could be; car, television, mobile phone, computer, soap, toothpaste, etc. With regard to agricultural produce, a retail consumers or households usually prefer to purchase smaller quantities of produce but more frequently. The retail consumer would also like to buy a variety of agricultural produce keeping in view of assuring a balanced diet for the family. At the same time, for convenience sake, the retail consumer would like to buy these from a single point. Contrary to these preferences, the same retail consumer would have different preferences with regard to purchase of industrial products. The different purchase preferences of retail consumers with respect to agricultural produce and industrial product are provided in **Table 2.0**.

Table 2.0: Preference & Behavior of Retail Consumers

Agricultural Produce	Industrial Products
Examples: cereals, millets, pulses, spices, vegetables, etc	Examples: car, television, mobile phone, computer, soap, toothpaste, etc
Quality of produce is assessed from freshness, taste and safe for consumption	Quality is in terms of finish, looks, durability and safety in usage.
Purchase smaller quantities every time	Purchase one/fewer item(s) at a time
Lower amount of money spent in every purchase	Higher amount of money spent in every purchase
Frequency of purchase is high	Frequency of purchase is very low
Prefer to purchase from single stop	Buy different products from different shops
Need to purchase a basket of food products to meet taste and nutritional requirement	Buy different items from specialized shops

Given the purpose of agricultural production by the farmer and consumers' preference of agricultural produce, *economies of scope* again emerge to be the appropriate design variable in the context of the internal design of farmer producer organizations.

Operational dynamics under scale and scope and their sustainability

Having looked at the science and dynamics of production, purpose & preference of production, we need to analyze the basis for operational sustainability in terms of (a) relationships between the primary, secondary and tertiary economic activities, (b) changing positions of gravitational force and transmutation of relational structures leading to un-sustainable relationships in the value chain, and (c) governance mechanism that can balance the tensions and promote sustainable relationships.

In the history of evolution of economic activities; agriculture has been the primary activity that determined the scope of industrial activity wherein the secondary economic activity. Distribution, marketing, and other support services to the primary and secondary economic activities evolved to be the tertiary economic activity. In other words, agriculture being the

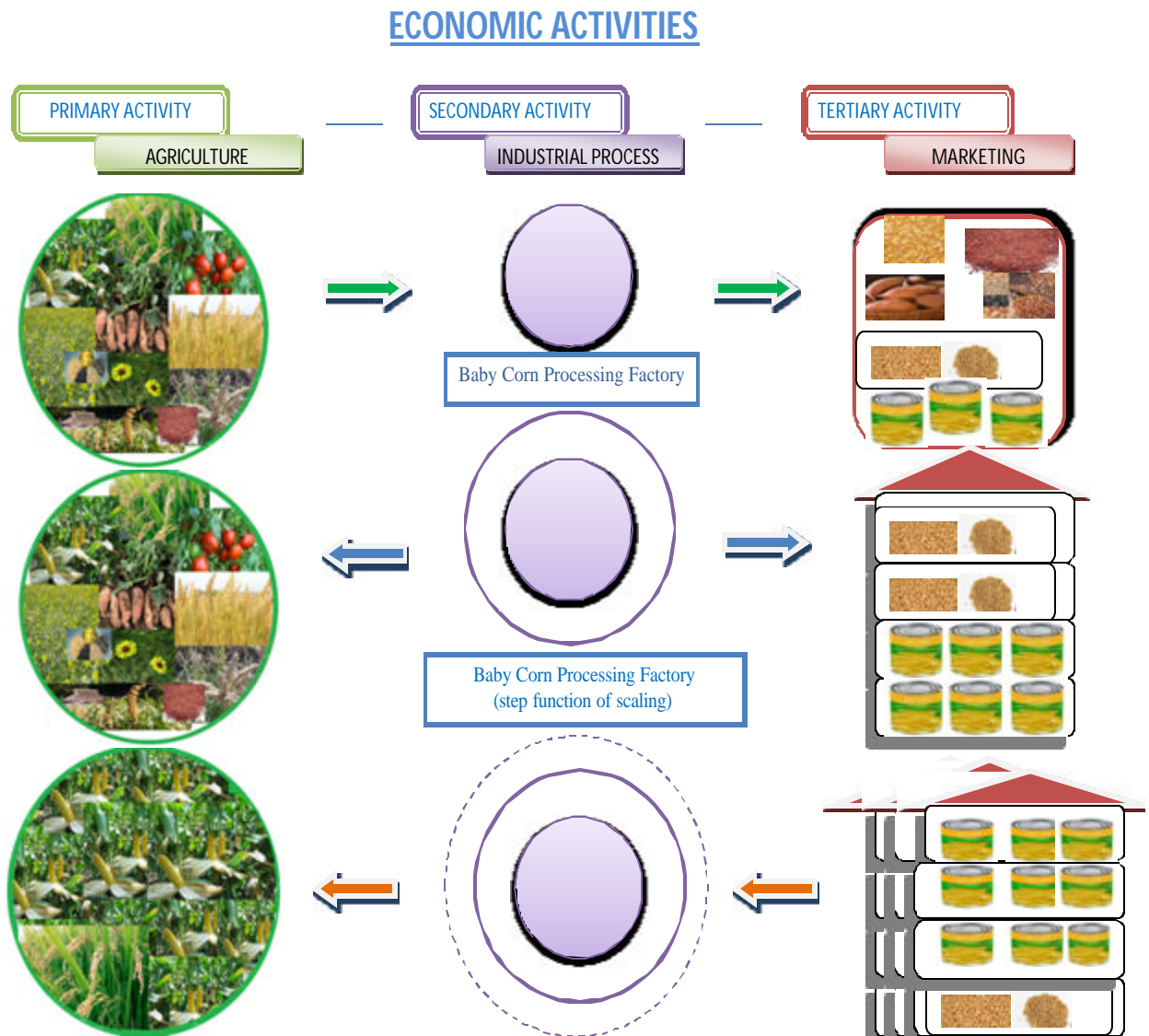
primary economic activity has naturally been the driver to all economic activities in a socio-cultural ecosystem.

However, in the top down approach under industrial production system, as the transactions along the value chain of primary, secondary and tertiary economic activities 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 actors of the value chain. The direction of control from the farmer to the marketer gradually shifts over time 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) both the secondary level and tertiary level of this value chain will alter the cropping pattern of the farming community and make them largely a baby corn producing community. **Figure 2.0** represents the different stages of a typical agriculture value chain in an industrial economy 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.

From the above analysis; at the primary level of production that is in the rural agricultural context, where the Farmer Producer Organization belongs to; how relevant is the idea of 'economies of scale'? Will *economies of scale* or *economies of scope* be more efficient and sustainable in such a context?

Figure 1.0: Direction and Point of Control at different evolution of a Value Chain



Scale of operation of individual operator/enterprise in the value chain therefore finally determines 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. In no circumstances, can the small and marginal farmers become the centre of gravity in the evolved value chain under the industrial product-market economy. Hence the small holder farmer is bound by the demands of the secondary and tertiary sectors that are driven by the logic of mono-cropping and *economies of scale*.

However, logically, the smallholder farmer, who is otherwise efficient and sustainable adopting *economies of scope*, were forced by the market forces to adopt mono-cropping in line with *economies of scale*, the result is obvious. At the cost of his own sustainability and the sustainability of the agricultural ecosystem the smallholder resource poor farmer is indeed forced to subsidize the efficiency and growth of the secondary and tertiary actors of the value chain.

To beat the industry players at the secondary and tertiary level of the present market economy, the current argument for scaling up of farmer producer organizations both in production and processing capacity is being proposed. It is perceived that this will give the small farmers the power to control prices of their produce/product in the market economy.

While the idea of economies of scale looks good and noble from the commercial-market logic, it is not supported by the science and dynamics of agricultural production; as already discussed. More over the small holder producers with their limited landholding; whose primary concern is to provide food and nutritional security should not logically adopt mono-cropping. It is by adopting multiple cropping and integrated agricultural practices can the small holder farmers leverage the seasonal variations in nature to produce efficiently and sustainably to meet the food and nutritional security of his family.

If at all, the strategy would be to engage in economies of scope at the farmer level but aggregate small surplus produce from a large number of farmers to a single Farmer Produce Organization, the idea may look feasible. However, for achieving economies of the scale of a processing unit, we need to get a very large number of farmers (say 10,000 members) spread over a large geography. In such a situation, the issues of management and governance arise. Building social capital of a diverse group of farmers across large geography is rather daunting and if not developed, the management and governance shall not remain with the small farmers/producers. This situation would lead us to the same problem of perpetual dependence of farmers/producers on external agents that we face today.

From a long term performance of an operational strategy or sustainability perspective, it is not only important to assess who controls the value chain but it may be more crucial to understand the technical nature of efficiency, nature of relationships among the various players in the agro-ecological and market system along with the moral perspective towards the majority of the

producers / people at the base of the social pyramid. **Table 3.0** provides the details of the three perspectives under different stage of economic activity.

Table 3.0: Moral, Technical & Systems Perspective at different levels of economic activity

Perspective	Primary Economic Activity	Secondary Economic Activity	Tertiary Economic Activity
Moral Perspective: Primary Stakeholders	<ul style="list-style-type: none"> • Small & Marginal Farmers • Rural Youth • Rural Resource Poor 	<ul style="list-style-type: none"> • Industrialists • Industrial Buyers • Engineers 	<ul style="list-style-type: none"> • Banks & Financiers • Large Wholesalers, Distributors & Retail Chains • MBAs/Professionals • Neo classical Economists
Technical Perspective: Production Efficiency & Nutritional Efficiency	Economies of Scope	Economies of Scale (Step Function of Scaling Process)	<ul style="list-style-type: none"> • Industrial Customers (Economies of Scale) • Retail Consumer (Economies of Scope)
Systems Thinking & Sustainability: Institutional Architecture & their relationship	<ul style="list-style-type: none"> • Interconnections • Interdependence • Higher frequency of interactions • Bio-diverse and networked relationship • Greater depth of relationships that not only facilitate efficiency but sustainability 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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

What kind of organizational design and institutional architecture will be required to balance the characteristics and perspectives of different levels of economic activities? Therefore we need to design optimally sized farmer producer organizations (FPOs), that encourages *economies of scope*. We also need to put in place the appropriate institutional architecture of FPOs for their stable and sustainable relationships. The details of this may be referred to from the manual on sustainable community enterprise system (Nayak, 2012).

Observations & Empirical Evidences across India

Empirical evidences from across India on the performance at the individual farmer level and at the producer organization level shows that *economies of scope* has been the way for greater efficiency and sustainability. Adoption of *economies of scope* has been inefficient in the medium term and disastrous in the long term for both the farmers and farmer producer organizations.

Performance of Farmers practicing system of sustainable agriculture

Agriculture has been the first revolution in human history nearly 10 millennia years ago. India for instance, has had a rich bio-diversity and highly productive low cost integrated agriculture systems, as applicable to the 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 was 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 and drastically modified the characteristics of agriculture during the past 5-decades across the world.

Smallholder farmers adopting precision agriculture with large 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, a baseline study (2013) 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 to agriculture.

There are indeed a variety of agricultural systems across the world and in India as a response to the crisis arising out of conventional market oriented industrial agriculture systems in both production and distribution. 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.

There are indeed a large number of farmers across India practicing different types of sustainable agriculture whose farms are highly productive earning high net incomes. In about one hectare of land, such farmers are able to make an average net income of about INR 50,000 per month. There are several such examples of farmers in Kerala, Tamilnadu, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Odisha, West Bengal, Assam, Sikkim, Meghalaya, Rajasthan, Haryana, Punjab, Uttarakhand, and Kashmir. It is interesting to note that this level of performance among the small farmers have been observed across different micro-climatic conditions with different temperature and moisture levels (Nayak, 2014).

Performance of Farmer Producer Organizations

Organizing the small farmers to form their own organization such that they can negotiate better with the various risks of product market, input market, climate, external institutions, culture of globalization, etc has been a very well intentioned objective of the development agencies and the government. Formation of primary agricultural cooperative societies (PACS) was initiated in India as early as in 1904; over a hundred years ago. Today we have over 94,000 PACS in India. With growing industrialization and competition, single product based large cooperatives have also been promoted since 1950s. Today we have large cooperatives in sugar, textile, coir, etc. The self help group (SHG) movement began in 1980s, and today we have millions of SHGs in the country. Since 2002, there has been a movement for promoting farmer producer organization (FPO) as producer companies. As a hybrid of company and cooperative, the producer company format is being perceived as the panacea to solving the problems of the small producers, agriculture, and impending food crisis.

Empirical evidences on the performances of these different forms of producer organizations across the country show that most of these organizations are unviable. Interestingly, most of these organizations 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*. This leads to adoption of high end technology, high capital investment, focus on large and far off markets, engagement of external professional & costly managers for management, and concentrated ownership structures.

The large and early Producer Companies from the states of Kerala, Tamilnadu, Rajasthan, Maharastra, Madhya Pradesh, Jharkhand, and Bihar have had poor financial performances (Nayak, 2014). The benefits to the farmers/producer from these producer organizations have been marginal. 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. 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) is given back to the members; the average net income earned by these 73% members is only **INR 3405** per month.

Further, the members from AMUL have been gradually withdrawing from dairy activity due to increasing cost of animal fodder. Today fodder is being imported by Gujurat from other states. Although, the volume of milk procured by AMUL has never come down since its inception; it however has been depending on sourcing milk from non-member farmers from other states. The present Managing Director of AMUL feels that with cropping pattern having changed from integrated agriculture to mono-cropping with green revolution in agriculture and industrialization in Gujurat, it is difficult to reverse the growing shortage and increase in price of animal fodder.

This will lead to decline in supply of milk AMUL in the next about five years said the Managing Director of AMUL (*Interview on August 30, 2013*).

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 Gujarat is one such example. The membership of this cooperative is around 3000 from a cluster of 17 villages. Its annual turnover is about INR 420 million. Since the beginning its engagement has been determined by the needs of its members; whether it was 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.

Similarly, there are a few other such smaller and multiple product based farmer producer organization that have either focused on local markets, or sustainable agriculture. The benefits to the members from these producer organizations seem to be sound and sustainable. After trying different alternatives, few more have begun to adopt local marketing with multiple products.

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. The logic of economies of scope need to simultaneously adopt optimal membership/ownership, sustainable agriculture with local value addition, trained local management (Nayak 2012), members ownership & governance, direct local marketing within 300 kilometer distance, and careful convergence of resources and schemes of the government (Nayak, 2012).

While the traditional firms focus on a few products or services for higher efficiency of the firm, a farmer producer organization (FPO) should seek economies of scope to fit well with the characteristics of the small producers or farmers; the owners of the FPO. Given their small land holdings, smaller resource base, and the environment friendly attitude, the marginal producers can only produce small quantities of items. The surplus after consumption by the family is still smaller. Further, the production relationship is linked to the natural resources and the seasons of the year. Therefore, they are best suited to produce a variety of items during the different seasons

of the year. Accordingly, adopting the principle of *economies of scope* by way of undertaking the multiple product basket approach in the FPO seems to be sound and sustainable.

Adopting multiple product basket require appropriate strategies on value addition and market landscape for the FPO. Local value addition and local exchange of produce shall reduce the cost of the produce by reducing the number of intermediaries in the process of value addition, total cost of transportation, packing and unpacking cost, taxes, and cost of certification by an external agency, etc. Reducing the cost of the produce and making them locally available would also increase the internal consumption of these produce in the local community; thereby increasing the nutrition levels in the community. After fulfilling the nutritional needs of the local community, the surplus produce/products could be sold at the local, district, national or international markets. Keeping the market place closer to the site of production could stabilize the local demand and supply situation and reduce the risk of fluctuations of the global markets for the smaller producers. Luckily, the demand of agricultural products is all around the producers and hence the local value addition and local marketing reduces food miles and fits with the strategy of economies of scope and ecological sustainability.

Summary & Way Forward:

At the base of our production pyramid, basic energy conversion processes of plants and agricultural ecosystem is highly complex and interdependent process. It is based on the science of interconnectedness and interdependence of sunlight, moisture, air, soil, plant/crop biodiversity, micro-organisms, livestock and seeds. In other words, '*economies of scope*' rather than '*economies of scale*' is indeed the science of efficient and sustainable production at the primary food production level. The perspective of '*systems thinking*' and rather than the perspective of '*linear thinking*' can explain these dynamics of production in nature.

Further, the resource (land) position and capability of the position of the producers also does not technically favor economies of scale in either at the stage of agricultural production or at the subsequent stage of value addition. From a nutritional security and convenience (lower transaction cost) point of view, *economies of scope* is also efficient and sustainable in agriculture. 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 the country strongly support the logic of *economies of scope* for greater efficiency and overall sustainability of agro-ecological systems.

The discussion of the ideas of scope and scale, the key pillars of the two major revolutions of human history viz., agriculture and industrial revolution is indeed a discussion of the ongoing **battle between these two revolutions**. The scholarship till date has hardly dealt seriously with the idea and significance of economies of scope. Since the industrial revolutions during the last three hundred years, there have been limited and short lived interjections on the ideas of economies of scope. But these analyses have been limited to exploring the economies of scope of production within industrial production systems and therefore it only focused on multi-product outputs in industrial production units. The **idea of *economies of scope* and its *science* with regard to agricultural ecosystems has not been 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 ongoing silent but brutal war of industrial revolution over agriculture and our ecosystem is indeed unnecessary, uncreative and disastrous. Serious research and scholarship on the *science of economies of scope* 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.

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