

Sustainable Development of Agro-Based Industries: An Overview

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ABSTRACT: Sustainable development of industries is increasingly assuming significance in the 21st century. Agro-based industries are an important component of the industrial sector of India. This paper reviews various dimensions of sustainability and presents the different contributions by researchers in the agro-based industrial sector. It identifies the research gap and scope for comprehensive research in this sector of Indian economy. It underscores the importance of an in-depth study to assist in proper policy formulation to ensure the sustainable development of this industrial sector in the long run.

KEY WORD: Sustainability, cleaner Production, agro-based industries, policy implications

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I. INTRODUCTION

Sustainability is defined by UNIDO as “the ability to meet needs of the present without compromising the ability of future generations to meet their own needs”. It is also termed as Triple Bottom Line (TBL) approach, as it is the amalgamation of three dimensions namely economic, social and environmental.

In the current sustainability driven new millennium, a key issue which is likely to dominate the survival and growth of all types of industries is the need for adoption of sustainable production. As a driving force ‘sustainability’ in 21st century industry is analogous to ‘automation’ of 20th century, and ‘steam’ of the 19th century. Sustainable production means “the development of manufacturing industry’s ability to underpin society’s need, not only to create wealth but also to do so in a way which will support sustainable economic development”. Present industrial systems are not sustainable in the long run because of their demand upon the world’s natural resources. Even the development of the present industrialized nations is unsustainable at current rates of resource consumption. Added to this, the natural aspirations of developing countries to emulate the consumption patterns of the developed world contribute only towards further magnifying the scale of this problem. The stability of the economic systems of developing nations depend upon their economic growth and hence they will not accept any externally imposed limits coming in their way of economic improvement. Such economic developments largely depend on their industrialization, among others [Balasubrahmanya, 2006].

1.1 Sustainability Dimensions

Sustainability has become more significant in product design and development, manufacturing management, transport sector, agriculture sector, and in R&D in the past four decades. For achieving sustainability, each type of industry focused on reducing their environmental wastes and geared up with newer technologies in designing more innovative and attractive products. Such initiatives are observed in the case of electronic goods, automotive vehicles, power generation, and civil structures, etc. Sustainability may also provide scope for innovation in production. There is a need for the firms to improve their quality of goods by simultaneously reducing the cost of production through product and process innovations. During 21st century, some companies started with a new initiative called Cleaner Production (CP), in the process of moving towards sustainability [Rajanbhatt, S Kukal, 2016].

Figure 1: Sustainable Development



A development which is sustainable economically, socially, and environmentally is called a Sustainable Development (SD). A comprehensive analysis of SD requires a thorough understanding of these three intimately interconnected dimensions as shown in fig.1, and briefly explained below.

a. Economic: An economically sustainable system must be able to produce goods and services on a chronic basis, to maintain convenient levels of government and external debt, and to avoid extreme sectorial unevenness, which impair agricultural or industrial production.

b. Environmental: An environmentally sustainable system must maintain an anchored resource base, avoiding over-exploitation of renewable resource systems and diminishing non-renewable resources only to the level of investment made on it. This comprises maintenance of biodiversity, biosphere, atmospheric stability, and ecological balance.

c. Social: A socially sustainable system must achieve equity in distribution and opportunity, reduce poverty, improve social life by providing adequate health and education resources, balance gender equity, and political accountability and participation.

Moving towards sustainable production is vital amongst all the industrial sectors including the agro-based industries. This is of a special significance in India, because ours is an agrarian dominated economy. While mechanization, modern cultivation methods and productivity enhancements are continuously promoted, it is equally imperative that sustainable agro-based industrial development is also given the impetus [MF Nunes and CL park, 2016].

1.2 Agro Industries

The agro industry is regarded as an extended arm of agriculture. The development of the agro industry can help stabilize and make agriculture more lucrative and create employment opportunities both at the production and marketing stages. The broad-based development of the agro-products industry will improve both the social and physical infrastructure of India. Since it would cause diversification and commercialization of agriculture, it will thus enhance the incomes of farmers and create food surpluses.

The agro-industry mainly comprises the post-harvest activities of processing and preserving agricultural products for intermediate or final consumption. It is a well-recognized fact across the world, particularly in the context of industrial development that the importance of agro-industries relative to agriculture increases as economies develop. It should be emphasized that 'food' is not just produce. Food also encompasses a wide variety of processed products. It is in this sense that the agro-industry is an important and vital part of the manufacturing sector in developing countries like India, and also the means for building industrial capacities [Basappaji and Nagesha, 2014].

1.2.1 Rice-Industry

Rice is the primary food grain for about 3500 million people around the world. In India, rice is consumed by 60-65% of the total population. In earlier days, paddy grains were processed at family levels by traditional methods. The increasing population, changed lifestyle, and increased technology have led to invention of rice milling. Rice milling in modern times has developed like a separate industrial sector. It is one of the largest agro processing industries in India. With increasing population, the human requirements also increases, especially in case of food grains. In the last 3 decades the Indian government has implemented different policies and programmes for improving the production of rice like Special Rice Production Programme (SRPP), Special Food grains Production Programme (SFPP-RICE), Integrated Program for Rice Development (IPRD), Integrated Cereals Development Programme in Rice based cropping areas (ICDP-RICE), and National Food Security Mission, etc.

1.2.2 Puffed-Rice Industry

Puffed rice is formed by the reaction of both starch and moisture when heated within the shell of the grain. Unlike popcorn, rice kernels are naturally lacking in moisture and must first be conditioned with steam. Puffed rice can be created by heating the steam-conditioned kernels either with oil or in an oven. Rice puffed in this way is crisp, and known as "crisped rice". Oven-crisped rice is used to produce the Rice Krispies breakfast cereal as well as the crisped rice used in Lion Bars, Nestlé Crunch, Krackel, and similar chocolate bars. Though not as dramatic a change when compared to popcorn, the process and end result are the same.

Another method of puffing rice is "gun puffing", where the grain is conditioned to the correct level of moisture and pressurised to around 200 PSI. When the pressure is suddenly released, the pressure stored inside the kernel causes it to puff out. This method produces puffed rice which is spongy in texture.

Puffed rice is consumed by people of most south Indian states. Variety of dishes such as "KharaMandakki", "Oggarane Mandakki", etc., are prepared from puffed rice. Puffed rice industries in Karnataka, send their products to various other states such as Andhra Pradesh, and Tamil Nadu, apart from exporting to countries like Bangladesh.

II. LITERATURE REVIEW

The literature survey pertaining to sustainability issues in this section include various works carried out in sustainable energy efficiency opportunities, energy management practices, material and energy (Resource) flow analysis, waste minimization, development of eco efficiency indicators, benchmarking, waste water recycle, and life cycle assessment (LCA) etc. But, it is observed that there are no uniform approaches in sustainability studies across the globe.

Basappaji and Nagesha (2014) Attempted to estimate the level of Cleaner Production (CP) in a SME cluster. They observed that thrust is shifting towards environmental friendly technologies for sustainable industrial production. CP is a strategy towards achieving sustainable production, reducing wastes and emissions at the source. Through investigation they presented a model to assess the CP status and implemented this model on 22 cashew processing units. In the assessment of CP level, contributing parameters viz., process efficiency, environmental degradation, and sustainability aspects were considered. Various dimensions of each contributing parameter was identified and measured in the overall estimation of CP level, and aimed at for catalyzing the CP initiatives.

Visvanathan (1999) investigated the approach of CP in industries. The research work illustrated introduction and implementation of CP in Small and Medium Industries (SMI).It advocated that CP needs to be implemented based on an integrated approach of seven focal areas. These are: integrated pollution prevention and control, interaction between energy, environment and climate, development of technology based benchmarking, identification and co-ordination of various internal and external actors, capacity building, technology development and transfer, and financial packaging. This paper underlined the importance of implementing a holistic approach when introducing CP in the SMI sector in Asia.

Moslehi et.al (2016) Investigated wheather the solar power generation would affect sustainability of a community energy infrastructure. Along with environmental impacts, cost and social dimensions of sustainability were also considered throughout the life cycle of energy systems and fuels. The study maintained different perspectives and encountered the complexities and limitations of power generation and developed a multi-criteria sustainability appraisal framework to evaluate and compare the sustainability of two different fuel mix scenarios.

Fresner and Engelhardt (2004) opined that sustainable development can be established by translating sustainable development into small steps relevant to the actual conditions of the companies. These steps are the application of cleaner production methods, followed by an integrated management system and optimising the supply chain relations and consequently the products. This procedure forms an effective way to start to understand sustainable development and to develop sustainable strategies in companies. In this investigation, the authors presented and analysed two case studies that demonstrated that real experiences in improving environmental and economic performance by improving processes and procedures occurred and motivated the company's leadership, suppliers and employees to continue to make additional improvements.

Rajaram and Ashutosh Das (2010) presented the utility of a fuzzy inference system to codify the interactions among the sustainability components for effective decision making. The method used local knowledge elicited through a participatory methodology to understand the linkages among the ecological, social, physical and financial components of sustainability in a village. This paper proposed a fuzzy rule based approach to model the interactions of sustainability components in an agro-ecosystem.

Khaled Medini and Xavier Boucher (2016) highlighted the impact of variety steering on environmental and economic sustainability indicators. The Customers' individual preferences were calling for greater variety of firms' offerings. Faced with this situation, firms failed to meet customer requirements while reducing their costs and impact on the environment to remain competitive. The attainment of these goals entails various issues

that must be addressed including multiple performance drivers and criteria relating to environmental and economic sustainability and variety. The paper underlined the impact of variety steering on environmental and economic sustainability indicators.

Polina Pimenova and Rita van der Vorst (2004) Conducted pilot survey of SMEs in the London area, examining their environmental concerns, constraints to environmental performance improvements, key incentives to caring for the environment, and the role of support initiatives and bodies in promoting best environmental practices in SMEs. The applicability of the results of this study to transition economies of Eastern Europe was examined, and further research was proposed in the region in order to test hypotheses developed by this study.

Ruth Hillary (2004) reported that the Small and Medium-sized Enterprises (SMEs) make a vast majority of businesses in Europe. These enterprises are vitally important for a healthy dynamic market economy. However, the environmental impact of small firms is not known either at national or regional levels. It underlined to provide all businesses with the means to develop systematic approaches to improve environmental performance.

Christopher OBrien (1999) underlined that the industry is not only to create wealth but also to develop sustainable production systems which minimize environmental consequences. Therefore the Governments have a responsibility to create the social climate within which companies can respond to their responsibilities without losing competitive advantage.

Pavel Danihelka (2004) Reported that the Cleaner Production (CP) gives a powerful tool to decrease waste production, to limit the pollution of the environment and natural sources depletion. This paradox is similar to human behavior with respect to risk whereby the reality of risk is not the same as the perception of risk. Moreover, the return of investment in CP is quick and hence CP activities should be highly demanded by enterprises. CP is actually the prevention of risks which exhibits several aspects of risks that are easily undervalue.

Bala Subrahmanya (2006) investigated the role of labour efficiency in promoting energy efficiency and economic performance with reference to small scale brick enterprises cluster in Malur, Karnataka State, India. It underlined need for energy efficiency improvement in the long run to improve sustainability. In small scale industries that are energy intensive, labour would play a major role in the level of energy efficiency and economic performance. The findings indicated that when technology is similar in a particular small scale industry, improving labour skills and efficiency can be an important strategy for improving energy efficiency, achieving higher returns and enhancing competitiveness and sustainability.

Robert Krueger (2015) addressed one of the emerging phenomena of the recent times the “Smart City” and investigated whether this new concept can improve the sustainability criteria of cities or not. The paper investigated the social factor of smart city and the new opportunities that smart city can bring to improve the quality of life for citizens.

III. CONCLUSION

The current study presented an overview of sustainability and associated issues in agro-based industry. The literature pertaining to this industry reveals that there is lack of comprehensive study of this industrial sector. The sparse literature available in the rice mill and almost no literature availability in the puffed rice sector pertaining to sustainability issues indicates a considerable scope for an in depth study in these industries. It appears that no researchers have not extensively worked on agro based industry clusters from sustainability perspective. Hence, there is scope for studies involving sustainability issues in agro-based industry. Such studies must recognize:

- There are many technologies and approaches available to implement sustainability development in Industrial clusters
- Industrial clusters are reluctant to implement sustainability development because of the lack of available information about the advantages and unforeseen benefits from it.
- There are mostly case studies/demonstration projects done in general
- Sustainability development is an effective tool in preventing environmental pollution and in turn producing benefits to the industries adopting it.
- Studies recognizing and incorporating the above aspects can go long way in improving the Sustainable Development of agro based industries in the years to come.

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