Review on Changing Technology Based Rural Development

Girish D Pandit[1], Dr. Kaushal Prasad[2]
[1, 2] Dept of Mechanical Engineering
[1, 2] Finolex Academy of Management & Technology, Ratnagiri.

Abstract- *As day by day changing technology is making human livings socially and economically more advanced, this technology is to be transferred to all layers of human livings especially in rural locations. More focus is to be given how we get the local stakeholders involved in energy planning. The initiatives like RIDI & CDM contribute to encourage technology transfer to rural areas. The paper reviews rural based activities in sustainable development such as Bioenergy, solar energy etc. Factors affecting creation of environmental friendly energy option and transfer of information and telecommunication services, which helps social and economic benefits in rural area are highlighted.*

Keywords- Bioenergy, CDM, RIDI, ICT.

I. INTRODUCTION

Worldwide people are unknown about the unequal distribution of modern energy between urban and rural area [1]. It is fact that energy plays an important role in the human development and the reduction of poverty. The United Nation's have launched *Sustainable Energy for All* (SE4All) activity in 2012. The aim of this initiative is to focus attention of political people and their action to achieve universal availability to modern energy, up to 2030. The General Assembly of United Nation declared the year 2014 as beginning of the '*Decade of Sustainable Energy for All'*, which has increased global interest in the issue of global energy problems and given unique platform to the global energy agenda [1]. To achieve universal distribution of energy sources energy planners must involve local stakeholders in to the process.

One of the key term related to development is 'participatory development'. The definition of 'Participatory Development' as given by World Bank is, "A process through which stakeholders influence and share control over development initiatives, and the decisions and resources which affect them". In this context of participatory development, 'stakeholder' is referred to all groups, institutions or individuals and those who have an interest in a project or program. The groups or individuals those are getting affected directly (primary stakeholders) and intermediaries (secondary stakeholders) are also included in the stakeholders [1].

Rural development as a whole refers to the economical and social development of rural communities through the participation of the people which are getting affected directly or local participants. With having participation of rural people, their capacity to help themselves can be motivated and facilitated by the mediation of external experts, organizations and individuals. Thus, successful rural development needs the involvement of people and organizations from different fields and related organizations. And this collaboration will help to make learning and knowledge creation accessible for local people. The primary objective of collaboration between public officials, village leaders and activity group leaders in rural development is to transfer technologies. This will lead to deliver valuable inputs such as education, constructing roads , building of water storages, and other required social infrastructures [1].

Maria Rivera et. al. [2] presented an analysis based on number of experiments and with through case studies in countries Spain, Italy, Lithuania, Latvia, Israel, Germany and Denmark. This analysis was focused on questions related to noneconomic aspects such as a self dependence, social recognition, welfare which is socially and environmentally. The author has discussed rural leader's understanding of rural prosperity in different countries. Also the strategies used to improve prosperity, and how these strategies can be enabled and implemented have been discussed. The evidence derived from number of trials or studies shows that prosperity in context to development of rural area is increasingly understood as being multi-dimensional and people seek to balance economic parameters with human, social and environmental well-being.

When thinking of rural development one should think of alternate energy sources originated to contribute rural lifestyle and sustainable development of human being. It seems that the solar energy can be a promising alternate energy option in rural areas. Article from Johannes Urpelainen et. al. [3] has analyzed the effect of solar home system demonstrations given on sales, awareness, and people's

opinion. The study was carried out for the 75 villages in rural Uttar Pradesh. The primary finding is that, the solar technology demonstrations do not have a considerable impact on SHS's (Solar Home System's) sales and awareness. It appears that belief for any technology comes by high levels of satisfaction with the product and service among customers. Based on more surveys author concludes that unless and until rural people get belief on solar technology, the markets for the same will not grow considerably in rural Uttar Pradesh [3].

Bioenergy is also one of the sustainable alternate energy source. The problems, policies and recommendations for increasing sustainable bioenergy approaches globally are summarized by Glaucia Mendes Souzaa et. al. [4]. Since most of the bioenergy is produced by biomass from plant [8] and is concerned with rural people, the scientific knowledge about its production and supply chains needs to be appropriately distributed.

For distribution of the knowledge of the new things there has to be a medium through which knowledge can flow in each and every region of the globe. Such emerging medium of knowledge distribution is internet. One survey paper [5] has shown that poor rural telecommunication infrastructure hinders rural development. The author observes that due to investments in broadband there is increasing entrepreneurship in a rural region. On the other hand digital connectivity in remote rural areas has created Internet based competition for local entrepreneurs, which is disadvantage for the local entrepreneurs. One of example of such competition is e retail. This means that improved access to markets can result a negative impact for traditional rural business. But, innovative entrepreneurs may respond positively to this competition. And this support will strengthen the rural economy in the future [5].

In view of different parameters contributing rural development, this paper is based on review of topics such as Bioenergy production and use, Awareness and Adoption of Solar energy and transfer of ICT (Information & Communication Technology) to remote regions. The study of different collaboration strategies [6] between government officers, local authority officers, and community leaders that are based upon conventional rural development approaches is studied.

II. DEFINITION OF PROSPERITY

In the past days, rural prosperity has been mainly associated with the modernization of farrns and the economic benefits from it. Today, the definition of rural prosperity has changed. There are structural changes to farms region wise. If there is modernization of a few farms that does not mean it has contributed to prosperous rural areas. According to the rural households, prosperity is related to minimum level of autonomy, social recognition and social and environmental welfare in line with the economic aspects [2].

For rural areas, the new understanding of prosperity is different. As per this new understanding we cannot measure prosperity of farmers and others in rural areas with economic growth at farm level and at regional level. Strategies such as a greater diversification of farming systems or farming which is organically done, involve different and broader values that can contribute to enhancing prosperity apart from economic. For rural people they have cultural and emotional things attached with the farms. Rural policies are lagging to channelize their activity towards prosperity. The rural policy must have provision of alternative farming strategies. Rural agricultural policy is still directed towards highly commercial full-time farms, causing other types of farms and strategies as problem to productive agriculture.

This does not mean conventional farm strategies do not have a role to play in rural prosperity. There is need to study the particular potentials and added value of alternative farming strategies [9] and practices. There are newly coming platforms where farmers and consumers innovate and seek alternative models for agriculture development and food networks [2].

III. PROCESS OF KNOWLEDGE CREATION THROUGH COLLABORATION

Chartchai Na Chiangmai [6] describes how collaboration for knowledge creation in an area based rural development in Thailand works for facing complex rural problems and needs. On the occasion of the sixtieth anniversary of King Rama IX's the *Royal Initiatives Discovery Institute (RIDI)* was founded in 2009. The purpose of RIDI was to divide accurate understanding and appropriate applications of *Royal Development Principles* and Initiatives to achieve sufficiency development. Its mission is to transfer practical knowledge derived from over three thousand Royal Initiative projects to community organizations, local authorities, government agencies, business organizations, and activity groups that are in need [6]. Also to provide the necessary technical support to knowledge management and knowledge sharing among communities. The RIDI have employed a people centered development approach. Since 2010, RIDI has implemented area-based development projects using a sufficiency development philosophy in the two territories of Nan and Udon Thani. The objective of RIDI is to cover administrative gaps resulting from relatively centralized administration, functionally divided government departments and poor integration of development functions among

government offices, at the regional and district levels [6]. The RIDI approach focuses on encouragement to development collaborations on area basis learning media to guide poor people to be self dependent. In this regard, the management's capability of development collaboration is also very important. In RIDI, the development collaborator's team consists of two groups of organizations and individuals from outside and inside a village. The first group consists of government officials from concerned central departments, provincial and district offices, local authority officials, RIDI development workers, university lecturers, nongovernment organization workers, and businessmen. The second group includes village development committee members, village development volunteers, local intellectuals, and members of village activity groups. Along with the implementation of Royal Development Initiative projects, the setting of development goals for a rural community is an important first step. A development collaborative team working in close cooperation with the village's development committee and village groups, identifies a precise and tangible development goal to be achieved in the next two to three years. Similar to successful complex organizations, a common purpose and goals among all the collaborators is a powerful driving force in efforts to achieve the decided development goals. The ability of rural people to gain practical knowledge needs to be improved. So that these people can understand the complexities and uncertainties of the global commodity markets and logistics. These are having direct effects on the costs of agricultural products and hence on their income [6].

According to the RIDI approach to rural development, a process of collaboration for local knowledge creation consists of three consecutive technical steps of interaction [6].

The primary step is to increase the ability of the local people to understand their own problems, needs, and opportunities in a more systematic manner, and to increase awareness of possible options for sustainable living.

The second step is to provide access to needed and desired technology and assistance in the form of training and education.

The third step is to assist them in application of knowledge, both technical and local, to improve quality of life and to generate new local knowledge or practical wisdom. These three steps are crucial to the development based on collaboration. The third step also to be directed to enable a combination of different type of knowledges to bring new local knowledge suitable for sustainable living in line with second step [6].

VI. BIOENERGY

Many times guidelines given by government initiatives becomes helpful for succession of the development projects. CDM is one of such global initiatives from World Bank. China has become the most important country in the development and implementation of *Clean Development Mechanism (CDM)* projects. The CDM has brought an opportunity for the development of household biogas in rural China. The points, like feasibility analysis, calculation methods and potential of emissions reduction, CDM project development process, problems and countermeasures of household biogas CDM projects are discussed by Yu Chen et. al. for rural China [7].

To register under the CDM, a project must meet three requirements:

1. Project must be capable to bring real, long-term greenhouse gas (GHG) emission reductions
2. Project can promote sustainable development
3. Project must be able to demonstrate "Additionality" [7].

The project on biogas digester, in rural China, have been discussed here in context of Clean Development Mechanism (CDM).

1. Green House Gas emission reduction effect due to installation of Biogas digesters

There are two ways through which GHG emission effect can be reduced by using biogas digesters. Biogas digesters can reduce the emission of carbon dioxide (CO_2). A household biogas digester with a volume of $8m^3$ can produce more than $400m^3$ biogas per year, which can be used for cooking. And can be used as alternate to straw, firewood and coal combustion. It is seen that production of the biogas by an $8m^3$ digester is equivalent to 1.5 ton of standard coal consumption.

Second, household biogas digesters can reduce the emission of Methane (CH_4). Methane contributes to the greenhouse effect 21 time that of the CO_2 [7]. The main raw material for house hold biogas fermentation in rural China is animal manure. Untreated manure naturally releases large amounts of methane gas into the atmosphere, and causes an increase in the greenhouse effect worldwide. Anaerobic fermentation is considered an effective way to treat and recycle animal organic waste and to generate biogas, reducing direct emission of CH_4 into the atmosphere.

2. Sustainability of the Biogas digester projects in villages

In rural China biogas digesters are used in combination with toilets. And it has become a popular eco-agricultural model in rural China. The main purpose of this model is to solve the rural energy problems and improve hygiene for rural households with clean environment. *The installation of biogas plants has helped to protect the forest, since biogas can be used as fuel for lighting and cooking*. There is an annual saving of 0.13–0.20 hm^2 (0.13-0.20 square hectometer) forest per household that has installed a biogas plant [7]. In operation of Biogas digesters there is production of organic fertilizer which is high in nitrogen, potassium and phosphorus contents. This organic form of fertilizer can be used in farms as an alternative to chemical fertilizers. From estimation following are the annual savings per household due to installation of biogas digesters [7]:

1. 150 kg nitrogen,
2. 100 kg of phosphorous and
3. 150 kg of potassium.

As toilets are connected to the biogas plants the diseases due to mosquito and other insects are eliminated. This has also helped to prevent diseases due to contamination of drinking water by human and animal waste to some extent. Also the employment rate can be improved as workers are needed for installation and maintenance of biogas digesters.
Multiple benefits of household biogas in rural China are shown in Table 1.

Table 1: The benefits of household biogas in rural China [7]

Benifits	Content
Ecological benefits	1. Protect forest 2. Increase the use of organic fertilizer
Economic benefits	1. Reduce the cost of chemical fertilizers and pesticides 2.Reduce the cost of commodity energy
Social benefits	1. Improve the living environment of rural residents 2. Reduce the risk of zoonosis 3. Improve the employment rate of rural labor

3. Additionality of the project

The third condition a project should fulfill to register under the CDM is that it should be capable to demonstrate "Additionality". Additionality means to find existing barriers that come for implementation of the project. The biogas digester project must be practically feasible to apply.
The barriers faced and their solutions are to be found out. The barriers for the biogas digester project are financial and technical barriers. Financial barriers include lack of government subsidies. As far as technical barriers concerned these are lack of management and technological skills. These barriers are being solved under CDM. For biogas digester case study, financial evaluation has resulted in the good results as shown in Table 2.

Table 2: Financial evaluation comparison of rural biogas CDM projects [7]

Background of the project	Net present value (Yuan)	Payback period (Years)	Internal rate of return (%)
No CDM project support	-470.2	8.18	4.79
CDM project support	315.27	6.09	13.24

V. INFORMATION AND COMMUNICATION TECHNOLOGY IN RURAL AREA

It has seen that rural communities have been struggling to keep up with developments in digital connectivity. A deal of governmental and market effort was done in advanced western societies to upgrade rural telephone networks for use by the Internet, at the end of the twentieth century. This action was taken in view that all regions should have access to the Internet in order to prevent growing regional inequalities.

Cable Internet, fiber optics, and mobile broadband are now all widely available, except to some extent in rural areas. The paradoxical problem of physical remoteness and the inadequate service provision can be solved by promoting digital connectivity for many of the services. Especially, Remote rural areas lack the required digital connectivity. There is a risk of serious situation of rural areas that these areas will fall badly behind in terms of accessibility to services. The factors effecting unequal accessibility and use of ICTs are being studied by relevant academic disciplines. The academic disciplines those have effect on digital accessibility region wise includes economics, IT, geography, planning, and the political sciences [5]. In general, as per the literature in this field price of e data infrastructure is also a factor affecting active participation in a digitalize information society. This e data infrastructure includes DSL, cables, fiber optics, mobile broadband etc. and this need to be available at a reasonable price. However, lower population and greater distances in rural areas are the barriers for the market to invest in new technologies in these areas [5]. Urban areas are easy to access where internet facilities of good quality are available everywhere. But in rural areas, it is not always possible that

high speed internet facility with reliable services will be available.

VI. CONCLUSION

The scenario of rural areas for the status of technology transfer in different areas of the world has been reviewed. The points which contribute for environment of knowledge creation are seen to be collaboration of the rural stakeholders with the urban organization and wish to adapt these technologies.

The RIDI approach adapted in Thailand can be a paradigm to other developing countries. The RIDI approach to rural development, gives guidelines to include the villages in knowledge creation.

Motivation to the farmers for land use to produce crops for biodiesel production can be a better option for amalgamation of rural people in changing technology. It can be concluded that from the prosperity point of view Quality of life include health, personal satisfaction built on values and ethics. Farms are part of a broader rural community context and their activities contribute to rural prosperity.

As far as information and telecommunication technology is concerned, in order to have equal opportunities for every person, household, and firm, everyone should be connected to high speed Internet. Furthermore, people have to know how to effectively use ICTs for their economic benefit or their quality of life.

REFERENCES

[1] M.J. Herington, E. van de Fliert, S. Smart, C. Greig, P.A. Lant, “Rural energy planning remains out-of-step with contemporary paradigms of energy access and development”, Renewable and Sustainable Energy Reviews 67 (2017), pp. 1412–1419.

[2] Maria Rivera, Karlheinz Knickel, Ignacio de los Rios, Amit Ashkenazy, David Qvist Pears, Tzruya Chebach, Sandra _S_umane, “Rethinking the connections between agricultural change and rural prosperity: A discussion of insights derived from case studies in seven countries”, Journal of Rural Studies xxx (2017), pp. 1-10.

[3] Johannes Urpelainen, Semee Yoon, “Can product demonstrations create markets for sustainable energy technology? A randomized controlled trial in rural India”, Energy Policy 109 (2017) pp.666–675.

[4] Glaucia Mendes Souzaa “The role of bioenergy in a climate-changing world”, Environmental Development 23 (2017), pp.57–64.

[5] Koen Salemink, Dirk Strijker, Gary Bosworth, “Rural development in the digital age: A systematic literature review on unequal ICT availability, adoption, and use in rural areas”, Journal of Rural Studies xxx (2015) pp. 1-12.

[6] Chartchai Na Chiangmai, “Creating efficient collaboration for knowledge creation in area-based rural development”, Kasetsart Journal of Social Sciences 38 (2017) pp. 175-180.

[7] YuChen, WeiHu, PaulChen, RogerRuan, “Household biogas CDM project development in rural China”, Renewable and Sustainable Energy Reviews 67 (2017), pp.184–191.

[8] Mindy S. Crandall, Darius M. Adams, Claire A. Montgomery, David Smith, “The potential rural development impacts of utilizing non-merchantable forest biomass”, Forest Policy and Economics 74 (2017) pp.20–29.

[9] Christos Karelakis, Georgios Tsantopoulos,” Changing land use to alternative crops: A rural landholder’s perspective”, Land Use Policy 63 (2017), pp.30–37.

[10] https://www.investopedia.com/walkthrough/corporate-finance/4/npv-irr/introduction.aspx