Women Technology Parks: A novel solution for women entrepreneurship and empowerment through location specific technologies and waste material utilization

V Mahesh¹, P V Ramana Rao¹, K Kiran¹ and Sridhar Condoor²

¹S R Engineering College, Warangal, India
²Saint Louis University, USA

E-mail: v.mahesh2@gmail.com

Abstract: Social and economic development of women will lead to the progress of any society. Particularly, empowering women in rural areas is both challenging and essential. Women entrepreneur faces many barriers to success such as a lack of financial independence and education, family, work-life balance, male-dominated society, and social-culture barrier. The Women Technology Park (WTP) is an initiative that leverages the use of appropriate technology to catalyze economic growth and development of rural women by raising their productivity, generating sustainable income, and improving their livelihoods. This paper uses a WTP model to illustrate the process of developing, training and enabling of rural technologies related to metal art, banana fiber extraction, weaving, construction and habitat services, and food processing technologies. It presents how a WTP acts as a resource center and a catalyst to translate opportunities into reality to empower rural women.

1. INTRODUCTION

The significant role played by women in society, the conditions that they face, and the need for empowerment of women have been emphasized by many. For instance, Nehru said, “You can tell the condition of a nation by looking at the status of its women” [1]. The draft resolution of General Assembly - Millennium Summit emphasizes “We recognize that gender equality, the empowerment of women, women’s full enjoyment of all human rights and the eradication of poverty are essential to economic and social development, including the achievement of all the Millennium Development Goals.” Continued persistence of gender discrimination around the world led United Nations to adopt empowering women in the Millennium Development Goals [2]. Former UN Secretary-General Annan viewed the empowerment of women as the most effective development tool [3]. Annual United Nations Human Development Reports (UNDP, 2001–2006) as well as researchers argue that gender discrimination results in long-term problems which will hamper the development of the society as well as result in persistence of the poverty [4].

According to the 2011 census, the population of India is more than 1.2 billion. Rural women constitute 77% of the female population. Indian women contribute about two-thirds of the efforts (labor), earn one-third of total financial compensation, responsible for half of agriculture output, and own 10% of wealth [5]. They share significant responsibilities in earning income as well as running the family. Many activities that they are engaged in (example – taking care of animals) are not visible in financial or social terms and can’t be easily be monetized. Women don’t enjoy equal status in the male-dominate Indian society. The Indian government as well as regional governments are promoting programs to empower them in various walks of life.
While the term empowerment is originally referred to the poor and the deprived groups, it is now used extensively concerning women’s programmes. In gender literature, empowerment refers to emboldening women to spearhead new income generating activities, lead an independent life, be recognized as an equal partner and improve their standing in the society. Empowerment enables women to pursue opportunities by building their skills and developing a different more challenging mindset, transforms the power relationships, sharing of responsibilities and in turn, transforms the social structure [6, 7, 8, and 9].

Empowering women is essential for nation's development. Saraswathy Amma, Panicker and Sumi [10] have defined empowerment as “a continuous process where the powerless people become conscious of their situation and organize themselves to improve it and access opportunities, as an outcome of which women take control over their lives, set their agenda, gain skills, solve problems and develop self-reliance.” According to UNIFEM, “gaining the ability to generate choices and exercise bargaining power, developing a sense of self-worth, a belief in one's ability to secure desired changes, and the right to control one's life” are essential elements of women’s empowerment.

Multiple structures of empowerment can be found in the literature. One model views empowerment as a process of transforming the social relationships between individuals and within a group [11]. Another perspective is from that of power as the key dimension of empowerment. This framework proposed by Murthy et al. [12] classified empowerment in three dimensions - power to, power with and power within. These dimensions manifest in how we control our conduct and collaborate and negotiate with others. Grown, Gupta and Khan [13] model uses economic, socio-cultural, familial/interpersonal, legal and psychological decision-making dimensions and is built on the original model of empowerment by Malhotra, Schuler, and Boender [14].

Culturally, women’s participation in work has often viewed an indicator of the social status in India. Typically, women’s work participation rates correspond to the society's engagement of the women in terms of using their capacities and offering opportunities and freedom. While women account for a significant fraction of the workforce in India, the government or society has not focused on developing their talent and bringing them into the forefront. In today’s world, women can empower themselves in many ways. Entrepreneurship can be an effective means for economic prosperity and self-satisfaction. Coupled with entrepreneurship, technology can relieve them from tedious tasks and provide free time to pursue their passion along with their family. Thus, these two means if coupled can empower women. Women can start this entrepreneurial journey by starting an individual or collaborative program assisted by the Self-Help Groups (SHGs) to generate additional income. This entrepreneurial activity will improve them as a person by making them a decision-makers and self-reliant [6, 8, 9 and 15].

Kuratko and Richard [16] view entrepreneurship as a dynamic process wherein an entrepreneur invests time, money and other resources, takes risks to create products and services to satisfy the needs of the society. In the process, the entrepreneur generates wealth and value. For funding rural entrepreneurs, microfinance is an interesting and effective means. Often, Self Help Groups (SHGs) play an important role in promoting microenterprises through microfinancing for socio-economic development.

The economy of rural India remains stagnant. A significant fraction of the rural population constitutes agricultural labor who are seasonally employed based on the crops. Typical Indian farmer holds less than one hectare of farmland with low productivity. As, agriculture can generate only partial employment and offer subsistence living in rural areas at the current time. To address growing unemployment in rural areas and decrease the tide of rural to urban migration, alternative source of income and employment is crucial for thriving rural India. Rural areas characterized by agriculture economy and decreasing employment in the farming industry and traditional arts and crafts. A
substantial number of women are unemployed as the agricultural labor markets prefer men to do physical jobs. But women can undertake an industrial activity and seek other revenue sources if opportunities arise. The authors consider Rural Entrepreneurship as a key for unlocking better living conditions for women.

In many parts of India, several women became successful entrepreneurs due to their abilities. While entrepreneurial talents exist in every person, they are realized to varying degrees. The traits associated with entrepreneurial success are not unique or universal. Factors such as culture, social networks, and education play an essential role. The entrepreneurial abilities of Indian women are not leveraged. Now, due to the change in the mindset of people, women in the leading role of are being accepted in our society. Developing women’s entrepreneurship qualities by exposing them to various profit generating avenues and enabling them to create new organizations can lead to rural prosperity. Rural entrepreneurship will improve the position and financial status of women in the society. The empowerment results in the improvement of their family, community, and country. It is the driver for regional economic growth and prosperity through employment and value creation.

Many opportunities can be provided to women through utilisation of waste materials, several research works were undertaken by researchers across the globe for the usage of waste materials for the benefit of society through conversion of them into useful products [28,29,30,31,32]. Authors made an attempt to promote one such work by utilisation of banana fiber based products for the development of rural women.

This paper shows the need for self-employed businesses, new kinds of opportunities, and issues in realizing these opportunities to empower rural women.

2. RURAL WOMEN – AN ETHNOGRAPHIC STUDY

2.1. Women in Workforce
A nation’s growth is intrinsically connected to its women development and empowerment [17,18]. Periodic surveys by the National Sample Survey Office (NSSO) estimate the employment in India. Between two surveys (1999–2000 and 2011–12), the number of rural women who are working as wage earners declined from 35% to 25% whereas the urban women employment rates remained steady [19].

To gain insights into the results of the survey, we must understand codes 92 and 93 which are assigned to tasks that very relevant to women. Code 92 refers to people who “attended to domestic duties only” - the care economy – taking care of their family members like children, elderly or sick people by activities such as cooking, cleaning, and provisioning. Code 93 includes people who “attended to domestic duties and were also engaged in the free collection of goods (vegetables, roots, firewood, cattle feed), sewing, tailoring, weaving, etc. for household use.” The survey results (employment statistics) exclude these two codes. If the statistics account for codes 92 and 93 women in the workforce, then their participation in 1999–2000 increases to 89% in rural areas and 81% in urban areas and declines to 85% and 80% correspondingly in 2011-12 (a drop that is may be due to increased enrolment in education). The consideration of codes 92 and 93 as workforce members is consistent with the definition adopted by the International Labour Organisation (ILO) in 2014.

2.2. Assessment of traits, barriers, challenges and business opportunities
Literature provides several entrepreneurial traits in Indian women. According to Garrido and Roman [20], the assessment of women on key entrepreneurial traits are:

- **Self-confidence** - Self-confidence in their own abilities and its impact on the potential positive outcome are crucial for any entrepreneurial endeavor. Self-confidence leads to persistence and optimism. Rural women have the capability to achieve their goals in a supportive environment. Further, they trust their judgement in leading any activity.
- **Risk-taking and problem-solving abilities** - Entrepreneurs take and manage risk and solve
problems as they arise every day in the creation of a new enterprise. Indian rural women who typically lead sheltered from problems by the family have low risk-taking and problem-solving abilities with a fairly reasonable chance of achieving their objectives. Ability to face unknown risks and considering alternatives are considered two strengths of rural women entrepreneurs.

- **Leadership and motivation** - Entrepreneurs are motivated by purpose and profit. To achieve the goals, engaging and collaborating with others is vital. Rural women entrepreneurs tend to take leadership position and also, encourage others.

While the entrepreneurial traits exist, several barriers to success are faced by rural women.

- **Lack of Financial Independence and Credit Opportunities** due to the perception of credit worthiness in the view of investors, friends and family. Further, most property is not held by women which results in their inability to put a collateral for any loans. According to Garrido and Roman [20] and Poster and Salime[21], one of the two critical business problems faced by women running micro-enterprises is financial resources in starting a business in terms of seed money and also, running the business in terms working cash. These funding issues make these women entrepreneurs dependent on government

- **Lack of Education** which leads to inability to adopt new technologies, tools, leverage opportunities provided by the government, mismanagement of finance, and capitalizing new market opportunities

- **Family-Work life Balance** limits their ability to pursue opportunities which requires significant time commitment. Most Indian women tend to balance by seeking appropriate opportunities. Nowadays many women in India are willing to pursue their career and just don’t want to limit to domestic works [21]

- **Male Dominated Society** where women and men are treated differently with respect to wages and also, independence. Women need approval from spouse or parents to pursue their own business. Further, male government officials and other villagers resist women empowerment and this factor is identified as a second critical business problems faced by women running micro-enterprises [20,22]

- **Procurement of Raw Material** is a barrier as women have to find a source for quality raw material at an affordable price. Often, poor quality raw material and the shortage of it can result in the failure of the businesses

Empowering rural women is a challenge. Pursuing the start-up of micro-rural enterprises can help women to develop these personal and social skills:

1. Economic empowerment
2. Self-confidence
3. Ability to interact socially and professionally with confidence
4. Leadership abilities
5. Individual and community problem solving abilities
6. Decision-making skills

The motivation for starting a business differs between men and women. While the inspiration for men is self-employment, independent lifestyle and financial crisis, women are inspired to uplift their family, resolve family problems and support the life partner. According to Selvaraj [23], women tend to operate lifestyle business such as readymade garments, dairy products, tailoring, and food related businesses. They are also into art and crafts due to their natural interest. These art and craft related businesses cover a wide range from personal ornaments to home decors. Women prefer these business as they typically require low investment. Further, they can be started quickly and generate income in a short time. The ease of financing, operating and generating revenue drive the decision-making process in women businesses.
3. WOMEN TECHNOLOGY PARK – AN INNOVATION MODEL

In 2000, the world leaders signed the Millennium Declaration with eight Millennium Development Goals (MDGs) which ended in 2016. Two MDGs (Goal 1 – eradicate extreme poverty and hunger and Goal 3 – promote gender equality and empower women) deal with the current project.

Goal 1: Eradicate extreme poverty and hunger
Rural women play an essential role in achieving MDG 1 by supporting their households and communities. The women help in providing nourishment, increasing the yield by contributing to the agricultural enterprise, earn income, and create thriving communities. Despite of their positive contribution to the world, women face persistent structural problems preventing them from completely exercising their rights and spoiling their individual as well as community growth.

Goal 3: Promote gender equality and empower women
Rural women are a part of the informal economy, with their contributions not accounted by labor statistics. Data from Africa, Asia and Americas consistently show the lower participation by the women in wage employment. The lack of gender equality in terms of wage gap and work opportunities can be found in most countries across the world. This MDG emphasizes the need for women empowerment to advance gender equality.

Starting 2016, Sustainable Development Goals (SDGs) or Global Goals came into effect. These SDGs built on MDGs and expanded the scope to include emerging concerns such as climate change. In each of 17 SDGs, women play a vital role. While the WTP addresses several SDGs, its focus is to address the following set of goals:

- SDG 1 – No Poverty
- SDG 2 – Zero hunger
- SDG 5 – Gender equality
- SDG 8 – Decent work and economic growth
- SDG 10 – Reduced inequality

Develop rural infrastructure and expand economy (both farm and non-farm) is a way for achieving inclusive growth. Comprehensive inclusive growth is an integral component in expanding employment, creating enterprises and enhancing livelihood opportunities in the region. Such development can be achieved by involving women through location specific technologies that utilize local strengths and resources. The Women Technology Park (WTP) is envisioned as a platform to design, develop or adopt appropriate technology, demonstrate its applicability, and coach women [24].

WTP brings women entrepreneurs, self-help groups (SHG), mentors and technology together to create an inspiring ecosystem and train women in potential rural technologies [Figure 1]. WTP intends to be an active catalyst to empower rural women and help them to become financially self-sustainable as well as technologically competent.
Figure 1. Women Technology Park – An innovation model

The Department of Science & Technology envisioned a scheme “Science & Technology for Women” with a sole purpose of empowering women through Science & Technology intervention and Entrepreneurship as an enabler for their success. The Science & Technology intervention is in the form of development of new technologies and adaptation of existing technologies for the benefit of women by solving regional needs and problems. The centrepiece of this scheme is the Women Technology Park (WTP) which act as a central hub for information dissemination, technology creation and transfer, and training. Further, it will be a catalyst for rural microenterprises for women thereby enabling them to generate income and employment [24].

The WTP set up by the S R Engineering College, Warangal, Telangana, India with the support of Science for Equity, Empowerment and Development (SEED) Division under Department of Science and Technology (DST) is proving to be valuable for the rural poor. It is now engaged in developing and adapting technologies to fit the needs of rural women in the areas of weaving, metal artware, banana fiber extraction, construction and habitat services, agro and forest-based processing technologies.

4. IDENTIFICATION AND ASSESSMENT OF OPPORTUNITIES

4.1. Opportunity Area #1 - Weaving and Handloom

With nearly 35 million employed, The Indian textile industry is the second largest employer after agriculture. This sector provides livelihood for one in six households either directly or indirectly. The Government of India notified Bacchannapet Mandal and its surrounding areas where 90% weaving community (close proximity to Warangal WTP) as an important cluster for development of power looms in 2011. However, no specific programs were implemented to advance weaving community. The following shortcomings were identified by WTP:

- Several problems exist in the cooperative societies including their inability to provide loans to weavers, mismanagement of the society, low wage structure for weavers working for the society, a lack adequate work for all the members. As a result, weavers are seeking their own routes to earn living rather than becoming members of the society (Less than 20% of weaver population are members).
- Due to the failure of the cooperative societies to meet the needs of weavers, skilled weavers are looking for alternatives and being exploited by middlemen.
- The emergence of master weavers and middlemen are able to provide work opportunities throughout the year. Middlemen supply raw material with a buy back arrangement providing
meagre benefit to weavers.

4.2. Opportunity Area #2 - Banana Fiber Extraction
The use of Banana fiber as a textile material is a new concept. Because of its high strength, several research organizations found banana fiber as a promising natural fiber by itself or in blended state. It is easy to blend banana fiber with other fibers (cotton or synthetics) [15]. Fibre extracted from waste banana stems has several applications [Figure 2]. The banana fibre reinforced soil has shown better geotechnical properties [25]. WTP found banana fiber as a promising technology intervention for the following reasons:

- The Government of India has identified Warangal district as a main cluster for the development and promotion of banana fiber extraction. However, there lack a spread and awareness about this industry.
- Banana is grown over an area of 1837 Ha in Warangal district. Production in 2011-12 was 55000 MT. The Department of Horticulture is further popularized the cultivation of Banana in the large tracts of dry lands / rainfed areas / wastelands [33].
- Andhra Pradesh Agro-Industries Development Corporation has developed various technologies for extraction of banana fiber and is providing subsidies for starting the units. Looms and other accessories are readily available in the local market.
- The district has ready availability of manpower with expertise in textile industry. As a result, banana fiber can be blended with their expertise and may find ready market in these traditional outlets.

![Figure 2. Sequence of Banana fiber extraction and utilisation](image)

4.3. Opportunity Area #3 - Construction and Habitat Technologies
Warangal district has an abundance of common construction raw material such as laterite, dolomite, coal, clay, granite and limestone, and sand. To empower women into this area, there are no formal training institute. Even if women masons have proficiency in their work, they lack confidence about delivering quality finished construction product such as fencing poles, water harvesting pits, cement rings, bricks, blocks, and tiles grouting. There is a lot of potential for women to work in construction field through the concept of reduce, reuse and recycle (3R) [26]. Efficient management of construction material and equipment improves productivity and ensure timely completion of the projects in an economical way [27]. The identified problems in this sector are:

- Most masons are illiterate. They lack the organizational skill, access to new technologies/skills, and bargaining skills.
- Masons have irregular livelihoods.
- Masons lack credit facilities and financial understanding which makes them vulnerable
towards getting indebted to moneylenders at high interest rates.

4.4. Opportunity Area #4 - Metal Crafts
In India, three million handicraft artisans are working in metal sector and play a pivotal role in protecting the traditional art and culture. Pembarthi village in Warangal District is synonymous for Sheet Metal Brass engraving and artifacts. It traces its historic roots to a number of temples constructed during the Kakatiya rule. During the subsequent Muslim rule, artisans entered into the sheet-metal wares such as small boxes for carrying beetle nuts, scent containers, vases, hanging metal lamps (chandeliers), plaques and mementos. While the local Government made investment and tried to help, the artisans of Pembarthi face several problems:

- 90% artisans are illiterate and are not in a position to manage their businesses. They lack the skills to incorporate advanced technology, new designs, and marketing techniques.
- While raw materials are readily available, it is expensive. Further, to start their own businesses, artisans need equipment and space. Initially, their primary source for loans tend to be banks.
- Currently, due to poor money management and past repayment history, most Banks are not financing artisans.
- As own ventures are not profitable, and most artisans are solely rely on metal crafts for their survival, the current artisans depend on middlemen or bulk buyers who exploit them by artificially fixing the prices low.
- The artisans are not in touch with the market and therefore, unaware of consumer’s changing tastes and preferences. As a result, product diversification is minimal.

4.5. SWOT Analysis
During the development of the park, the WTP performed a SWOT analysis (Table 1).

| STRENGTHS | WEAKNESSES |
|-----------|------------|
| - The locations are known for their traditional and ethnic arts | - Lack of literacy (financial, market and technology) |
| - Skilled artisans | - Inability to adopt to changing market needs and technology |
| - Availability of raw material | - Dependency on middlemen and money lenders |
| - Environmentally friendly | - Lack of unity and trust among their artisan groups |
| - Supports rural economy | |

| OPPORTUNITIES | THREATS |
|---------------|---------|
| - Market potential for ethnic art at higher value | - Government policies which are inconsistent and financially nonviable. |
| - High social impact including women empowerment and job creation | - Middlemen or bulk buyers may act against the success of the project. |
| - Transformative possibilities due to technology intervention | |

As seen in the table, the primary weakness stems from a lack of literacy. Training the artisans can lead to better living standards through self-employment. Also, on the upside, the market potential for these traditional and ethnic products are significant. Appropriate use of technology can increase production volumes and quality and reduce cost. The artisans can sell more of the same products for a higher price due to higher quality and reap the benefits. Thus, artisans are blending traditional art with
modern technology for their success.

5. OUR MODEL FOR TRANSLATING OPPORTUNITIES INTO REALITY

5.1. Our Premise
Connecting rural women to appropriate technology for empowerment

5.2. Guiding Principles
1. Women and men are equal in their abilities. Therefore, there should be an income parity between the two genders.
2. Women is the backbone of rural community. Empowering them can lead to sustainable community development.
3. Women bring a unique combination of skills. Coupled with hard work, passion and purpose, these life-style businesses can have a sustaining effect on the rural economy.
4. Women are already in close knit social groups like self-help groups and actively seeking for opportunities to improve their lives and others.

5.3. Our Strategy
1. Cluster based approach – WTP is based on the Hub and Spoke structure and adopts Provision of Urban Amenities to Rural Areas (PURA) strategy, a concept spearheaded by the former Indian President Dr. Abdul Kalam. The WTP, the hub, is located at Hasanparthy and houses Common Facility Center, Capacity Building Area, and Training Center. One satellite or cluster unit for each opportunity area is established within 70 km radius (Bacchannapet for Weaving, Pembarthi for metal crafts and Atmakur for banana fiber).
2. In-line with availability of resources (labor and material) – The artisans find work in the agriculture fields lucrative during the harvesting season (approximately 6-8 months a year). At least in the initial stages, WTP expects them to participate in the skill development during the non-seasonal time. Also, the raw material for banana fiber (banana stems) are available during September through December. WTP designed the programs keeping these seasonal availabilities of resources in mind.
3. Technology interventions to improve the value created - The interventions in all the areas follow the common strategy. The general interventions planned are:
   a) To enhance the motivation level of the artisans to adopt improved technology in a cluster-based approach supported by self-help groups.
   b) To develop new improved appropriate technologies at the WTP. For instance, the WTP pioneered blending of banana fiber with cotton to create cost-effective designs.
   c) To train the artisans in newer technologies to enable them to increase productivity, improve quality, and create greater value through innovative products. As a result, they increase their earnings.
4. Financial Empowerment – To provide financial freedom from the middlemen, increase income by creating higher value products, the WTP planned to:
   a) Enhance their financial literacy to increase their motivation to start new businesses and reduce their vulnerabilities to financial pitfalls.
   b) Connect artisans to banks for credit so that they have easy access to the raw material, working capital and new technology. As a result, artisans can work independently and earn a decent living free from the middlemen.
   c) Provide direct access to better markets for their products including branding, marketing assistance, and access to government societies.
   d) Encourage and support self-employment and new job creation for others through startup culture. To this end, the WTP connects women to the local incubator.
6. POTENTIAL IMPACT

The WTP identified four opportunity areas which can significantly benefit women by empowering them with financial literacy, market awareness and technology adoption. To achieve this goal, the WTP plans to engage in the development and deployment of training programs, new technologies and market development. It also acts as a catalyst to help artisans to obtain financial assistance and loans from Banks and government organization. Further, it will help in aligning the artisans in community building through self-help groups. During the first three years, the WTP plans to empower more than 2600 women and increase their individual annual income (Table 2) to about Rupees (₹)60,000 – (₹)90,000.

| Opportunity Area                          | Target number of women to be trained in a 3-year period | Expected annual income per women (₹) |
|------------------------------------------|--------------------------------------------------------|-------------------------------------|
| Weaving and Handloom Technologies        | 270                                                    | ₹80,000                             |
| Banana Fiber Extraction                  | 250                                                    | ₹75,000                             |
| Metal Craft Technologies                  | 270                                                    | ₹60,000                             |
| Construction and Habitat Technologies    | 1800                                                   | ₹90,000                             |

We envisioned that to create a Women Technology Park, it takes about 3 years. The time includes staffing the WTP, acquire the hardware resources, create training programs, establish connections with self-help groups, and empower the women. The Table 3 below provides the original proposed timeline. The actual implementation described in the subsequent paper shows that actual implementation mirrored this timeline and therefore, the proposed timeline was reasonable.

7. CONCLUSIONS

Women’s entrepreneurship is about the position of women in society. These women entrepreneurs face many challenges in the market that they must overcome to access the opportunities that are readily available to men. From our work at the WTP, we found that rural women have indigenous knowledge of arts and other work, possess skill, and are resourceful to establish and manage
microenterprises. Rural women can be successful due to their competence, involvement and attitudes. Therefore, we recommend that the rural women must be encouraged, enabled and leveraged to enter micro-enterprises for betterment of society.

A key in the encouragement is creation and empowerment networks – entrepreneurs’ networks, self-help groups. These networks are a valuable source of knowledge and can help in the success of rural micro-enterprises. These networks can help in imparting education through awareness programs, lectures, workshops, information material giving technical expertise in entrepreneurial skills, management techniques and technologies. These networks have the potential to involve and motivate other rural women to either start or contribute in micro-enterprise thereby increasing their standard of living and national productivity.

Women are often not able to reap adequate benefits of progress due to lack of empowerment. To enable their empowerment, the idea of setting up a rural Women Technology Park (WTP) was conceived. It equips rural women with appropriate and affordable technologies to aid in solving regional problems. As the paper shows the proposed model can serve as a platform for sustainability researchers and policymakers to empower rural women.

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References

[1]. Nehru J and Bhardwaj S 2013 Women entrepreneurship in India: Issues & Problems - You can tell the condition of a nation by looking at the status of its women Spectrum: A J. of Multidisci. Res. 2(7) 2278-0637
[2]. Draft resolution of the General Assembly 2010 United Nations Agenda items 13 and 115 Follow-up to the outcome of the Millennium Summit http://www.un.org/en/mdg/summit2010/pdf/mdg%20outcome%20document.pdf
[3]. Annan K 2005 Empowerment of women is the most effective development tool Press Release SG/SM/9738/WOM/1489 http://www.un.org/News/Press/docs/ 2005/sgsm9738.doc.htm
[4]. Sharma U 2003 Women empowerment through information technology(New Delhi: Authors Press)
[5]. Mehar Afroz Qureshi, Pervez Ahmed Khan and Sudhir Uprit 2016 Empowerment of rural women through agriculture and dairy sectors in India, Economic Affairs61(1) 75-79
[6]. Baden S and Reeves H 2000 BRIDGE Report No 55: Gender and Development Concepts and Definitions(UK: Institute of Development Studies)
[7]. Sylvia Maier and Usha Nair-Reichart 2007 Empowering women through ICT-Based business initiatives: An overview of best practices in E-Commerce/E-Retailing projects Inf. Tech. and Int. Dev.4(2)
[8]. Dejene A 2003 Integrated natural resources management to enhance food security: The case for community-based approaches in Ethiopia Working Paper No16Food and Agriculture Organization of the United Nations Rome.
[9]. Ogato GS2013 The quest for gender responsive information communication technologies (ICTs) policy in least developed countries: Policy and strategy implications for promoting gender equality and women’s empowerment in Ethiopia Int. J. Inf. Tech. and Bus. Mang.15(1) 23-44
[10]. Saraswathy Amma, K P Panicker K S and Sumi M 2008 Micro credit and women empowerment: A study in India Int. J. of Glob. Bus.1(1) 184-213
[11]. Batliwala S 2007 Taking the power out of empowerment: An experiential account Dev. in
Murthy R K, Raju K and Kamath A 2002 Towards women's empowerment and poverty reduction: Lessons from the participatory impact assessment of south Asian poverty alleviation programme in Andhra Pradesh, India United Nations Development Program

Grown C, Gupta G R, and Khan Z 2003 Background paper of the task force on education and gender equality promises to keep: Achieving gender equality and the empowerment of women Sociology

Malhotra A, Schuler S, and Boender C 2002 Measuring women's empowerment as a variable in international development (Washington, DC: World Bank)

Geetha N, 2014 Rural Women empowerment through micro-entrepreneurship development: Issues and prospects - AReview, IOSR J. of Econ. and Fin.3(2) Ver. III PP 18-20

Kuratko DF and Richard M H 2001 Entrepreneurship - A Contemporary Approach (New York U.S.A: Harcourt College Publishers)

Boserup E 1970 Women's role in economic development (London: Allen & Unwin)

Marchand M and Parpart JL 1995 Feminism/Postmodernism/Development London and New York (London: Routledge)

Participation of women in specified activities along with domestic duties 2014 National Sample Survey Office (NSSO), Ministry of Statistics and Programme Implementation, Government of India

Garrido M and Roman R 2006 Women in Latin America appropriating ICTs for social change in Cinderella or Cyberella? Empowering women in the knowledge society (Bloomfield USA: Kumarian Press)

Rajya Laxmi M, Sudhir Reddy M and Satyavathi M 2018 Work-life balance of working women professionals—a study of women in different sectors in Warangal region, Int. J. of Civil Eng. and Tech.9(4) pp 446-451

Poster W and Salime Z 2002 The limits of microcredit: Transnational feminism and USAID activities in the United States and Morocco in Women's Activism and Globalization: Linking local struggles and transnational politics (New York: Routledge) 189–218

Selvaraj N 2016 Personality traits of micro enterprises runs by women self help groups in Madurai, Ramnad and Dindigul districts of Tamil Nadu - A Study J. of Bus. and Fin.Aff.5:167 doi:10.4172/2167-0234.1000167

Donald F Kuratko and Richard M Hodgetts 1997 Entrepreneurship (USA: Dryden Press Series in Entrepreneurship)

Gobinath R, Akinwumi II, Afolayan OD, Karthikeyan S, Manojkumar M, Gowtham S and Manikandan 2020 A Banana fibre-reinforcement of soil stabilized with sodium silicate Silicon 12(2) pp 357-363

Singh S P, Satheesh Raju G and Shrvan M 2018 Waste management in construction-A study with reference to India, Int. J. of Civil Eng. and Tech.9(9) pp 533-538

Shrvan M, Satheesh Raju G, Singh S P, Yamsani N and Mahesh D 2018 Construction materials management on construction sites, Int. J. of Civil Eng. and Tech.9(13) pp 809-818

Awoyera PO, Adesina A and Gobinath R 2019, Role of recycling fine materials as filler for improving performance of concrete - A Review Aust. J. of Civil Eng. 17(2) pp 85-95.

Awoyera PO, Akinwumi II, Karthika V, Gobinath R, Gunasekaran R, Lokesh N, Manikandan M and Narmatha T 2019 Lightweight self-compacting concrete incorporating industrial rejects and admixtures: Strength and durability assessment Silicon https://doi.org/10.1007/s12633-019-00279-2

Duhan NR, Srivastava JP, Aquib Anis M and Sarkar PK 2018 Stress intensity factor for a semi-elliptical rail head crack under traction IOP Conf. Series: Mat. Sci. and Eng. 402 2nd International conference on Advances in Mechanical 10.1088/1757-899X/402/1/012132

Kumar BS, Raju GJ and Ranga Janardhana G 2018, Performance analysis of different material handling devices in flexible manufacturing system Int. J. of Mech. and Prod. Eng. Res. and Dev. 8(6) pp 425-436.
[32]. Venkata Ramana Rao P, Srishailam K, Devender K and Radha Krishna L 2018 A study on the aspect of nanomaterials towards sustainable energy *Ind. J. of Public Health Res. and Dev.* **9**(11) pp. 688-692.

[33]. Ramesh Babu D, Narasimha Rao KV and Kolati S 2018 The design of refrigeration, thermal insulation and an equipment for healthy ripening of mango and banana without using harmful chemicals *Int. J. of Mech. and Prod. Eng. Res. and Dev.* **9**(1) pp 423-434