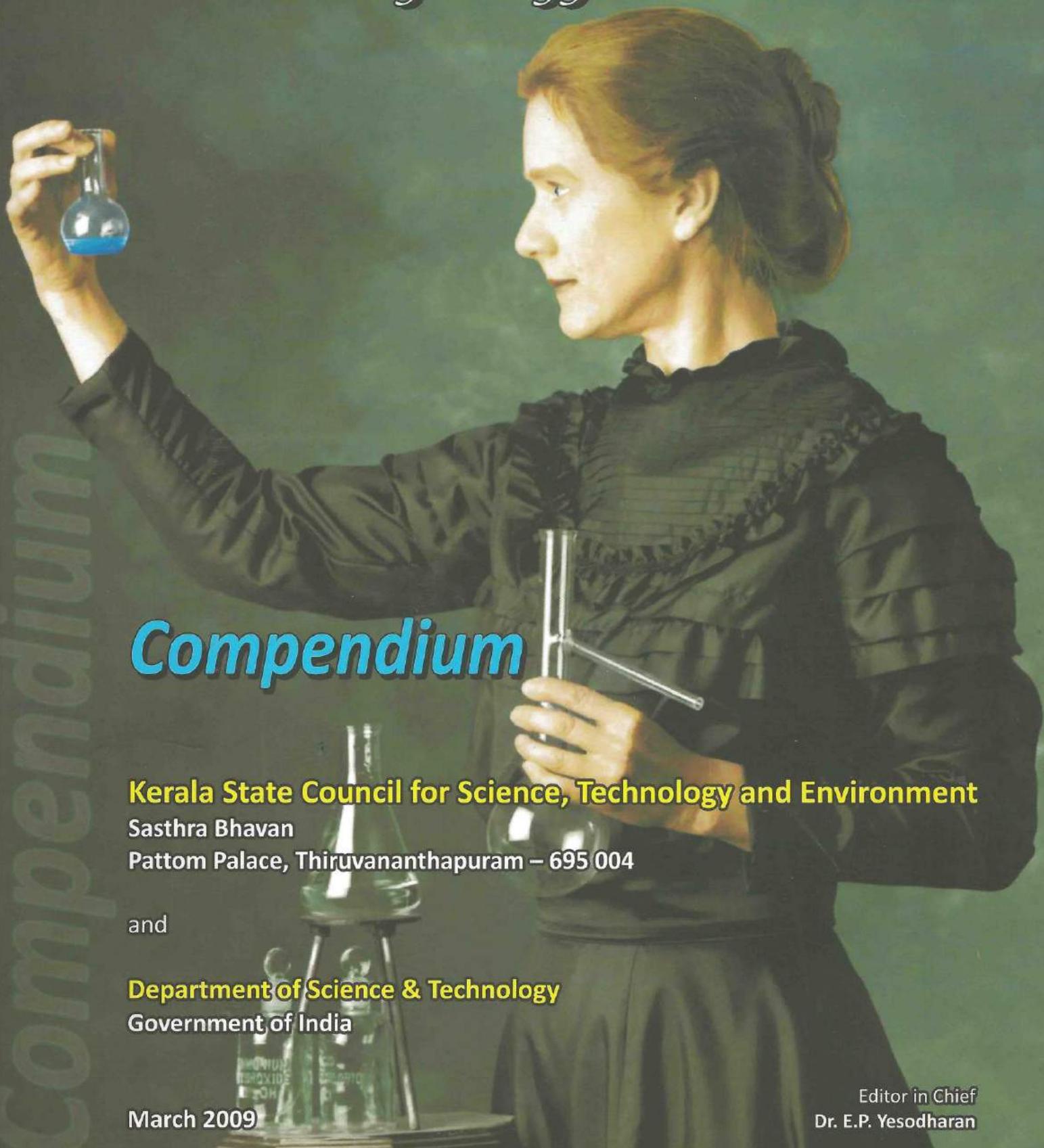




# **CAREER IN SCIENCE FOR WOMEN-** *Challenges & Opportunities*



## **Compendium**

**Kerala State Council for Science, Technology and Environment**

Sasthra Bhavan

Pattom Palace, Thiruvananthapuram – 695 004

and

**Department of Science & Technology**

Government of India

March 2009

Editor in Chief  
Dr. E.P. Yesodharan

# **CAREER IN SCIENCE FOR WOMEN- CHALLENGES & OPPORTUNITIES**

Compendium of invited talks and presentations

National Seminar organized on the occasion of International Women's Day 2009  
17<sup>th</sup> & 18<sup>th</sup> March 2009



**Kerala State Council for Science, Technology and Environment**

Co-sponsored by



**Department of Science & Technology,  
Government of India**

# **CAREER IN SCIENCE FOR WOMEN- CHALLENGES & OPPORTUNITIES**

Collection of invited talks and presentations

## ***Editor in Chief***

Dr. E.P.Yesodharan  
Executive Vice President, KSCSTE

## ***Compiled and Edited***

Dr. K.R.Lekha  
Scientist-E1, KSCSTE

## ***Secretarial assistance***

R. Asha Devi  
KSCSTE

***Published by:*** **Kerala State Council for Science, Technology & Environment**  
Sasthra Bhavan, Pattom (P.O), Thiruvananthapuram - 695 004

NOT FOR SALE

2009, KSCSTE, Govt. of Kerala  
No. of copies 1000

---

*Cover: Madam curie working in her laboratory*

## CONTENTS

	Page No.
<b>Preface</b> .....	i
<b>Foreword</b> .....	ii-iii
<b>Inaugural Address</b> .....	1
<i>Smt. P.K. Sreemathy</i>	
<b>Presidential Address</b> .....	4
<i>Dr. E.P. Yesodharan</i>	
<b>About KSCSTE and background of the Seminar</b> .....	8
<i>Dr. K.R.Lekha</i>	
<b>Making Women Scientists Visible in the Kerala Economy -Key Note Address</b> .....	10
<i>Dr. Mridul Eapen</i>	
<b>Role of S&amp;T in Women Empowerment</b> .....	19
<i>Dr. R.V.G. Menon</i>	
<b>Challenges faced by Women Executives</b> .....	21
<i>Dr. Ashalatha Thampuran</i>	
<b>Local Technologies for Empowerment of Rural Women</b> .....	23
<i>Dr. M. Lalithambika</i>	
<b>Career in Space Science and Technology- Opportunities and Challenges for Women</b> ....	25
<i>Mrs.S. Athula Devi,</i>	
<b>Women's Health</b> , .....	27
<i>Dr. Ramani S Wesley</i>	
<b>Electronics - Career Opportunities and Challenges for Women</b> .....	34
<i>Ms K.T. Beena</i>	
<b>Women in Science- National Initiatives</b> .....	38
<i>Dr. Sudha Nair</i>	
<b>Role of Women in Agriculture</b> .....	42
<i>Dr. M.S. Sheela</i>	
<b>Empowerment of Rural Women through Biotechnological Intervention-</b> .....	50
<i>Dr. C.G. Sudha</i>	
<b>Role of Women in Energy Conservation</b> .....	64
<i>Sri. K.M. Dhareshan Unnithan</i>	
<b>Role of Women in Water Management</b> .....	68
<i>Dr. George Chackacherry ,</i>	
<b>Recommendations</b> .....	75

## PREFACE

Women Scientists and Technologists have made significant contribution in every sphere of development. In India, the number of women scientists in various fields of Science, Engineering and Technology is still very low. Women Scientists not only play an important role in their respective areas of expertise but can play significant role in engineering social changes. Science and Technology play a vital role in the development strategy for various sections of the society. Full utilization of sufficient number of educated and trained women resources in Science and Technology is an economical and effective option to meet the challenges in development. There is a growing recognition of the need to strengthen women's capabilities and to promote their participation in decision making. This can be achieved by increasing their access to information and education particularly in the areas of Science and Technology.

International Women's Day is celebrated world over every year on 8th March to inspire women and celebrate their achievement. The Kerala State Council for Science, Technology and Environment is committed to increased women participation in the field of Science and Technology. With this objective, the KSCSTE, in association with the Department of Science and Technology, Government of India, had organized a National Seminar entitled '**Career in Science for Women – Challenges and Opportunities**' on 17<sup>th</sup> and 18<sup>th</sup> March 2009. The objective of the seminar was to ensure greater involvement of women in Science and Technology. The seminar was also aimed to serve as a platform for prominent women scientists to showcase their achievements in various fields of Science and Technology. The seminar covered various aspects related to the subjects, including the challenges faced by women Scientists and the opportunities ahead of them while selecting Science as a career.

The participants included women Scientists, faculty, Professionals from Academic and R&D institutions and students at national level. The Two day deliberations covering various aspects of Science included topics such as Space Science, agriculture, biotechnology, electronics, health science etc.

The Seminar was arranged in association with and with the financial support from The Department of Science and Technology, Government of India.

The Seminar was Coordinated by Dr. K.R. Lekha, Scientist, under the guidance of Dr. E.P.Yesodharan, Executive Vice President of the Kerala State Council for Science, Technology and Environment.

## FOREWORD



**Dr E.P. Yesodharan**  
*Executive Vice President,*  
*KSCSTE*



Our country has been witnessing fast progress in the field of Science & Technology for the last few years. From a meager 0.5% of the GDP, our investment in R&D in Science & Technology has gone up to more than 1.5% of the GDP during the last 2-3 years. We have established a number of new research institutions in frontier areas of Science & Technology such as Biotechnology, Information Technology, Nano Technology and so on. We also have increased the number of educational institutions such as IITs, NITs, IISER, NISER and central Universities. But at the same time, it is observed that the number of female scientists or number of girl students entering the field of Science is relatively less. In spite of the fact that a number of incentives are given by the Government at the Centre as well as at the State to encourage girl students, the number of girls enrolling in science institutions and pursuing career in science is very limited. Realizing this, the Kerala State Council for Science, Technology and Environment, together with the Department of Science and Technology (Government of India) decided to organize a programme to create awareness among our people, especially the women and young girls about the career prospects available for them in the field of Science and Technology.

Today, our women excel in almost every branch of science; be in Nuclear science, Space Science, Bio Technology, Nano Technology, Information Technology, Stem Cell Research or Molecular Spectroscopy. But still, the fact remains that the percentage of women entering the field of Science and Technology or the percentage of women who choose Science and Technology as a career option still remains less than 20%.

The Kerala State Council for Science, Technology and Environment is embarking upon a very ambitious programme to enroll more girl students in the schools and Universities, in the science stream and also to ensure that women will be getting adequate representation in our Science and Technology institutions as Scientists and Research Administrators. Our expectation is that, the delegates who are participating in this conference will spread the message that Science and Technology is a good career option for everybody, especially for girls. There are many incentives available at the State level and National level to pursue a career in science. The council also intends to hold more Seminars /discussions in this direction in the coming days and we look forward for your valuable suggestions.

This compendium presents several fascinating articles from prominent women professionals. It gives an insight into major career options available for women in Science and Technology. This, I am sure, will be a good source of information not only for women, but also for the general public. I congratulate my colleagues Dr. K.R. Lekha and others for bringing out this compendium aimed at inspiring young girls to choose science as a preferred option for higher study and career.



**P.K. Sreemathy**  
*Hon'ble Minister for Health, Family & Social Welfare*  
*Government of Kerala*

---

*Inaugural Address during the Inaugural function of the Seminar on "Career in Science for Women – Challenges and Opportunities"*

At the outset, I congratulate Dr. E.P. Yesodharan, Principal Secretary (S&T), for taking the lead role in organizing many programmes academically and other wise, with social perspective. The S&T department has undertaken many projects for the betterment of women in the State and the present seminar on "Career in Science for Women – Challenges and Opportunities", is one such initiative.

If we look at a world-wide scale, the number of women scientists compared to men scientists are very limited. Though the State of Kerala is way ahead academically compared to other parts of the country, only very few turn out to be Researchers or Scientists. But the blame on this cannot be imposed fully on women. The limitations of women are many. Though women come out with flying colors academically from our Colleges & Universities and some even with Doctorate, our environment is not conducive for them to continue their research. We know that Madam Curie is a well known personality who is honored and respected worldwide in the field of research. But even after so many years, the number of women scientists who rise up to this level is very limited. It is not because our women are not capable of achieving laurels, but by the time they complete their Graduation, Post Graduation etc., and wish to enter into research profession, as per our tradition they have to willingly or otherwise enter into married life. With that, she is burdened with additional responsibilities such as giving birth to children, bringing them up etc. By the time they get relief from this, 5 or 8 years would have passed. And many times, they will never get the opportunity to complete the research they have left half way through. But there are quite a few personalities who take up such issues and hurdles as challenges and go ahead with willpower to complete their research.

Research is a unique area unlike other areas of profession. It is a very competitive field which requires extra intelligence, knowledge and talent. Only those with willpower can stay in this profession.

In this context, I remember my recent visit to Vellore, where I happened to meet a girl who was doing research in the Stem Cell Research Centre there. She was a Keralite from Trichur. She was very happy to see me there. I asked her how long will she take to complete her research. She said that it may take a few more years. We know that Stem Cell Research has unlimited opportunities. A span of 4-5 years is required for her to complete her work. With so much of pressure and after so much of time, once she completes her research and takes up a job, her age will be 32-35. By that time her parents would have other worries such as getting her married, having a family etc. This is a social issue faced by our society. What I have to suggest is that she deserves a bit more flexibility in her career and research, especially with regard to time and other facilities, compared to their male counterparts. I am sure, many more ladies will come up in research profession if this flexibility is made available to her in her career.

Today, women outnumber men in our Universities. But the number of men exceeds the number of women in research profession. It is very much essential to create a positive attitude among our women in the field of Research. I don't think our country is taking the full advantage of the latest advances in Science and Technology. When the developed Nations are competing in adopting modern technological concepts and innovations, we lag behind them in this aspect.

But things are changing now. Many changes are happening in our country also. If our women scientists, who leave their research half way through due to the pressure of societal and family issues, are encouraged and inspired to continue their research, they can be turned out into successful scientists. . It is very much essential to create a positive attitude among our women in the field of Research.

In many cases where high-profile research is taking place world wide, there will be at least one Indian Scientist in their group as Doctors, Scientists or Technologists to contribute to their successful research. We can see very efficient people from India, contributing to the cause of Science and Research in almost every part of the world. The KSCSTE, under the leadership of Dr. E.P Yesodharan, has been constantly interacting with our Department; the Health, Family and Social Welfare Department, particularly on the welfare of women in Kerala. Several special programmes for women have been envisaged for the women folk in Kerala in this year's budget also.

In this context, I urge the women scientific community to prepare project proposals for the welfare of women. Our department will give all necessary support for implementing those programmes that contribute to the improvement in social, economic and living conditions of women.

Dear women Scientists, I am proud of you and I am very happy to attend the seminar and see you all. In Kerala, women occupy very high positions in their profession, such as Chief Secretary, Chief Post Master General etc. I am sure, more women can be brought into science profession. There would be some hurdles on the way and these have to be overcome so that more women take up science as a profession and contribute equally along with men, in the area of research.

I wish, this seminar will help to inspire our women scientists to create a positive attitude towards science research and become successful in their profession. Many more things can be done for the welfare of women. Each one of you must contribute towards women welfare through your profession.

I wish this seminar will achieve its objective. With this few words, I declare that this Seminar is officially inaugurated.

## STATUS OF S&T RESEARCH IN INDIA - PROSPECTS

**Dr. E.P. Yesodharan**

*Executive Vice President,*

*Kerala State Council for Science, Technology and Environment*

*E-mail: epyesodharan@gmail.com*

---

*Presidential address during the Inaugural function of the Seminar on “Career in Science for Women – Challenges and Opportunities”*

In these days, when we are talking about equality of gender, or as some people may call it the superiority of one gender, ie. the fairer gender, is it really relevant or necessary to have a special seminar for women alone?. In this context, I am reminded of some articles on “Celebrating Womanhood” written by leading women celebrities of our country. I was surprised to see that the concept of what a women should be, or what is expected of an ideal woman remains basically the same, irrespective of the vast changes happening around us and irrespective of whether it is a man or woman who is commenting on this.

In fact, some of the comments about women in one of the articles really attracted my attention. I don't want to name the author who happens to be a leading women activist. She says that an ideal women is the essence of delicacy, she is the wealth of inner strength, her silence speaks volumes, her words can enthrall, as gentle as she is; she is tough, she is wise and she is child like.

Whatever it is, today, as the Hon'ble Minister has also mentioned, women are excelling in almost every field of day to day life. We know that we have a number of women pilots, women Space travelers , women Scientists, women engaged in social causes and women in all kinds of professions. And in that context, what I want to emphasize is that Science and Technology is a very good career option for women. It is particularly relevant to note that we are having this national seminar today immediately after we observed the National Science Day and a few days back the International Women's Day.

I had the opportunity to participate in a number of functions related to the National Science Day. We all know that the National Science Day is observed to commemorate the greatest scientific contribution from our country so far, that is the discovery of Raman effect by Sir. C.V. Raman. That is something which happened in the late 1920's. That means 90 years have passed since we got our first and only Nobel Prize so far in science.

So the question which many in the audience were raising was; what is wrong with our S&T? I happened to be a representative of the State government in Science and Technology. So they raised the question to me; "why are we unable to produce another Raman or Raman effect for almost a century?". In fact, one Senior Professor from the audience in one such meeting was suggesting that the KSCSTE should commission a project to identify the problems faced by Science and Technology in our State and in our country.

I don't think the answer is difficult to find. The reason as to why we could not produce another Raman or Raman effect for almost a century is very simple. The fact of the matter is Research and Development in Science and Technology is a long term investment. It is something which requires very huge investment and the results are slow to come by. So at the national level and at the state level, we need to earmark a good amount of money for our research programmes.

If we look at the statistics, when most of the developed countries like the United States, Western Europe and Japan are investing something of the order of 4-8% of their GDP for R&D in Science and Technology, our country until very recently has been investing as low as 0.5% of our GDP. Already our GDP is small and the percentage of the GDP which we invested in our Science and Technology makes the actual investment very low. In absolute numbers, when the United States is spending, say something of the order of Rs. 500/- for Science and Technology Research, in India our investment is just 1 Rupee. So you can imagine; when there is a competition between 2 persons; one person having Rs.500/- and the other person having 1 Rupee and both competing for the same thing, who will be the winner? The answer is very obvious and very simple. That is one of the reasons why our Science and Technology remained backward all these years.

But things are changing now. At least since the last 5 years, our investment in Science and Technology has grown many fold. Today, we have almost reached 1.5% of our GDP as investment in Research and Development in Science and Technology. And what is even more important is that, probably ours may be the only national Government in the world which is having 7 major departments exclusively for Science and Technology related subjects. We have the Department of Science and Technology, Department of Biotechnology, Department of Atomic Energy, Department of Space Science, Department of Scientific and Industrial Research, Department of Environmental sciences and Department of Earth System Science. All these departments probably except one or two are managed by top class Scientists and Technologists in the country and not by career bureaucrats. And

if you happened to see the human resources in many of these Science and Technology related Departments, most of those at the level of Secretaries, Additional Secretaries and so on are career scientists and career professionals and not bureaucrats. So certainly, the future of S&T remains very bright in our country and if our investment in Science and Technology continues at today's rate, we will be able to produce another Nobel Laureate in Science in another 10 years or even earlier.

So what I am about to say is that Science and Technology is a very good career option for everybody and certainly for women. If we look at the remuneration package for scientists, that is also much better today. Recently with the revision of pay and other service conditions, things are becoming ever better. Again if we compare the salary received by a middle level scientist in our country and that in the United States, in absolute terms, our salary may be 1/5<sup>th</sup> of what our counter part in the United State is getting. But when you compare with the quality of life in the country and the cost of living index, probably the scientists in India will be one of the best paid compared to the scientists elsewhere in the world. So, certainly, there is no dearth of incentive for S&T in our country today.

One of the important things in this context is that it is not enough to have good funding for projects, we should have good human resources to carryout the activities. And in that context again, both at the national level as well as at the state level, government has been doing lot of things at least during the last 5 years. We have started a number of Indian Institutes of Technologies, NITs and research institutions in frontier areas of S&T. So certainly, the future looks very bright.

Our country has achieved a consistent growth rate of 7-8% during the last 4-5 years, and this growth rate is propelled by the advancement in Science and Technology. Earlier our exports used to be handicrafts, spices and other traditional agriculture based items. With S&T as the basis for export and economic growth we have to always remain at the edge of competition. We have to be developing newer and newer technologies to keep up competitiveness.

Earlier it was the United States. Japan took over US, then Taiwan took over Japan, then South Korea took over Taiwan. Now China has almost taken over south Korea. So, when your economy is dependent on advancement in Science and Technology, we have to be extremely vigilant. Our policy makers and decision makers have realized the importance of investing in Science and Technology and lot of money is earmarked for this sector. Many of

you being Scientists and Academicians, may be aware of the fact that there is no shortage of money for Science and Technology in our country today. So if you have a good research project or an ambitious programme nothing stands in your way to perform.

Again, let me emphasize here that there is no difference between Basic science or Applied science. I know that many of my colleagues talk about Applied science; but as a Scientist, I certainly do not find any difference between Basic Science and Applied science because, there cannot be any Applied science without Basic science. All that we are talking as applications today are the result of basic science developed 15 or 20 years back. All of you know the story of X-rays or dynamo. When the X-ray was first invented, it was considered as some kind of a radiation. But today you all know how X-ray has become an integral part of modern medical treatment and it has saved millions and millions of lives. What about Nuclear Magnetic Resonance? It was an abstract Science term until few years back, may be 10-15 years back. Only some Chemists and Physicists used to talk about Nuclear Magnetic Resonance. When Nuclear Magnetic Resonance was invented, all that was said casually was; some nucleus of some atom can have a spin and such nucleus will have magnetic activity. It just did not appear to mean anything new to the day-to-day life of a normal person. But today, we know that, all the images we are talking about in the field of medicine, whether it is whole body CT scan, whether it is MRI scan or any other scan which revolutionized modern medical treatment, they are the result of the basic observation that the nucleus of an atom can spin. So Basic science is more important and the Applied science follows. At the KSCSTE, when we are inviting project proposals, we certainly do not distinguish between Basic science and Applied science. For us, anything that can contribute for improving the quality of life of the people, today, tomorrow or the day after, is science and we will be providing the same kind of treatment for all research projects.

I am very happy that we got a very good representation of women from all sections of Science and Technology for the Seminar on "Career in Science for women – Challenges and Opportunities". I take this opportunity to call upon the women scientific community in the State and the country to be proud of their profession and excel in their career.

## ABOUT KSCSTE AND BACKGROUND OF THE SEMINAR

**Dr. K.R.Lekha**

*Scientist-EI & Seminar Coordinator,  
KSCSTE.*

*E-mail: lekharajendran@hotmail.com*

---

The Kerala State Council for Science, Technology and Environment (KSCSTE) was constituted in November 2002 as an autonomous body to encourage and promote Science and Technology related activities in the Kerala State by restructuring the erstwhile State Committee for Science, Technology and Environment (STEC), that was established in 1972 in concurrence with the Science Policy of Government of India.

The apex body of KSCSTE is the State Council with Chief Minister of Kerala as the President. The chief executive officer of the Council is Executive Vice President (EVP).

The Main functions of the State Council are to:

- Plan, formulate and implement Science and Technology Promotion and other related research and development programmes.
- Provide overall guidance to the programmes and the developments of R&D centres of the Council.
- Disburse the grant-in-aid funds from the Government and sponsoring agencies to R&D Centres and other grant-in-aid institutions.

The seven R&D centres under the umbrella of the Council engaged in research education and training in specific identified domains are, The Centre for Earth Science Studies (CESS) at Thiruvananthapuram, The Centre for Water Resources Development and Management (CWRDM) at Kozhikode, The Kerala Forest Research Institute (KFRI) at Trissur, National Transportation Planning and Research Centre (NATPAC) at Thiruvananthapuram, Rajiv Gandhi Center for Biotechnology (RGCB) at Thiruvananthapuram, Tropical Botanic Garden and Research Institute (TBGRI) at Thiruvananthapuram and The Kerala School of Mathematics (KSOM) at Kozhikode.

In consonance with the Government's Science & Technology Policy 2002, several activities and programmes have been initiated and implemented by the Council Headquarters. These programmes are implemented towards promotion and popularization of Science and Technology, both fundamental and applied research, primarily among the academic and

R&D institutions in Kerala. The key strategy of the Council is to identify programmes in focused areas and target groups to ensure maximum benefits to the society.

The National policy for empowerment of women 2001 is committed to creating an environment through positive, economic and societal policies for the full development of women to enable them to realize their maximum potential. In Kerala, though the state has the highest women literates, no concerted efforts have been made to attract and retain women in science. There is a need to develop a spirit of entrepreneurship among women, thereby creating more job opportunities self esteem and societal recognition of women.

To respond to the call for increased participation of women in Science, Technology, Engineering and Medicine, KSCSTE proposes to expand its activities on initiatives that help women succeed more in the field of Science.

Against this background, a two-day National Seminar on "Career in Science for Women – Challenges and Opportunities" was organized by Kerala State Council for Science, Technology and Environment on 17 & 18 March 2009 as part of International Women's Day celebration 2009. The objectives of the seminar were,

1. To make women scientists aware of their potential and the need to take up programmes to contribute to the National economy.
2. To motivate young women to take up career in Science, Technology, Engineering and Medicine (STEM) and retain them in the profession.
3. To provide a platform for prominent women scientists to showcase their achievements in respective areas.
4. To evolve a strategy for supporting women scientists in the State through various programmes and measures and also help them in tackling issues specific to women scientists in their profession.

The deliberations included possibilities in various fields such as Biotechnology, Agriculture, Space Science, Electronics, Medical sciences, Energy, Water Resources and other topics of relevance to women scientists. Some of the critical issues and proactive measures for attracting and retaining young girls and women in various sectors of Science & Technology were discussed. The Council intends to undertake many more such programmes in the coming months to achieve these objectives. For more information on the Council and its activities please visit our website [www.kscste.kerala.gov.in](http://www.kscste.kerala.gov.in)

**Key note lecture**

**MAKING WOMEN SCIENTISTS/TECHNOLOGISTS VISIBLE IN THE  
KERALA ECONOMY**

**Dr.Mridul Eapen**

*Member,*

*Kerala State Planning Board,*

*Pattom (P.O),Thiruvananthapuram – 695 004.*

*E-mail: mridul@cds.ac.in*

---

I am very happy and honored to be here today at the National Seminar on "*Career in Science for Women-Challenges and Opportunities*" organized by the Kerala State Council for Science, Environment and Technology, in association with the Department of Science and Technology, Government of India and co-sponsored by the State Bank of Travancore, Trivandrum, on the occasion of the International Women's Day this year.

The under representation of women in science, particularly at the higher levels of teaching and research not only in Kerala but the rest of the country has become a serious cause for concern (a loss of potential) and such Seminars are very useful in visibilising this issue.

There is a specific reason for titling my paper as I did. Data reveal very high enrolment of girls/women in science subjects in Kerala at the graduate level and post graduate level, 70-80 percent of the total students in the final year of BSc and MSc (see Table 1) and as revealed by other studies, much higher than in other states.

Many of them do very well and are gold medalists; many of them also enter PhD programmes. However, they are not very **visible** as "scientists" in our scientific institutions, their numbers are low in faculty positions and negligible in higher faculty positions.

This suggests a loss of women scientists in research, even more so at the post doctoral level. Difficult choices have to be made by women, in terms of marriage and family building, before they reach the point of choosing a career in science.

**Table1: BSc and MSc Students Enrolled in colleges during 2007-08**

Subject	BSc final year			MSc Final Year		
	total	girls	%girls	total	girls	%girls
<b>Mathematics</b>	5088	2896	<b>56.92</b>	686	588	<b>85.71</b>
<b>Physics</b>	3970	2733	<b>68.84</b>	650	538	<b>82.77</b>
<b>Chemistry</b>	3753	2573	<b>68.56</b>	749	628	<b>83.85</b>
<b>Zoology</b>	3231	2460	<b>76.14</b>	571	456	<b>79.86</b>
<b>Botany</b>	3206	2580	<b>80.47</b>	518	405	<b>78.19</b>
<b>Statistics</b>	262	138	<b>52.67</b>	40	30	<b>75.00</b>
<b>Geology</b>	138	98	<b>71.01</b>	59	53	<b>89.83</b>
<b>Home Science</b>	44	28	<b>63.64</b>	712	597	<b>83.85</b>
<b>Bio-Chemistry</b>	165	93	<b>56.36</b>	30	22	<b>73.33</b>
<b>Polymer Chemistry</b>	130	90	<b>69.23</b>	**	**	
<b>Bio-technology</b>	133	96	<b>72.18</b>	**	**	
<b>Computer Science</b>	98	**		**	**	
<b>Industrial Fisheries</b>	32	**		**	**	
<b>Electronics</b>	73	42	<b>57.53</b>	**	**	
<b>Analytical chemistry</b>	11	10	<b>90.91</b>	41	31	<b>75.61</b>

Source: Economic Review, 2008

It is imperative that the Council should offer to compile a data bank of all women doctoral students in Kerala to hasten the National Survey which has been initiated in 2007 by the Panel on Women in Science (and not yet complete as far as my knowledge goes) categorizing them into four groups: (a) whether engaged in research; (b) whether engaged in teaching; (c) whether engaged in industry; and (d) whether discontinued and the reasons for doing so. To me the last would be very critical in understanding the low visibility of women scientists in our institutions.

Let us look at some data that I have compiled on a few Institutions, for which I could procure some information on gender break up of scientists (see Tables 2 and 3) and then discuss some possible reasons for dropouts. The NSSO has a category of 'Scientists' defined as *those engaged in research and experimental development in natural sciences and engineering* (NIC code 73100); the number of women is 70 and of men is 2250 in Kerala. Experts here should tell me whether the definition is too narrow.

A very obvious finding of the Tables is the negligible presence of women among senior level scientists-categories G, F and E2. Another is the considerable variation between institutions; while in CESS, KFRI and TBGRI, the largest employers of scientists and technical personnel in our sample, the percentage of women is relatively small ranging between 11 and 17, in CWRDM it touches almost 30 percent.

The pattern is very different in RGCBT; on the whole, the proportion of women scientists is high but is it because we are including PhD and post doc fellows? So one has to probe a bit more to see whether the data are comparable. The question is whether the differences are also due to nature of the subject?

**Table 2: Women Scientists/Technologists in Selected S&T Institutions**

Institution	Scientists- Category						Technical	Total	%women
	G	F	E2	E1	C	B			
<b>1.NAT PAC</b>	<b>4</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>	<b>18</b>	
men	3	0	8	0	0	2	2	15	
women	1	0	0	0	0	2	0	3	16
<b>2.CESS</b>	<b>1</b>	<b>9</b>	<b>24</b>	<b>9</b>	<b>8</b>	<b>4</b>	<b>6</b>	<b>61</b>	
men	1	9	23	7	6	3	5	54	
women	0	0	1	2	2	1	1	7	11
<b>3.CWR DM</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>16</b>	<b>6</b>	<b>5</b>	<b>3</b>	<b>37</b>	
men	1	2	4	12	3	3	2	27	
women	0	0	0	4	3	2	1	10	27
<b>4.KFRI</b>	<b>2</b>	<b>5</b>	<b>21</b>	<b>11</b>	<b>1</b>	<b>9</b>	<b>6</b>	<b>55</b>	
men	2	5	16	10	1	6	6	46	
women	0	0	5	1	0	3	0	9	16
NB:technical relates to SSA									
<b>5.TBGRI</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>1</b>	<b>7</b>	<b>13</b>	<b>23</b>	<b>53+29</b>	
men	2	2	4	1	7	11	17	44+21	
women	0	0	1	0	0	2	6	9+8	19+27
NB:Technical relates to SSA and JSA: There are also two Scientist A (male) and 27 technical officers (19 male and 8 female)									

Source: Annual Report

**Table : 3 RGCBT**

<b>Department</b>	<b>Scientist</b>	<b>Post doctoral</b>	<b>PhD students</b>	<b>Tech</b>	<b>Project Fellows</b>	<b>Total</b>	<b>% Women</b>
<i>RGCBT</i>							
<b>(a)Dept of Molecular Medicine</b>	<b>6</b>	<b>1</b>	<b>6</b>	<b>2</b>	<b>-</b>	<b>15</b>	
<b>Men</b>	5	0	3	1	-	9	
<b>Women</b>	1	1	3	1	-	6	40
<b>(b) Molecular Endocr. &amp;Reprod.</b>	<b>2</b>	<b>-</b>	<b>7</b>	<b>-</b>	<b>2</b>	<b>11</b>	
<b>Men</b>	1	-	3	-	0	4	
<b>Women</b>	1	-	4	-	2	7	63
<b>(c) Molecular Microbiology</b>	<b>2</b>	<b>1(res assoc)</b>	<b>5</b>	<b>2</b>	<b>-</b>	<b>10</b>	
<b>Men</b>	2	0	2	1	-	5	
<b>Women</b>	0	1	3	1	-	5	50
<b>(d)Cancer Biology</b>	<b>5</b>	<b>-</b>	<b>15</b>	<b>2</b>	<b>11</b>	<b>33</b>	
<b>Men</b>	2	-	7	0	6	15	
<b>Women</b>	3	-	8	2	5	18	54
<b>(e) Neurobiology</b>	<b>3</b>	<b>-</b>	<b>7</b>	<b>-</b>	<b>-</b>	<b>10</b>	
<b>Men</b>	2	-	5	-	-	7	
<b>Women</b>	1	-	2	-	-	3	30
<b>(f) Plant Molecular Biology</b>	<b>4</b>	<b>1</b>	<b>13</b>	<b>2</b>	<b>3</b>	<b>23</b>	
<b>Men</b>	2	1	6	2	1	12	
<b>Women</b>	2	0	7	0	2	11	48
<b>(g) regional facility for genetic finger printing</b>							

Source : Annual Report

Again, from Table 4, we see that in the Bio-technology wing of Sri Chitra Tirunal Institute too, women comprise less than 20% of scientists/technologists. However, at the senior level of Scientist G, they have almost 50% representation.

**Table4:Women Scientists/technologists in Sree Chithira Thirunal Institute for Medical Sciences and Technology**

<b>Division</b>	<b>G</b>	<b>F</b>	<b>E</b>	<b>D</b>	<b>C</b>	<b>B</b>	<b>JSO</b>	<b>Engr.G</b>	<b>Engr.F</b>	<b>Engr.E</b>	<b>Engr.D</b>	<b>Engr.C</b>	<b>Engr.B</b>	<b>Total</b>
<b>Bio-medical technology wing</b>	6	4	6	6	2	1	4	1	5	2	1	3	3	45
<b>Men</b>	4	3	6	4	2	1	4	1	5	2	1	2	3	37
<b>women</b>	2	1	0	2	0	0	0	0	0	0	0	1	0	8

*Source: Annual Report 2006-07*

*Note: G, F, E etc are Scientist Categories; Engr-Engineer*

This concern of a near reversal of gender break-up of science students when it comes to scientists, has been expressed for some time and several policy changes have been made to encourage women scientists as well as to inspire girls and women to take up science careers. Why do women have more difficulty pursuing research careers than men? We saw from Tables 2 and 3 that a larger proportion of women scientists are found in the area of Biotechnology. Is it due to the innate liking for such subjects within the larger area of Science or are these areas more amenable to gender roles of women? It is evident that more importantly a social change is required.

We all know that women on average work longer hours within the household the burden of which also constrains their full participation in outside work as part of the nation's employed population.

There are social restrictions on women's behaviour in an environment that stresses female sexual purity and family responsibility. This constrains physical mobility and therefore professional mobility of girls reflected in fewer opportunities for higher education requiring relocation or foreign travel; developing professional contacts outside their local research systems; gaining access to research materials on frontiers of research; publishing in national and international journals or travelling abroad for professional reasons.

Especially after marriage, a woman has to assume a large amount of household responsibility which most often interferes with her career and breaks the continuity in her research. The child bearing period inevitably coincides with the period of active research and advancement.

And this is one of the major challenges that women face in pursuing a career in any sphere, particularly so in science, given its demanding nature in terms of hours of work, need for continuity and the highly competitive nature of research since so many issues are of common global concern.

As stated earlier several measures have been taken to overcome some of these 'social' problems of women scientists and provide them with better opportunities to pursue research, some of which are worth noting:

- A number of incentives were announced by the Union government to help women scientists to pursue research careers after marriage and motherhood, a key proposal was to offer flexible working hours for women with children up to 3 years which however was turned down by the Cabinet;
- But some other measures which were accepted like setting up of crèches, providing feedback on recruitment of women scientists to senior positions, have not been followed up by several key scientific institutions;
- A very interesting scheme which is operating is the Fellowship programme offered by the Department of Science and Technology to allow married women scientists to pursue research careers after a break. Upper age limit is 50 years and the selection procedure is very rigorous. In fact I think this facility should be made available in other fields also, for instance in social sciences, by the Social Science Research Funding Institution ICSSR to those women who could not pursue research due to child bearing and rearing;
- Honoring women scientists especially young scientists is another major incentive (for instance S Jyoti who bagged the Best Young Scientist award this year at the Kerala Science Congress; showcasing work done by women scientists and publicizing women being promoted to high positions, for instance Dr. Tessy Thomas of DRDO appointed to the post of Project Director of the upgraded version of the nuclear capable Agni II-missile).
- Initiatives taken to form network of women scientists, specifically the Women in Science Panel, Indian Academy of Sciences, is very noteworthy. Holding conferences with local Institutions to highlight the work being done by women scientists is very

useful. There is also *Shakti*, the women's wing of Vigyana Bharati. Today I read about the Science Facilitation Centre in Mar Ivanios where school students of science learn from BSc and MSc students. There must be many other such initiatives to encourage girls and boys to pursue science in higher studies.

Recently some social science research has emerged emphasizing that the diffusion of ICT is helping women scientists in Kerala to overcome the above mentioned barriers to their professional development by tapping into international networks. The study surveys 293 scientists based in Ghana, Kenya and Indian state of Kerala. Its results show that there are very small differences between men and women in individual characteristics, professional resources and organizational conditions within which research is conducted. However, a combination of educational and research localism limits the likelihood of professional networks for women given their restrictions on mobility. **There are systemic deficits in the acquisition of social rather than material resources** which to a large extent are being overcome through internet connectivity. More importantly it is also enabling women to "circumvent" though not yet "undermine" the patriarchal structures constraining their mobility and professional contacts. The advantages of this would of course accrue primarily to the urban located better off women in our society and its scope would have to be enlarged.

I would like to conclude with a few observations which have a bearing on **challenges** and **opportunities** women in science face:

- Women play a critical role as producers of both economic and 'social' goods and services; but given the way gender is socially constructed, they occupy different economic and social positions within the household, the workforce and the community which are structured in such a way as to leave them with little power economically, socially and politically. Women should be visibilised in terms of their productive role in every sector (to guide policy making in a gender sensitive way) and ensured support in their domestic role both from within the household and the state: the link between discrimination and women's reproductive role is very clear which impacts not only on their decisions regarding careers but once working prevents their upward mobility in discriminatory ways;
- This was one of the opportunity aspects I wanted to emphasize—the need to break the glass ceiling, as shown above in the case of scientists. The Government's recent Policy on Women also focuses on this issue; how do we modify social and cultural patterns of the conduct of men and women which would remove prejudices based on

stereotyped roles for men and women and the presumed superiority of the former over the latter;

- Institutions should implement all necessary measures to reduce the burden of social responsibilities of women scientists in terms of crèche, child care facilities; safe transportation for those working late, and rewarding the deserving doers;
- The Council should play a nodal role with the help of other institutions in compiling a Data Bank on women scientists which would feed into the National Bank. Also all information regarding Fellowships, grants etc for pursuing research careers should be accessible to all aspiring scientists;
- Networks not only among the scientists but with concerned Departments (whether agriculture, industry, infrastructure) are essential to evolve ideas which would help women in reducing drudgery of their work and enhance livelihoods. For instance in 2004 Ms. Seethalakshmi, a scientist in the KFRI, was selected for the National Award for Women's Development through Application of Science for her contribution to the development of value addition of bamboo resources that has empowered women at the grassroots; women and men scientists to some extent have to be grounded in the realities of the state which would benefit from their knowledge and its application.
- A look at the Seminar programme makes me happy that a lot of work being done by women scientists whether in the field of agriculture, energy conservation, water management and space science does appear to be embedded in areas of potential for women. This is not to undermine research in other areas which may not have an immediate application.
- ICT and its positive impact should not become discriminatory between the richer and poorer sections of women if it gets restricted only to those who can afford a personal computer with an internet connection. SBT through its two schemes for women could also encourage the women scientists from poorer households to access the equipment. Of course located in a rural area problems of power and connectivity could be there but the efforts should be there to continuously improve the situation.

Let me in conclusion thank KSCSTE and DST for giving me this opportunity to talk about visibilising women and their contribution as Scientists.

## S&T AND EMPOWERMENT OF WOMEN

### **Prof. RVG Menon**

*Former Director, ANERT & IRTC,  
Haritha, KRRRA-22,  
Kesavadev Road, Poojappura (p.o.)  
Thiruvananthapuram – 695 012.  
E-mail: rvgmenon@yahoo.com*

---

Science improves our understanding of the world, and Technology enhances our capacity to change it, so as to suit our convenience. Both lead to empowerment. Knowledge gives us self confidence, and enables us to analyze and manipulate the environment. Technology improves our ability to do so. Technology gives us more efficient tools and the power to operate them. It boosts our self esteem and also increases our productivity.

Human progress has been a saga of the use of S&T in the service of man: the mastery over fire, the invention of the wheel, the taming of animal power, the harnessing of natural sources of energy, and the breakthroughs in production techniques as well as organization – all have led to our present position – for good or bad.

But one factor which has not received the attention it deserves, is that men and women have not been equal beneficiaries of this progress. In fact, the application of technology has only worsened the relative status of women in society.

There is a general consensus among historians of technology that agriculture as probably a women's invention. Because in the hunting gathering days, hunting was a men's job and the women had been assigned to the task of gathering; and naturally they knew more about plants and fruit, than the men. So, when there was a scarcity of hunted meet, due to various reasons, it must have been the womenfolk who came to the rescue, with their knowledge of alternative food. But with the harnessing of animal power and the advent of the heavy plough, it became a man's job.

In the beginning, women were skilled in the art of pot making. But again, with the invention of the potter's wheel, we find the women being sidelined. In many traditional potter societies, the women are not allowed to work the wheel!

Similarly, we find women being kept away from workshops, machines and many labor saving devices, under various pretexts. And, together with this, the myth is created that "women are quite good in repetitive, tiresome jobs" which men find distasteful.

The other side of the picture is the fact that women are universally considered to be the second earners in the family. This is taken as justification for a "family wage concept", according to which, women need to be paid only a lesser wage, even when they do practically the same kind of work. This formula is applied even when they happen to be the sole bread winner, or the head of the household. This has come to such a pass that if a work is usually done by women, it is sure to carry a low wage. Take the instance of Anganwadi workers, house maids, STD booth operators, sales girls, In fact, almost all the low paying jobs in our society are the ones predominantly done by women. Normally, if a job involves the use of 'high technology' it is bound to carry a high wage. Except when it is predominantly done by women! Otherwise, how come the DTP jobs carry a comparatively small remuneration?

Apparently, the prejudice against women is stronger than the glamour of high tech!

The big question is, how this can be changed?

Nowhere in the world, has a discriminatory system been dismantled unilaterally by the beneficiaries of discrimination. So, the struggle for change has to come from those who are discriminated against, namely the women themselves. They have to carry the fight to the enemy camp; by mastering those technologies which give great advantage in the job market. By using technology to change their status from that of wage labor to Entrepreneur or Self Employed Women. Thus they can achieve true control over their technology and its productivity.

There is another, totally different aspect also to empowerment. The mastery over technology, even if it is only an ordinary bicycle, gives a tremendous boost to the self esteem and confidence of the user. This is much more so in the case of powered vehicles or machines. The feel of the vibrating machine and its throbbing power, rearing to go, enhances our feeling of control over nature, and over our own life.

Our women are equally entitled to this feeling of power and fulfillment.

Why should men have all the fun?

## CHALLENGES IN THE PROFESSION

**Dr. Ashalatha Thampuran**

*Principal,*

*Mohandas College of Engineering and Technology,*

*Anad, Nedumangad, Thiruvananthapuram.*

*E-mail: ashalatha@asianetindia.com*

---

1. To meet the expectation level of the public. Since architectural field is a male dominated area they expect the woman architect to behave like male that had posed some problems in the beginning- traveling, keeping away from home for a long period, striking balance between family and profession etc.
2. To prove the physical ability to undertake any work especially those in this field
3. There is hesitation to accept the woman as one among them. This can be overcome by putting in additional effort to be an expert in the chosen area.
4. There is a feeling that women are mentally weak but it is the reverse, weak when it came to physical labour, but mentally and emotionally they are more stable than male counterparts.
5. The society expects the ladies to perform same functions or than own (bearing looking after young children) house keeping and social interaction etc. Of these the bearing and looking after of young children only cannot be delegated. That is where she has to strike a balance. A little bit of planning properly can help you in this regard.
6. House Keeping and social interactions are every individual's responsibility. Priority to be fixed as highly essential, essential and not essential.
7. There is more flexibility in lady executives since they are capable of managing more than one activity at any point of time.

## CHALLENGES AS AN ACADEMICIAN AND PRINCIPAL

1. As an academician the main challenges is to strike balance between teaching, learning and research. With a little bit of planning it is not very difficult to strike a balance as these are very flexible.
2. As a principal it is a very responsible 24 hours job where the demand of your time and presence is highly essential. Delegation of power is not possible in most of these cases.

3. It is highly essential not to have any obligation towards anybody specially Government officials and politicians should be 100% impartial while performing duties dealing specially with the students.
4. Controlling unruly students and keeping the discipline inside the campus is the most challenging job.
5. Have to function as a leader who leads from especially while dealing with the students. No affiliation to any political parties. The students should feel that there is genuine interest and concern for them. Once that is achieved very easy to control and run the institution.
6. As the Principal has to deals with money running into crores, should be thorough with purchase procedure and other financial situations.

## **LOCAL TECHNOLOGIES FOR RURAL WOMEN**

### **EMPOWERMENT -The IRTC experience**

**Dr M. Lalithambika**

*Project Coordinator,  
Integrated Rural Technology Centre,  
(IRTC),Mundur,  
Palakkad-678592.  
E-mail: irtc@vsnl.com*

---

It has been said that even God will dare to appear in front of a hungry person, only in the form of food. Similarly, in our socio-economic context, where almost half the families are living either in poverty, or under threat of impoverishment, science and technology can appear before them only in the form of better livelihood opportunities. For these rural women, empowerment means the power to ensure food and security to their children and other dependents. Otherwise, they feel helpless. To overcome this, they need better employment, or other income generating activities. They know that the traditional occupations yield comparatively low incomes. Some of them have become outdated also. So, they are looking up to the scientists and technologists, for better options. This is the challenge IRTC has been addressing for the past two decades.

Some of our experiences are presented here.

#### **Our basic approach**

We are aware that for any rural enterprise, marketing is usually the major limitation. So, we target the local or easily accessible market. The raw material also should be either locally or easily available. The skills required should also be either already existing, or easily acquired through a simple and short training program. The capital requirements should also be reasonable or within the reach of this segment.

The first such product that we identified was Toilet / Washing Soap and Detergent powder. The technology is easily disseminated, through a two day training program. However, since we are dealing with an item which comes under the Drugs and Cosmetics Act, we have to be extremely careful about quality control. So, we devised a careful package of practice for ensuring quality. The raw materials are easily available. In fact, the major component is coconut oil, and the occasional fall in its price is another reason for giving this value added use for it, locally. However, if the individual soap makers try to procure factory made items

like caustic soda, they will have problems. So, we devised a system for making quality raw materials at reasonable prices for all soap makers, locally, making use of the KSSP Network. There cannot be two opinions about the size and proximity of the market. However, the fact that the market is dominated by a single MNC is a major factor to be taken into account. We realized that it would be futile to challenge them in their own game, at their own terms. So, we devised a different marketing strategy. We depend on house to house marketing, and word of mouth publicity. KSSP has launched a campaign on 'Swadesi Products' with emphasis on local production and local consumption. The Self Help Groups under the 'Kudumbasree' and the Tsunami Rehabilitation Program, as well as many NGOs and individuals, have taken enthusiastically to this product. There are many women who earn two to three thousand rupees a month through this activity.

Mushroom production is another activity, which belongs to this category. Here also, we have adopted a networking strategy to ensure that quality spawn is made available to the Mushroom cultivators. Training is also given at IRTC. Some 'hand holding' also may be necessary at the initial stages. Marketing is again, done locally.

Ornamental fish rearing is another activity which has found many takers, and which yields surprisingly good incomes.

Value addition to traditional pottery is an innovative project, which has benefited the potter community enormously. This has several components. One is mechanization of the raw material preparation, using pug mills. This can relieve the women from the drudgery of the laborious process of preparing clay for moulding. This also leads to better product quality. The next step is the mechanization of the production process using electrified wheel. Traditionally the women folk are not allowed to work on the wheel, but we have given training to women as well. Now they are able to make better products using the electric wheel. The third component is the value addition using decorative techniques, like decoupage. Here women, who have an artistic taste and talent, get a wonderful opportunity, not only to get more value for her labour, but also as a means of self expression in an artistic venture. There are several steps in this production process, so that even the less skilled women can find an employment opportunity here.

Of course, here, the potters will need assistance from the governmental agencies or NGOs for marketing this product, as the potential clientele, even though living in the same community, belong to another socio-economic class!

This function is also performed by the IRTC, for the present. But we are planning to make them self reliant in this respect, by starting an emporium, which can be run by themselves.

## **A CAREER IN SPACE SCIENCE & TECHNOLOGY - OPPORTUNITIES AND CHALLENGES FOR WOMEN**

**Mrs. S. Athula Devi**

*Engineer 'SG',*

*Head, Quality Division- Devices, Test,*

*VSSC, Thiruvananthapuram.*

*E-mail: s\_athuladevi@vssc.gov.in*

---

### *Abstract*

Today, exploration of space is one of the most stimulating and exciting areas of scientific research. In the area of space research, compared to the other developed, space faring nations, India had a late start. The Indian Space Research Organization, ISRO, was set up in 1962 to develop a national space programme. ISRO was still a toddler in space research, when man first set foot on the moon. In spite of this late start, ISRO has come a long way in her capabilities. ISRO has achieved self reliance in the development of Satellite, and Launch vehicle technology as well as implementing Space Application programmes. Our recent 'Chandrayaan' mission was a real achievement which had received national and international acclaim. With this mission we are now among the four nations who have made their presence felt in lunar soil. ISRO has not only pursued and promoted scientific and technological advances in the area of Space research, it has also given equal importance to extending the benefits of this cutting edge technology to society and the common man, through a variety of application programmes.

The main challenges in space research are that they are high end, state-of -the art technologies requiring very high degrees of accuracy and precision. A small deviation in even one of the thousands of elements / subsystems can cause a catastrophic mission failure. Future missions such as re-entry vehicles, interplanetary spacecrafts, etc, require development of entirely new technologies and new materials.

In all areas of development, ISRO women have performed exceedingly well and have contributed substantially. They have made their presence felt in every discipline of activity, every project and in every programme. In general, the number of Science and Engineering women graduates is less and this is reflected in the number of women employees in ISRO also, which is less than 20% of the total. Though they have reached top management

positions, the numbers are few. The technological challenges and demanding schedules often put tremendous pressure on the ISRO community, especially women employees since they have to balance both career and family. Balancing career and family, finding time for professional update, working late hours, frequent travel, taking work home, etc are some of the hurdles which may hinder their performance and accomplishments.

Although we witnessed tremendous technological advancements in space flight and space science in the last 40 years, we are yet to realize the full potential of space. Moon mining, space tourism, microgravity manufacturing, future generation launch systems, interplanetary exploration, space based power generation systems, etc are some of the space visions for future. ISRO has many ambitious projects lined up in these areas for the future and the women scientists and engineers have a significant role to play in these activities.

## WOMEN'S HEALTH

### **Dr. Ramani S Wesley**

*Professor & Head,*

*Dept. of Community Oncology,*

*Regional Cancer Centre,*

*Thiruvananthapuram.*

*E-mail: preventcancer@rcc.tvm.com*

---

The woman's body is wonderfully complex and delicate. However, multiple roles as the mother, daughter, wife, homemaker, wage earner can be physically and mentally quite taxing. As a woman, you might share some common health risks with men, such as heart disease, but because of your special reproductive role, you are at risk of some distinctly female disorders.

**Women's health** refers to health issues specific to human female anatomy. These often relate to structures such as female genitalia and breasts or to conditions caused by hormones specific to, or most notable in females. Women's health issues include menstruation, contraception, maternal health, child birth, menopause and breast cancer. They can also include medical situations in which women face problems not directly related to their biology, for example gender-differentiated access to medical treatment.

Women's health is an issue which has been taken up by many feminists, especially where reproductive health is concerned.

- **Breast Problems:** Breast abscess which usually occurs during lactation and diabetic women should be immediately shown to Surgeon for antibiotics and surgery or incision and drainage of pus. Benign harmless conditions like pain during menstruation (mastalgia), fibroadenosis, fibrocystic disease of the breast, fibroadenoma etc are the common conditions which need only follow up and FNAC, mammogram etc.

### **Breast Cancer**

It is not clear whether a high-fat diet is associated with breast cancer. Overweight or obese women are thought to be at greater risk for developing the disease. With increased weight, there are greater amounts of estrogen produced by the body. Just as estrogen in

HRT increases breast cancer risk, high amounts of estrogen produced by women before menopause may also increase the risk of breast cancer. One recent study suggested the red meat and processed meat consumption may be linked to breast cancer, as well. However, further studies are needed to confirm this finding. (British Journal of Cancer, April 2007-UKWCS).

Studies on breast cancer incidence reveal rates in American women are much higher than in women of other populations. Women from Mediterranean areas, where olive oil and fish oil comprise a large part of the diet, have less breast cancer, even though caloric intake from fat is higher than for American women. Also, women who live in sunnier areas tend to have a lower incidence of breast cancer. This prompted several new studies, which indicate that Vitamin D may be protective against breast cancer.

Breast Cancer is one of the commonest causes of death in many developed countries in middle aged women and is becoming frequent in developing countries as well. In Regional Cancer Centre, Trivandrum, out of 12000 cancer cases coming every year about 900 cases are breast cancers. This cancer is the leading cancer among women of Kerala. Till 1985, breast cancer was the second commonest cancer and uterine cervical cancer was the leading cancer. After that there is an increasing trend for breast cancer and a declining trend for uterine cervical cancer. Breast cancer is easily detectable and completely curable if detected in early stage and treated promptly. More than 60% of women detect breast lumps in early stage when it is curable. But due to fear of mutilating surgery, radiation treatment, and because of shyness, majority of the women do not reveal the matter to a doctor or to her relatives and may consult doctors of other systems of medicine like Ayurveda, Siddha, Homoeo etc and come in an advanced stage when treatment is difficult, expensive, distressing to the patient and we cannot save the patient also.

**Risk Factors:**

1. Those women with family history of breast cancer. For eg. if your sibling sister, or mother, or aunt had breast cancer you are at slight risk of developing breast cancer.
2. Unmarried women, Nuns, Women who married late, Women who does not breast feed carry a high risk.
3. Those women whose first pregnancy is delayed to their late thirties are at high risk than multiparous (more than one child).

4. Women above the age of 35 years.
5. Women who have benign breast conditions
6. Those who consume plenty of fatty diet, roasted beef, fried foods etc and who take less vegetables and fruits.
7. Those who are obese.
8. Affluent women (higher socio economic groups)

Even though women with these risk factors have a relative risk greater than normal women, all women with these risk factors need not get cancer.

- Irregular periods: Could be due to mainly hormonal factors and some abnormal pathology in reproductive system which can be cured by consulting a gynecologist.
- PMS (Premenstrual syndrome): Just before periods and during periods some women get headache, nausea, severe weakness, irritability, anxiety, depression, abnormal behaviour, oedema, pain in breast etc. which needs no treatment usually.
- Cystitis: Cystitis is very common in diabetics. Honeymoon cystitis is common during first week of first intercourse. Since the rupture of hymen is difficult in some women, prophylactic antibiotics, Lignocaine local anesthetic and metrogyl gel can be applied near mouth of genital area so that first intercourse will not be much painful and can prevent cystitis to some extent.

**Menopause:** Menopause initiates unique risk factors in women for both osteoporosis and coronary heart disease. When a woman goes through menopause, there is a 70 percent decline in estrogen production. Estrogen is one of two major reproductive hormones that women's bodies synthesize. Besides its primary role in the reproductive cycle, estrogen plays a key role in helping bones absorb and retain calcium. Estrogen also positively influences women's cholesterol levels by increasing HDL, the so-called "good" cholesterol and decreasing LDL, the "bad" cholesterol. After menopause, the drop in estrogen synthesis contributes to rapid bone loss, increasing the risk for osteoporosis and higher blood cholesterol level, which in turn increases heart disease risk.

- Endometriosis: This is a condition where endometrium is present in areas other than uterus which is the commonest reason for infertility.
- Infertility: is very common and 50% of infertile women can conceive with modern methods of treatment.

- Miscarriage: Abortions can be due to many causes. Consult a gynecologist for diagnostic evaluation and treatment. Consult a gynecologist from the second week of pregnancy onwards.
- Pregnancy: Women should regularly have antenatal check up to avoid complications during pregnancy, delivery and after delivery. Women are not supposed to take any medicine without doctor's advice. Even Vitamin A, Vitamin E are hazardous for the baby. But they should take iron with folic acid and calcium tablets as per the advice of the doctor. The inmates of her household like husband, in laws should be very kind and compassionate to the woman especially, if the woman has severe vomiting. Try to avoid conflicts and strife in the family. Women should not smoke during pregnancy. Smoking husbands should not be near her since the toxic substance of smoke can affect the baby by passage through umbilical cord.
- Fat Around the Middle: Even from childhood babies should not be given high fatty junky foods, fast foods, fried bakery items which may lead to childhood obesity. Avoiding fried foods and too much fat and sweets, too much carbohydrates along with physical exercise can reduce fat around the middle. Consult a physiatrist for proper exercise.
- Fibroids: Fibroids are very common condition among women which can be detected early by taking an ultrasound and in late stages by doing a per vaginal examination. If symptoms like profuse bleeding for long period of time during menstruation, painful coitus, severe abdominal pain during menstruation etc are present patient may need a surgery
- Heavy periods: with passage of clots can be due to fibroids, adenomyosis and some dysfunctional uterine bleeding etc. Consult a gynecologist for treatment.
- Osteoporosis: Osteoporosis is a major public health problem. Women are most at risk for developing this often-debilitating bone disease. Bones become strong as calcium and minerals are deposited from birth until around 30 years of age. The strength of bone depends on adequate calcium intake, yet many women don't consume enough calcium for adequate bone thickness. Menopause is considered a critical time for bone health. Most women experience a rapid loss of bone mass in the first five years following menopause. Diet and exercise are two ways that women can retain bone strength and slow age associated bone loss. Smoking, excess alcohol, caffeine-containing beverages, some prescriptive medications as well as a high-sodium intake, have all been shown to increase bone loss.
- Thrush(Fungal infection like candidiasis): is a very common problem resulting in discharge from vagina, itching etc. It is more common in obese women and

diabetic women. Treatment include candid vaginal tablets and candid cream for one month for both husband and wife. The same treatment should be repeated six monthly for three times. They should apply abzorb powder which will absorb sweat

- Hysterectomy: Removal of uterus for various reasons like fibroids, endometriosis, early malignancies, precancers, adenomyosis etc.

## **Women's Health Issues**

### **Quick Facts-----**

- Diet and exercise are two ways women can achieve greater bone strength and slow down age-associated bone loss.
- Estrogen is a woman's natural protection against heart disease until menopause.
- Women should evaluate their own health risks and discuss with their doctor whether menopausal hormone therapy (MHT) is a an appropriate choice.
- Phytoestrogens (plant estrogens) may offer protection from health problems associated with menopause.
- Coronary heart disease (CHD) is the leading cause of death in women over 50.

Women's health issues have been gaining wide attention and are now at the top of the health-research agenda. Scientifically supported nutrition information is being provided to help women understand ways to prevent disease and maintain health. Some advice creates more questions than it answers. Trying to sift through all the details can be overwhelming.

### **Menopause Hormone Therapy (MHT)**

Choosing a course of menopause hormone therapy, previously referred to as hormone replacement therapy, to treat hot flashes and other menopausal symptoms as well as to decrease the risk of osteoporosis can be a difficult decision. There are various types of MHT, such as taking estrogen alone or in combination with progestin, a form of progesterone. As research on postmenopausal women expands, new risks, benefits and alternatives to hormone treatment are being discovered.

### **Phytoestrogens**

Phytoestrogens, or plant hormones, may offer protection from symptoms and health problems associated with menopause. If taken in large enough amounts, plant hormones

may slow the onset of osteoporosis and temper menopause symptoms. And it appears they do this without negative side effects. Additionally, plant hormones may help reduce the risk of breast cancer, although further research is needed.

### **Cardiovascular Disease**

Cardiovascular disease (CVD), which includes stroke and coronary heart disease, is the leading cause of death and disability in women. Women differ from men in their vulnerability of CVD. Also, the risk factors that predict cardiovascular disease risk and incidence differ in women.

Compared to men, women's onset of heart disease (CHD) is delayed about 10 years due to the presence of estrogen prior to menopause. Once women reach 70, their rates for CHD mortality catch up to men's. However, as women age, they have a greater chance than men to develop specific CHD risk factors, such as Type 2 diabetes mellitus, hypertension and congestive heart failure.

The three most modifiable risk factors for CVD are cigarette smoking, high blood pressure and high blood cholesterol. Physical activity, weight maintenance and a heart-healthy diet have been shown to prevent the development of CVD. Furthermore, studies show that the benefits of taking a daily dose of aspirin to prevent CVD outweigh the risks of side effects, such as gastrointestinal bleeding. However, consult your physician to determine whether or not aspirin therapy is a good choice for you and also to identify the appropriate dose.

### **Cancer of the cervix**

Cancer of the cervix is the most prevalent form of cancer in developing countries, especially the South East Asia Region. It accounts for 25 to 50 per cent of all cancers in Indian women. It is widely prevalent in China, South and Central America. In Kerala, Uterine cervical cancer was the leading cancer till 1985. After that there is a declining trend and now it is the second commonest cancer in females. 19-20 % of all female cancers coming to Regional Cancer Centre are uterine cervical cancer. This cancer is easily detectable by a simple test called pap smear test and this cancer is completely curable if detected early and treated promptly.

### **Precancers of the Cervix**

About 10-20 years before the development of cancer, precancerous lesions occur which can be detected early using colposcope and treated to prevent cancer by cryotherapy and LEEP.

## **Oral Cancer**

Oral cancer is one of the ten most common cancers in the world. This is a major problem in India and accounts for 50 to 70 per cent of all cancers diagnosed. About 35 % of male cancers in RCC are in the oropharyngeal region and this cancer is the first leading cancer among males. Oral cancer is easily detectable and completely curable if detected early and treated promptly.

### **The causes of oral cancer in women**

1. Tobacco chewing.
2. Lack of nutritious food.
3. Trauma due to sharp carries tooth, broken tooth, dentures etc.
4. Poor oral hygiene.
5. Infections.

## **Dietary Fiber**

Research suggests that some women who eat large amounts of fiber have lower incidence of breast cancer. Insoluble fibers such as bran, obtained from unprocessed grains, provide the most protection. Soluble fibers such as apples, beans and oatmeal also appear to offer protection. The role fiber plays in breast cancer prevention may stem from its ability to decrease levels of circulating estrogens. High levels of estrogens may promote the growth of breast tumors.

## **Caffeine**

Caffeine is one of the most thoroughly investigated ingredients in the food supply, including its effects on women's health. Health concerns associated with caffeine include ulcers, fibrocystic breast disease, cardiovascular disease, heartburn, cancer and birth defects.

An even more discussed concern over caffeine intake by women is the incidence of fibrocystic breast disease. Also known as benign breast disease, it is characterized by benign fibrous lumps and breast tenderness.

## **ELECTRONICS - CAREER OPPORTUNITIES AND CHALLENGES FOR WOMEN**

**Ms. K.T. Beena**

*Additional Director,*

*Broadcast & Communication Group,*

*C-DAC, Thiruvananthapuram.*

*E-mail: beenakt@cdactvm.in*

---

It is very rarely that one gets an opportunity to address a gathering in which majority are women. I am extremely thankful to the organizers for giving me an opportunity to address this gathering of women Scientists. This seminar addresses career opportunities for women in different areas of Science and Technology and "Electronics", is the topic which is assigned to me. I am sure you all are experts in your respective disciplines. Whatever I am presenting here are, out of my personal experience as a practicing electronics engineer for around thirty years and it is not really a summary of any research I have carried out in the particular area of career opportunities.

Electronics, is all about flow of electric current through semi-conductors or we can say that electronics is all about the flow of electric current through non-metals. Electronics as a Technology and as a Science, had its beginning in the early 1900's with the invention of the Vacuum tube and later moved forward with the discovery of transistors and later integrated circuits. If you think of electronics as a subject which has been of benefit to mankind, I am sure, we can have no two opinions regarding this. Its role in areas like medical instrumentation, avionics, defense are very significant. Even in our day to day life, we come across myriads of gadgets based on Electronics. For example, the mobile phone which is something like a life support device to many of us is a contribution of electronics. If we look around our home, we see the TV, computer, microwave oven etc which are taken for granted as a part of our life. If you ask me to name one device which has really helped me in carrying out my day to day chores, I will definitely put it as my washing machine. Definitely it is a big boon to women particularly the working women like us. Silently it is doing quite a lot of our manual work for us.. So we all agree that electronics has played a big role in making our lives easier. A user may not really be aware of the immense amount of technology that has gone into these gadgets. Many of these products are the result of years of effort from scientists and technologists across the globe.

There is no doubt that electronics is a very interesting field of study. There are subjects in science which fail to attract good students, however Electronics has always been in high demand among the student community. As I understand from statistics the Engineering course in electronics is the most in demand option for science students in Kerala. There is no difference in this option whether the student is male or female.

When we compare the situation in our country, with the situation elsewhere, we see that even in advanced countries like the US, the number of women who are going into science subjects or engineering studies is very less, and as a State we really do stand out in this particular aspect. Earlier, when I started my career in the early 1980's and I joined in the Department, we were a group of 40 people, of which I was the only lady Scientist. Now, 20 to 30-% of engineers and scientists who walk in to our Department are women, which is really commendable.

If you ask me what are the basic requirement for someone to become an electronic Engineer, I should say that the person should have sound knowledge of Mathematics and Physics. Electronics is actually an extension of physics. Having sound knowledge in this subject and an interest to pursue a career the girls students can very well opt for Electronics discipline. Of course they should have an aptitude for applying the scientific principles to practical applications which is what engineering is all about.

Another basic aspect to be considered is whether the student has a love for the subject. When we think of sending our children for some course are we really giving consideration to their interest in the subject? Though one needs to earn your bread and butter out of your job it is really necessary to enjoy whatever you are doing. When we encourage our daughters to take up a career in electronics we should make sure that they really have the aptitude and love for the subject because they are going to spend a large part of their time doing an activity and it makes a huge amount of difference whether they are doing something they enjoy or not.

Sadly these days, when we think of environment in which the students are working, we really don't see much of a relationship between the subject they have studied and the job they again are doing. This is really a very sad state of affairs. These days, Information Technology seems to have swallowed all other fields. This naturally has happened in the case of electronics also. Job opportunities in other areas seems to have come down.

Looking back to the early 1980's, the job situation in electronics, even in our state was more bright. Keltron – Kerala state Electronics Development Corporation as an organization, was matter of pride for all of us. In fact, we were really proud to have the Keltron TV sets on our homes. Other states in the country also had their State Electronics development Corporations doing development and production of electronics goods in a big way. But, unfortunately things did not take off from there for the better. Today many of these development corporations exist only for namesake. Some of them have even wound up because of the difficulties in pursuing their business. The fact that people are not interested in investing in big factories, and lack of infrastructural facilities etc are attributed to the slow development of electronics industries. Fortunately, thanks to the IT industry, now we have quite a lot of infrastructural development with electronic also benefiting out of it. It is predicted that electronics is going to have a revival in the coming few years people are starting investing in electronics productions in a big way.

Let us see the career opportunities in the area of electronics for women. If we look at in the public sector there are quite a lot of R&D institutions like ISRO, DRDO laboratories, Civil Aviation, All India Radio etc., that recruit electronic graduates; a large percentage women. Now a days the government gives a lot of incentives to women to start small scale industries in the electronics sector. I was told that generally, for small scale industrial ventures people enroll in the name of women only for getting the benefits of whatever is being offered for women . The industry will be in the name of a women only for name sake and all decisions concerning the job will be taken by men. This situation has to be changed. Women should be empowered to take decisions for themselves, gain in confidence and build up their industry.

In this context it is worth mentioning that the IT industry has brought about a change in status of employed women. Thanks to IT, sisters and daughters have assumed the role of bread winners in many families and have got elevated to the role of decision makers in the family.

When it comes to career growth, somehow, the career growth of women is not at par with men, which one has to admit. But if we look at the issue critically, there is something missing from the part of girls/ women also. Girls often move back when challenging assignments are offered to them or for that matter when a simple question is asked, the girls, though she is sure of the answer keeps quiet But the boy who though doubtful of

the answer would immediately speak out and get the recognition for that. It is high time that we change our attitudes. We should be bold enough to communicate our ideas. By keeping quiet we are not gaining anything. Only if we communicate and let our knowledge come out, will somebody appreciate us. The more you volunteer, the more confident you become.

The first and foremost thing we should do is to build confidence in our girls right from the school days. The girl should be trained to stand on their own feet and talk for themselves and accept challenges that come her way. We should convey to them the message that they should not expect somebody else to talk for them or create opportunities for them. If the girl is really good in field of work, there is no doubt about her career growth.

Women often need to play the dual role of a home-maker and a career person. This is a big challenge, During child bearing and child rearing years, women need to spend more time for the family and as a civilized society, allowance should be given for that.

I come from a Government R&D sector. The satisfaction which I get from job is immense. Every problem is a real challenge. Engineering is the application of science which we have studied. If you have the aptitude for applying knowledge, electronics is a very interesting career. As I mentioned earlier always opt for a career which you enjoy and be committed to your profession. So I would like to conclude by saying that when you make a choice of subject that you plan to study, assess your interests and your potential. Get your subject basics clear, then opt for a career related to your subject. If you really love the subject, keep going. You will definitely have excellent career ahead.

**WOMEN IN SCIENCE- INCREASING THEIR VISIBILITY**  
*NATIONAL INITIATIVES*

**Dr. Sudha Nair**

*M.S. Swaminathan Research Foundation,  
3rd Cross St.  
Tharamani Institutional Area,  
Madras- 600 113.  
E-mail: sudhnair@mssrf.res.in*

---

To foster, promote and sustain the cultivation of sciences and scientific research in the country and to secure for the people all the benefits that can accrue from the acquisition and application of scientific knowledge...

**Scientific Policy Resolution (SPR) of 1958**

To promote the empowerment of women in all science and technology activities and ensure their full and equal participation....

**S&T Policy 2003**

The Nation has a very clearly defined SPR and S&T Policy, which states that we need to foster, promote, and sustain the cultivation of sciences and scientific research and that this should include full and equal participation of women. Yet, women practitioners in science still remain a minority in spite of the fact that they constitute almost half the population of the country. It becomes important to analyze and see what needs to be done to improve this.

A report brought out by INSA in 2004 'Science Career for Indian Women' establishes the fact that while we seem to have made some progress, much more unequal steps is needed to make the participation of women in science more visible and that we need to still address issues starting from the primary education of girls. The Gross Enrollment Ratio (GER) for elementary schools (1-3) increased from 82.4% in 2001-02 to 93.5% in 2004-05 but the drop out rate continues to be at 50.8% mostly girls. The GER for higher education (18-23) is around 10% (China is 21%) again it is not favoring girls.

While there has been a steady growth in the enrolments at the Universities from about 10.9% in 1950-51 to @ 40% in 2005-06, this trend is not been uniform across the regions. In states like Goa, Kerala, Punjab and Pondicherry women represent more than 50%

university enrolment, whereas the proportion of women in universities in states like Arunachal Pradesh, Bihar, Orissa and Rajasthan, is less than 35%. While women tend to be seen more in life sciences there numbers at faculty/research positions are very meager. Not much of disaggregated data is available, to assess the progress.

Task Force for Women in Science: In continuation to this report a Task Force (TF) was set up by The Department of Science and Technology under the directive of the Prime Minister's office in Oct 2005 to suggest ways to ensure that the interests of women practitioners of science and technology are protected, as well as to suggest further measures in order to facilitate and promote the visibility of Women in Science.

The members of the TF embarked on understanding the situation and the needs from the women – different groups like students/scholars/faculty/researchers and scientists and decision makers were met through interactive sessions held in different parts of India and a National meeting was convened at Delhi on the last International Women's day where more than 900 women scientists from different streams of Science, Technology and Engineering participated and gave a feedback to a structured questionnaire.

While some of the views expressed and the needs felt were common to most of them, there were a few requests, which were very location specific. The needs expressed revolved around the following major areas: retention; recruitment and career development; recognition and reward; self-employment; proactive measures at the organizational level and policy changes. The TF has made several specific recommendations towards educational reforms measures to attract girls to the profession and their recruitment, enabling measures for career advancement and re-entry; reforms in service conditions at the workplace; gender-segregated data collection, and processes to monitor progress. The detailed findings and recommendations will be brought out as a publication, which will be released shortly.

National Initiatives: The 11<sup>th</sup> five year plan in the history of planning recognizes gender as a cross cutting theme and also recognizes women as agents of change and that they are not a homogenous category. To catch them young, the plan chalks out initiatives on enhancing educational facilities at the school education level inclusive of the rural areas and a lot of initiatives have been spelt out like rapid up-gradation of 15,000 upper primary and secondary schools; expansion of intake capacity in existing 44,000 secondary schools; provision of labs/libraries and also strengthening of the existing facilities etc. Special efforts will have to be taken to attract young girls to schools or retain them. There is a felt need to take unequal steps and address the retention factor of girls in the chain from primary to

tertiary levels Also, there are much larger socio-economic issues, which needs to be addressed and by far needs an integrated approach too especially when all gender social and regional gaps in enrolments is to be eliminated by 2011-12 a set target by the Nation!.

One of such initiatives which shows a good prospect to address the nurturing of good talents is INSPIRE – Innovation in Science Pursuit for Inspired Research scholarships for students after classes 10-12 which has been launched by DST, supports innovations in schools – one million young innovators; summer camps with science icons; assured opportunity schemes for proven talent and retention of talent in publicly funded research institutions. This has already been kick started and will produce results in the years ahead. The other such initiative is Scholarships for Higher Education (SHE) for attracting talented science students to B.Sc ad M.Sc courses. Special efforts should be taken to see that girls also benefit from this given that they still form the minority. The reentry fellowships given by DST will fall under this category targeted especially for women who have had a break. DBT and DST also have awards for women bioscientist at mid career and lifetime achievers.

To improve science and technology as a career option of choice for the young it has been proposed in the plan to increase allocation of funds; increase the efficiency of the delivery system; attracting a new generation of students and playing a catalytic role in attracting trained researchers to come back to Indian soil with vigorous and attractive remunerative recruitment policies. Inter-institutional linkages will help in bringing together cumulative strengths, establishment of tech-business incubators for promoting low initial capital start – ups, strengthening academia industry interface (including public pvt. partnerships) and S&T for small and medium enterprises. Building clusters with the above initiatives enables innovation in research/tech-management/investment and business skills. Technology incubators and parks for startups when co-located functionally get linked based on a common vision – necessary synergies and sharing of resources, ideas and facilities. Such facilities are already being set up in form of agro parks; techno parks bioparks etc..

The Department of Biotechnology has taken very many steps to promote the stream of biotechnology. They catch them young by supporting summer camps and formation of DNA clubs for school children. Post graduate teaching programme, training of postgraduate students in industry to reduce the mismatch between the manpower produced and required, and fellowships for doctoral and post doctoral work as well as retraining for skill up gradation. The details of these are available in their biotech newsletter and are available on their web site too.

Programmes, which support small and medium sector innovation and venture support for good ideas have also been initiated like: Initiatives of the National Science Technology Entrepreneurship Development Board – NSTEDB, DST and the Technology Development Board, DST, ABLE – Association of Biotechnological Enterprises – to promote Entrepreneurship for student team with innovative ideas, DBT, Ministry of S&T - all support this. They support technology clusters and parks in various sub sectors - 7 operational state supported biotech parks and 30 at different stages of development are already on. All such initiatives should take special efforts to see that girls/women also benefit from this. One such park for first generation women entrepreneurs in Chennai is a good example of reaching out to women.

Lessons drawn from such different initiatives should be adopted through targeted programmes for women. If all streams of science follow this end to end approach we will be able attract lot more of youngsters in science, technology and engineering and especially women.

What can the State do: State Policy has a large role to play in building gender awareness and strengthening the hands of Women. To achieve this, the Policy should be engendered and should provide guidelines and set targets to assess impacts. For this they would need disaggregated data. Even while the TF was working lack of data at the National level was felt as a major impediment. I believe that the Kerala State Council for Science, Technology and Environment is the right body to do this. A status report could be prepared to assess the performance of the State. Drawn on the similar lines of the proposed initiative of a Bibliographic database of science and technology output for the Kerala State in the last 20 years, an initiative to collect disaggregated data on women in science will give the status to plan affirmative actions to improve the visibility of them.

Setting up an equal opportunities office cell to address the specific findings in a mission mode will help the State to set an example for the rest. Kerala has always shown the path in terms of respecting girl children and their women and therefore should outline path-breaking initiatives to promote their women to greater visibility. Catching them young, offering scholarships at school /fellowships to continue higher education, recognition and rewards systems in place, providing enabling spaces at work and following the recommendations of the TF proactively will help greatly in this!

## WOMEN IN AGRICULTURE

### **Prof. (Dr). M. S. Sheela**

*Associate Director (Plant Protection),*

*College of Agriculture*

*Vellayani, Thiruvananthapuram - 695 522.*

*E-mail: thiruvonam\_ms@yahoo.co.in*

---

In India, agriculture is the single largest production endeavor that supports 60 percent of the work force. Over the years the contribution of agriculture to GDP has gradually decreased from 50 percent in 1950's to 25 per cent at present. According to Dr. M.S. Swaminathan, the famous Agricultural scientist "some historians believe that it was women who first domesticate crop plants and thereby initiated the art and science of farming, while men went out in search of food ,women started gathering seeds from the native flora and began cultivating those of interest from the point of view of food, feed, fodder, fiber and fuel". Now the role of females is increasing in these activities and this phenomenon is termed as "feminization of agriculture". It is estimated that 75 per cent of all female workers are in agriculture (Jain, 2007). Between 1977 and 2001, the female to male agricultural labour percentage has gone up. Similarly, the female to male cultivator percentage rose from 14 to 32 per cent. The women are the majority of the workers in many critical processes or steps in agriculture as detailed below:

Activity	Involvement percent
Land preparation	32
Seed preparation and sowing	80
Inter cultivation activities	86
Harvesting reaping winnowing drying cleaning and storage	84

(source Jain 2007,Women and plans )

Apart from participation in actual cultivation ,women participate in various forms of processing and marketing of agricultural produce (Aggarwal,2003). Women s suggestions are not given due consideration because of illiteracy, have little time to know about the latest techniques of farming and restricted mobility. Many polices and decisions neglect women and undermine their abilities and roles

Dairying is an occupation that support the livelihood of many women, especially the rural poor in India .It is estimated that in dairying there are 75 million women as against 15 million men (Govt. of India 2001). Women contribute 75 per cent of the labour force in livestock farming (Singh 1999) and majority of landless livestock keepers in rural areas are women . Women have greater control over this resource compared to other resources like land in the village .

Traditional backyard poultry production is common in interior rural areas particularly with unprivileged community. Poultry is a source of low cost, high quality food for the family and small income for women through sale of birds and egg . Most women are not interested to expand the poultry production and using improved breeds due to management difficulties and the need for external input required (Rangnekar 1998). There is a need for creating awareness, training and systematic planning to help to develop into a sustainable project to uplift the rural women.

The official statistics do not always reveal fully the actual status and role of women in agriculture but such data provide adequate insight for economic analysis and policy decisions in agricultural planning, food security, and alleviation of rural poverty, rural development and agrarian reform.

In Asia, most of the countries are at an early stage of development, where a high proportion of women are employed in agriculture. Even in most of the South- East Asian countries, where convention prevents women from working outside the home, care of livestock, processing of the harvested crops, craft and other pursuits still provide them with the status of contributing materially to the family income (Whyte and Whyte, 1982).

In Pakistan, women take part in husking, winnowing, storing wheat, transplanting rice, and picking cotton and chillies (Khan and Bilquee, 1976) . Women's role in rural Bangladesh goes far beyond cooking, cleaning and child bearing, as they undertake almost all the processing of rice, grow most of the vegetables and much of the fruit, care of livestock and prepare fuel from dung. As most of these activities are done within the confines of the household and not remunerated, the extent of women's contribution does not find its way into the census figures (Bartocci, 1974).

Nepalese women work with men in the field during planning, cultivation and harvesting (Jones and Jones, 1976). Beyond the domestic services women provide, they contribute to farming, fish processing or trading. Men tend to do dangerous tasks, such as cutting and burning the forest, climbing palm trees, or fishing in deep waters. Overall female activity

rate in Sri Lanka is influenced by the high rate of participation in the plantation sector, where women form 53.1 per cent of the total labour force and 59.6 per cent of the female labour is engaged in agriculture and forestry. There is great overlaps in the sexual division of labour as men can cook, tend baby, wash clothes and shop for food. Women can work in the field, drive bullock carts, chop wood, and be prominent in market transactions (Whyte and Whyte, 1982).

In India, a review of the economic role played by women reveals some distinct trends. In the traditional village community, the women play a distinctive and accepted role in the process of earning a livelihood by participating in both production and marketing of agricultural and handicraft products. Agriculture is still a family endeavor, but the pattern of women's participation varies according to regional and cultural norms. In tribal societies of Arunachal Pradesh, Tripura, Mizoram, Assam, Meghalaya and Manipur, where *Jhumming*, a form of shifting cultivation is generally practiced, women workers play an important role in agriculture. They clean the *jhum* land, sow seeds and harvest the crops. Throughout the Himalayan region, the major role in agricultural production is played by women. With terraced cultivation the man's activities increased as they usually undertake ploughing, but women engage in all other activities. In Karnataka, Tamil Nadu and Andhra Pradesh, the entire work of sericulture from feeding of silk worms to reeling is handled by farm women. Similar involvement of women is found in lac production and fisheries besides home science activities.

A study in Haryana (Kaur, 1987) shows that rural women devote on an average 8.70 hours daily in home, 1.70 hours in dairy/ live stock/ animal husbandry, and 1.73 hours in farm sector. Further analysis shows that her time spent in the agricultural sector increased with the decreasing size of land holding, farm mechanization and income of the family; a significant correlation was discerned. For certain castes, the correlation was more significant. However, women devoted relatively more time in farm operations in moderately developed zone, middle class family and moderate per capita income; middle age women did relatively more work. As per level of rural development, both activity pattern and time devoted also differs.

### **Women in Developing Agriculture**

The strategy for agricultural development in India and other developing countries has the basic elements of the use of high yielding varieties, mechanization of farm operations and use of agrochemicals (fertilizers, pesticides, weedicides, fungicides hormones etc), improved cultural practices like proper sowing time, depth of sowing, critical stage of

irrigation, weeding and harvesting and post harvest technology. Similarly in plantation crops, dairying, fishery, and other allied aspects of agriculture operations are much more technical as compared to traditional agriculture .These changes drastically changed the role of women.

Fragmentation of land and holdings is one reason of decreasing the size of farm holdings and that reduces role of women in Agriculture.

Commercialization of agriculture and the shift of food grain production for subsistence to cash crop also drastically reduce the role of women .

With the introduction of modern marketing systems women s contribution in terms of post harvest operations home made consumer goods and decision participation in have been decreased substantially and she has remained only as unskilled labour supplier with alienation to production processes . She is not only deprived of but also of the modern marketing systems .

Mechanization is one of the most important element of agricultural development with its promise of getting maximum out of the scarce resources. The traditional division of work between men and women was changed with the innovation of machines and thereafter the chain of technological development brought changes in work division.

In countries with labour shortage farm mechanization is to meet that but in India with dense population, mechanization has brought tremendous changes in the work pattern and participation ,especially of rural women In Green revolution farm mechanization displaced women labourers and female family workers (Singh ,1972; Ahuja 1979 ; Kaur 1987 ) but at the same time increased the employment opportunities by intensive cultivation But now due to labour scarcity the area under paddy cultivation is diminishing and growers are demanding farm mechanization especially in harvesting and post harvest operations .

Agrochemicals have become an integral part of the development of agriculture and their use is expected to increase many fold in India and Asian countries. With the introduction of weedicides women s participation in weeding in paddy and wheat was completely ceased (Kaur 1983 ; Rani 1986; Sunita 1986 ) .On the other hand ,women from land less families do not get fodder for their animals which they used to get from farmers field in lieu of wages or mutual interest basis .Keeping animals on purchased fodder is difficult for poor families thereby depriving them of the animal products and byproducts in their diet . Women is the worst sufferer in the food distribution system in our social set up ,which is

apparent both in direct assessment to food intake and , relative requirements (Batliwala , 1983) and relative mal nutrition (Gulati 1978) mortality (Chatteerjee 1983)and morbidity .

Due to the indiscriminate use and handling of agro -chemicals women are exposed to several health hazards such as gynecological infections (UNDP ,1980) , arthritis, intestinal and parasitical infections (Mencher and Saradmoni 1982)

Biological technologies especially biotechnological advancement there is every possibility of propagation of plant by tissue culture means, the women folk employed in nurseries would be left in a lurch.

Over the centuries women have made great contribution to conserve the seeds. Even tribal and poor women have been involved to save seeds now it is hampered by the multinational seed companies e.g. bio piracy of wheat by Monsanto.

The nature and extent of participation of women changes with the development of the community in general and development of agriculture in particular .New demands of skill in developing agriculture is to be acquired by different means of exposure or training is highly warranted for women empowerment

Women in developing agriculture do not find a place in pride . Our development plans have failed .Data collected is inadequate for proper planning .A comprehensive base information on all aspects of women working in agriculture is the necessity of the time for proper planning ,monitoring and execution of development programmes This is the urgent need of the year .

### **Special Initiatives for Women**

- 1 National Commission for women 1992
- 2 Reservation for women in Local self government 1992
- 3 The National Action Plan for girl Child National 1992
- 4 National Policy for the empowerment of women 2001

### **Research Efforts to empower women in agriculture**

#### **Indian Council of Agricultural Research**

Institute have been tried to relieve her of the farming drudgery by providing time and labour saving tools .Vocational trainings are also being conducted to impart skills to undertake different avocations .In extension activities the women is now the center point and activities are being planned keeping her in view . It will change the face of rural India .

Several programmes started at the National Research Centre for Women in Agriculture (NRCWA) and Krishi Vigyan Kendras (KVK), are taking right steps in this direction . Projects are initiated on nearly all aspects . There are 16 projects ongoing in this line of work .KVK s organized extension programmes including field trips ,kissan melas, exhibitions, exposure visits etc .Established Self Help Groups (SHG) also . In some of the states it is linked with viable micro credit Institutions . Another initiative in this line is the establishment of All India Coordinated Research Project on Home science (AICRP) . Research initiative is taken up by starting National Agricultural Technology Projects (NATP). A project on fisher women in coastal ecosystem of Andhra Pradesh, Karnataka and Kerala was taken up to empower the fisher women for creating awareness to latest technology .

Policy Framework for Agricultural Extension (PFAE) was developed by the Ministry of Agriculture Government of India during 2003. This centre also started new programmes for women in Agriculture

### **Programmes and Projects with Women in Agriculture**

Programmes and projects that have a broader development agenda but contain a significant component on women in agriculture have been under implementation in India .For example, the DFID funded Eastern India Rainfed Farming Project , IFAD funded Tamil Nadu Women development project , the Uttar Pradesh Sodic Land Reclamation Project, the Kudumbasree programme supported by the State Poverty Eradication Mission ,Kerala and the National Dairy Development Board (NDDB) supported Women Co operative Dairy Programme.

### **Rural Women's Development and Empowerment Programmes**

A number of programmes have been implemented by other Govt Departments such as the Department of Women and Child Development, which compliment and supplement the programmes offered by the State Department of Agriculture .The major programmes are Indira Mahila Yojana (IMY),creating SHG ,Swayamsidha (IWEP) , Rural Women s Development and Empowerment (Swa-Shakti) Project, Distance Education Programme, Support to training and employment programme for women (STEP) , Establishment of employment-cum-income generation -cum-production units , Rastriya Mahila Kosh and the NABARD constituted Credit and Financial Service Fund.

A number of Non Governmental Organizations (NGOs) in India and Kerala have implemented programmes for empowerment of women, with a special focus on income generation through organizing women SHGs eg BAIF , MYRADA , SEWA etc.

## **Recognition for women in Research (National Level)**

Merits and Awards instituted by Indian Council of Agricultural Research for Agricultural Workers and Extension workers . Among the 11 awards instituted one was set apart exclusively for women ie, Punjab Deshmukh Women Agricultural award.

## **Externally aided Projects for training of Women in Agriculture**

- 1, Women Youth Training and Extension Project (WYTEP) –Karnataka
- 2, TamilNadu Women in Agriculture (TANWA)- Tamil Nadu
- 3, Training and Extension for Women in Agriculture (TEWA )-Orissa
- 4, Training of Women in Agriculture (TWA) – Gujarat
- 5, Andhra Pradesh Women in Agriculture (ANTWA)- Andhra Pradesh
- 6, Centre of Gender studies with emphasis on Agriculture –Kerala

In addition to this an expert committee was constituted for women in agriculture.

## **Role of Agricultural Universities**

Agricultural Universities are good potential grounds for starting Centres for the development of women in agriculture for pooling the existing information ; for studying the women; for carrying out action research; developing execution models; developing training programmes and material for replications ; fixing priorities of different areas and categories of women; identifying appropriate enterprises, technologies and necessary inputs; guiding research teaching and extension activities of other related disciplines; and working as liaison etc.,

## **Kerala Agricultural University**

College of agriculture was started in 1955 for agricultural education for catering the needs of the farmers in the State of Kerala and the university was established in 1972 with the mandate of making provision for imparting education in different branches of study, particularly in agriculture , horticulture , animal husbandry including veterinary and dairy science ,banking and co operation ,fisheries, forestry, agricultural engineering ,home science and other related branches.

The University also impart advancement of leadership and execution of research, particularly in agriculture and allied subjects and undertaking extension education

programmes. The ultimate aim is to help the farmers to adopt new technologies for boosting the production and productivity and overall development of the society .

The agricultural graduates from the University are responsible for the management of farming and in turn improve the condition of the women. They have a pivotal role in the planning and implementation of projects in Panchayath level onwards (as Officers of the Department of Agriculture ). The trained manpower employed in the University are involved in teaching ,research and extension activities related to agriculture . In addition to that they are also involved in training to farmers including women at KVK s ,Central sector schemes for women . They are also posted in research wings in Central Institutes like Central Plantation Crops Research Institute , Kasaragod and the Regional Stations, Central Tuber crops Research Institute Thiruvananthapuram Coconut development Board, Cochin ,Rubber board, Kottayam and Forest Research Institute Peechi . They are also posted as agricultural management and development sectors like State Horticultural Mission, Kerala Horticultural Development Board , Vegetable and Fruit Promotion Council, Coir Board, Coirfed, Serifed etc . In order to cater the need of Nationalized banks in implementing the agricultural development projects the service of agricultural graduates are utilized . The service of agricultural graduates in insurance sector is essential.

Thus agricultural university have a major role in equipping the farming community, indirectly women about the latest technologies. In spite of all these activities the top positions in society and agricultural sector in particular are still occupied by men and women have limited role in decision making process. Concerted efforts are required for a positive change.

India implemented women in agriculture programmes for the overall development. These programmes have conclusively proved that women when given access to improved information and resources could increase agricultural production significantly.

# EMPOWERMENT OF RURAL WOMEN THROUGH BIOTECHNOLOGICAL INTERVENTIONS: A CASE STUDY ON MEDICINAL PLANT CULTIVATION

**Dr.C.G.Sudha**

*Scientist,*

*Plant Biotechnology & Bioinformatics Division,*

*Tropical Botanic Garden and Research Institute,*

*Palode, Thiruvananthapuram 695 562.*

*E-mail: cgsudha@yahoo.co.in*

---

## **Abstract**

Efforts have been initiated to empower the unemployed rural women of Kanjikuzhi Grama Panchayat, Alappuzha district of Kerala State through medicinal plant cultivation. To achieve the objectives, an Agreement had been executed between Tropical Botanic Garden and Research Institute (TBGRI) and the Panchayat. A model nursery with scientifically organized infrastructure for medicinal plant cultivation at the Panchayat owned land was established. Two hundred women beneficiaries were selected by conducting a local awareness programme on medicinal plant cultivation and by collecting their socio-economic profile. They were grouped into twenty with a leader beneficiary for each group. Seven high value demanded medicinal plants, suitable to the agro-climatic conditions of the target site were propagated, in TBGRI and distributed to the beneficiaries for cultivation along with garden implements and manure. Among the selected species, *Holostemma annulare* (Roxb.) Schum was propagated through micro propagation techniques. Hands-on training on conventional propagation techniques and hardening techniques of micro propagated plants was imparted to the beneficiaries. In order to co-ordinate the programme group wise, special instructions and guidelines were given to the leaders. The beneficiaries started homestead cultivation and periodic evaluation was carried out. The beneficiaries earned initial income by selling the seedlings and saplings to other cultivators, raw material to the domestic and local Ayurvedic centers in the Panchaya. A model, marketing system has been demonstrated and later group leaders have taken the responsibilities and did a collective marketing of raw materials to the local raw drug shops. As part of the programme, a Co-operative Society was registered under the Kerala state Co-operative Societies Act. The steps for establishing marketing linkage with leading pharmaceutical units in the state are underway.

## **Introduction**

Women are a great human resource throughout the world and their role is important for the development of a society. To achieve this development, women should be encouraged to bring their vision, leadership, skill, knowledge, and aspirations in social, cultural, political and economic aspects. Gender inequality existed from time immemorial as part of the male dominated culture all over the world. However, when women came forward to co- ordinate and strengthen the women movements internationally, tremendous progress have been made in different fields. Now, world has recognized the fact that enduring solution to society's most threatening social, economic and political problems cannot be found without the full participation and empowerment of women.

The empowerment of women is one of the key issues in the process of developments in each country. As per the Report of Government of India, "Empowerment means moving from a position of enforced powerlessness to one of power". Empowerment leads women to become a critical and vital stakeholder among the humans capital and their strategic presence in the society is widely accepted (Anonymous 2008). Many basic women qualities like, sincerity, devotion towards work, determination, patience and faithfulness to commitments enable them to play important role in social and economic development of the country.

Government of India has passed various legislations to safeguard constitutional rights to women. Besides, different welfare measures with specific objectives have been taken up by the Government to empower women in different periods (Table 1). A separate department for Women and Child Development was set up in India in 1985 to deal matters relating to women's development and funds are earmarked for various schemes. Formation of National and State Commission for women is noteworthy for the welfare and prosperity of women. From the Fifth Five Year plan there has been a remarkable change from the attitudes to women component and issues of women's welfare to developmental aspects. The Government of India has made empowerment of women as one of the principal objective of the 9<sup>th</sup> Five Year Plan and declared 2001 as the year of "Women Empowerment". Across the country, innumerable Non -Governmental Organizations (NGO) have mushroomed with concrete and deep vision and mission on women developmental activities and upliftment of socio-economic status of women.

**Table 1.** Women welfare measures implemented by Government of India for women empowerment

<b>Sl. No</b>	<b>Schemes</b>	<b>Year</b>
1.	Training for Employment Programme	1987
2.	Mahila Samriddhi Yojana	1993
3.	Rashtriya Mahila Kosh	1992-1993
4.	Indira Mahila Yojana	1995
5.	Balika Samriddhi Yojana	1997
6.	Self-help Group Programme	2001

### **Rural Women Empowerment**

Rural women have an active role and extensive involvement for the development of our society and nation. Even though, Government of India is being taken various steps for the social and economic uplift of rural women, still they remain a disadvantaged segment. Rural-urban difference is well noticed in the women population than men. In India, rural poverty was 39% whereas urban poverty was 30% in 1994 (UNDP, 1997). Approximately 35% of the households below the poverty line are headed by women (Venkateswaran, 1992). The sex ratio is one of the major criteria to measure the status of women. Normally women slightly outnumber men. If this is not so, the status of women is not good in that region. The sex ratio and life expectancy of women in Kerala may be higher than even that of Washington D.C. (USA) (Census of India 2001).

In India, rural women generate income in many ways, mainly through agriculture, processing of non wood forest products, and earnings from handicrafts, weaving, spinning and other small scale enterprises (EIU, 1997). India has successfully shown to the world that the Self Help Group (SHG) and Group Lending Model could be viable and is quite well distributed. Recently, New York –based Women’s World Banking (WWB) reported that when a woman is given the tools to develop a small business, build assets, and protect against catastrophic loss, she is empowered to change her life and that of her family (The Hindu 2008).

The Government of Kerala and NABARD jointly initiated women build participatory poverty-irradiation multi faceted programme, “Kudumbasree”. In Kerala, SHGs and Kudumbasree

units are well established in many small scale income generation activities using natural and synthetic resources compared to other states in India. High rate of literacy in Kerala, communication, information and transportation facilities were circumstanced for the development of such activities.

### **Biotechnology oriented programmes for the socio-economic uplift of rural women**

Technology has a major role in the development of skill and intellectual power of women. It is well noticed that fast and vast development of technology displacing women often from many areas especially in the field of agriculture, where immense women labour is required. Women's labour and their participation are well analyzed and documented in various sectors of agriculture. In the scenario of many labour oriented problems in different fields, the immense scope in the use of Biotechnology for reducing the burden on women is worth mentioning. The applications of Biotechnology can provide them an opportunity for more productive role to develop society and enterprises for their own economic uplift and social status. This can led to progressive growth of state and national economy.

Biotechnology have wide array of applications for the development of products, processes and technology from the basic and traditional plant propagation to the advanced genetic engineering. Recently, biotechnology applications have opened up many women -friendly and eco-friendly techniques for homestead and public microenterprises in agro technology/agro industries, food, fuel and waste water managements etc. The basic micro propagation techniques are very well adopted for floriculture, plantains and medicinal plants, vanilla etc. Fermentation technologies has immense scope in processing jam, squash, soft drinks, fish and meat processing, fibrous and gelatinous health food preparations etc. There are new inoculants from microorganisms which can generate enzymes that break down fish and meat into more digestible substances. Biofertilizers, vermicompost and other organic manures are good marketable products generated by biotechnological methods. Biopesticides and biofuels are another productive areas of biotechnology. Production and application of neem and other plant derived compounds are appreciable biopesticides for many insect and agriculture pests and storage pests. By over viewing the wide and viable possibilities, State and National Government are supporting women oriented biotechnology based programmes to the research organizations, University Departments and Non-Governmental Organizations to implement various income generating programmes. The major areas through which Department of Biotechnology (DBT) and Department of Science and Technology (DST), Government of India are

supporting women beneficiaries on biopesticides, biofertilizer application organic farming, cultivation of mushrooms, processing and development of mushroom based products, sericulture, medicinal and aromatic plant cultivation, floriculture and food processing area etc through various projects. Biotechnology park for women, jointly established by DBT, Government of India and TamilNadu State Government at Siruseri as part of the Golden Jubilee Celebration of India's independence is worthwhile to note. The park has twenty industrial module and forty land modules for agro-biotechnological activities apart from centralized facilities for technology, resourcing, training and marketing. Out of the 20 pre-built industrial modules, 12 were allotted to women entrepreneurs on lease basis, for starting their production activities related to ornamental fish, herbal products, fortified salts and food products.

### **Medicinal and aromatic plant cultivation**

India is one of the richest abode of medicinal and aromatic plant genetic resource and a well known heritage of indigenous systems of medicine like Ayurveda, Siddha, and Unani. These systems of medicine use over 2000 medicinal plants of which Ayurvedic system uses about 700, Siddha 600 and Unani 700 medicinal plants. In recent years, it is revealed that, international trade in medicinal plants and phytopharmaceuticals preparations is one of the major forces in the global economy. It is needless to note that medicinal plants are important not only in the local health support but in rural income and foreign exchange earnings (Annie Abraham and Meena Bhai 2003). India is one of the leading countries in exporting medicinal plants and expected to grow to a turn over of 5 trillion US \$ by the year 2010. In India, there are 8,400 Pharmacies manufacturing Ayurvedic medicines. The key suppliers in Ayurveda are Dabur, Baidyanath and Zandu which together have about 85% India's domestic market. The vertical growth of the consumer demand, industrialization and lack of organized cultivation have led to the indiscriminate harvest of the herbals from its natural wild habitat and many species are facing threat for the existence. Moreover acute scarcity of many raw materials paved the way for adulteration in drug industry. Only 10 % of the raw materials for the Ayurvedic drug preparation are from the cultivated source. And rest of them from domestic and wild collection. Nationally the Kerala state is identified as a major consumer of medicinal plants (Suneetha and Chandakanth, 2002). It was estimated that the demand for the Ayurvedic medicines in Kerala State alone is growing at a compound rate of 10-12 per cent per annum. There are about 853 pharmaceutical units in Kerala out of which a dozen of them consume about 50 % of the total plant based raw materials produced and used for drug manufacture (Ajith kumar 2003). Sixty seven per cent

of the total turnover of Ayurvedic pharmacies in Kerala was from only six pharmacies (Arya Vaidya Sala, Kotakkal; Arya Vaidya Pharmacy, Coimbatore; Sitaram Pharmacy, Thrissur; Thaikkattcherry Moos' Pharmacy, Thrissur; Nagarjuna herbal concentrates Ltd., Thodupuzha; Oushadhi, Thrissur while the remaining 33 % was from around 800 and odd pharmacies (Suneetha and Chandakanth, 2002).

Compared to other states, cultivation of medicinal plants has not been progressed in Kerala. The state does not have a regulated market system for medicinal plants. Lack of clear economics, exploitation by mediators, unsteady supply of raw materials, unreliable and unorganized market, fluctuations in price etc. are the various factors for the limitations of medicinal plant cultivation in the State. The scope of commercial cultivation of medicinal plants as pure crop is very much limited in Kerala compared to other state, owing to the smaller land holding size and high pressure on land. Even small, available space including kitchen garden can be utilized for growing medicinal plants. Therefore, homestead cultivation need to be encouraged in Kerala. There are many high value and highly demanded medicinal plant species which can be cultivated as intercrop/monocrop and even as hedges and fence (Table.2).

**Table 2.** High value and highly demanded Medicinal plant species suitable for intercropping, hedges and fences

Sl.No	Medicinal Plant	Common Name	Part used	Market value Rs/kg	Market demand tonnes
1.	<i>Aloe vera</i>	Kattarvazha	Leaves	10-15	1000
2.	<i>Plumbago rosea</i>	Chuvanna Koduveli	Root tubers	50-65	600
3.	<i>Asparagus racemosus</i>	Sathavari	Root tubers	20-30	900
4.	<i>Caesalpinia sappan</i>	Pathimugham/Ch appangam	wood	100-120	600
5.	<i>Holostemma annulare</i>	Adapathiyam	Root tubers	150-200	900
6.	<i>Saraca indica</i>	Asokam	Bark/flower	200	1200
7.	<i>Indigofera tinctoria</i>	Neela amari	Leaves	30-40	600
8.	<i>Kaempferia galangal</i>	Kacholum	Rhizome	130-150	2000
9.	<i>Kaempferia rotunda</i>	Chenganeer kizhangu	Rhizome	80-100	1000
10	<i>Alpinia calcarata</i>	Chittaratha	Rhizome	50-60	1000

As against to vegetables or plantains or other cash crops, recurrent attention and requirements are not needed for the medicinal plants. Apart from this, natural calamities like flood draught etc. also scarcely affect this sector of plants. However, certain medicinal plant species have constrains to propagate conventionally due to delayed rooting, scanty fruit and seed set, lack of high frequency germination etc. It is ideal to propagate those species through micropropagation, a basic technique of Biotechnology. In rural areas of Kerala the unemployed women can take care of medicinal plant cultivation without disturbing their on-going programmes of income generation.

Keeping in view of the above factors and considering the importance of empowerment of rural women and uplift of their livelihood, Tropical Botanic Garden and Research Institute (TBGRI) has initiated a programme on Medicinal Plant Cultivation in the selected village of Kerala with the financial assistance from DBT, Govt.of India and Kerala State Science, Technology and Environment (KSCSTE), Govt. of Kerala with the participation of the selected Panchayat.

### **Objectives and Action Plan of the Case Study**

The major objective of the programme is to empower the rural women to enhance their livelihood options through medicinal plant cultivation without disturbing other income generating activities. The action plan of the programme in the target area is concentrated to establish a model nursery for medicinal plant cultivation in the selected Panchayat owned land, to impart training on conventional propagation techniques, rearing of rooted micropropagated plant lets, harvest and post harvest techniques of the target medicinal plant species to the selected women beneficiaries, distribute the planting materials of target plant species to the beneficiaries to initiate homestead cultivation, evaluation of the homestead cultivation, to establish marketing linkage for income generation and form a Co-operative Society for Medicinal plant Growers at Kanjikuzhi Grama Panchayat, Alappuzha District.

### **Target area**

Kanjikuzhi Grama Panchayat, Alappuzha District of Kerala State is selected to implement the programme. The Kanjikuzhi Grama Panchayat is backward in terms of the standard of living of the people as seen generally in Alappuzha district. The majority of the people (82%) depend on coir industry, cattle rearing and agriculture crops especially vegetables which are seasonal. Though literacy rate in the district is in the second rank as compared to

the other districts, employment rate is not proportional to the literacy rate. The soil condition of the target area is loose sandy with high water percolation capacity and the medicinal plants for cultivation were selected considering the ago-climatic conditions of the target area (Table 3).

**Table 3.** The selected target plants distributed to the selected women beneficiaries Kanjikuzhi Grama Panchayat for cultivation

Sl.No	Medicinal Plant	Common Name	Family
1.	<i>Aloe vera</i> (L.) Burm.f.	Kattarvazha	Liliaceae
2.	<i>Plumbago rosea</i> L.	Chuvanna Koduveli	Plumbagenaceae
3.	<i>Asparagus racemosus</i> Willd.	Sathavari	Liliaceae
4.	<i>Caesalpinia sappan</i> L.	Pathimugham/Chappangam	Fabaceae
5.	<i>Holostemma annulare</i> (Roxb.) Schum	Adapathiyam	Asclepiadaceae
6.	<i>Indigofera tinctoria</i> L.	Neela amari	Fabaceae
7.	<i>Kaempferia galangal</i> L.	Kacholum	Zingiberaceae

## Methodology and Approach

### Selection of the target nursery site and establishment of the nursery

An Agreement was executed between Panchayat and TBGRI for the smooth implementation of the programme. Followed by a preliminary discussion, the Panchayat had provided 85 cents of Panchayat's own land, provided a well for the irrigation purposes and road access towards the nursery. The proposed area was a bare land menaced with overgrown weeds which were cleared prior to the activities.

### Establishment of Nursery Infrastructure

The nursery infrastructure includes a Store room with over head water tank, Potting Shed, Mist Chamber, Shade house, Barbed Wire fence supported with stem cuttings of *Gliricidia sepium*, a metallic gate, name board, irrigation facility. Electricity connection under agriculture tariff was also brought for irrigation.

To look after the cultivation programme and day to day attention and maintenance, the nursery was entrusted to four woman beneficiaries and one man (for mist operation)

residing close to the target nursery cite. A special training on conventional propagation techniques and instructions were given to them for the nursery activities and maintenance. A monthly honorarium of Rs 500/ month for each beneficiary was provided. The seedling/saplings of the selected plants were provided and initiated the cultivation activities at the nursery.

### **Selection of the Women Beneficiaries**

Selection of the Beneficiaries was carried out by distributing the Selection forms through Panchayat and Krishi Bhavan. As part of the selection programme, a awareness class on medicinal plant cultivation, women empowerment and self income generation was conducted at the Panchayat. The class also emphasized the importance, need and various strategies for group activities, development of leadership qualities and how to achieve women empowerment, rural development and marketing mechanism. In addition, during the second year onwards, an opportunity had been given to the leader beneficiaries of the previous years to express and share their experience in this programme to the newly selected beneficiaries. Total 200 beneficiaries for 3 batches were selected based on the criteria like age, education, size of the family and socio-economic status, social activities, entrepreneurships, land and irrigation facilities possessed and their interest on the programme etc. The beneficiaries were grouped into twenty with 10 numbers in each group and selected a leader beneficiary from each group. To initiate the homestead cultivation and promote their activities, a one time stipend of Rs 500 per person was disbursed in addition to the garden implements, manure, and planting materials (target plant species).

### **Activities carried out prior to initiate homestead cultivation**

The profile of the beneficiaries was analyzed, the soil analysis of the proposed cultivation land was also done. Training and instructions to the leader beneficiaries were imparted to co ordinate the programme in sustainable manner.

### **Distribution of the planting materials, garden implements and manure**

The well established plants of *Indigofera tinctoria*, *Aloe vera*, *Plumbago rosea*, *Kaempferia galanga*, *Asparagus racemosus*, *Holostemma annulare* (tissue cultured ) and *Caesalpinia sapan*, raised in TBGRI were distributed to the selected beneficiaries along with garden implements and manure.

## **Training Programmes**

Training on conventional propagation techniques with special reference to the target species in particular and medicinal plants in general was given. During the field demonstration, the beneficiaries attained hands-on experience on the conventional propagation techniques of the target species. Training was given on manure application. Biofertilizers, vermicompost, green manure ash and cow dung were only used as manures for the entire crop selected.

A demonstration was given to harvest the raw materials of *Plumbago rosea*, *A. vera* and *I. tinctoria*, *K. galana* and *H. annuare* and their post harvest techniques. A demonstration and training class have been given on hardening techniques of micropropagated plants followed by hands-on experience on deflasking procedure of the rooted plants, preparation of community pots, planting and weaning techniques, irrigation and field transfer of the plants.

## **Evaluation on homestead cultivation and market linkage**

Periodic evaluation was carryout out on homestead cultivation in the randomly selected beneficiary's cultivation land. Market linkage was mainly established with local raw drug shops at Cherthala. The marketing linkage with Oushadhi, and other units like Nagarjuna, Sami Labs, Bangalore etc is under consideration which will be possible after the functioning of the Co –operative society.

## **Activities at TBGRI**

The target plant species were collected and the conventional propagation techniques through stem, rhizome and seeds were standardized. The micropropagation technique was standardized for *Holostemma annulare*, established the seedlings and saplings for distribution to the beneficiaries at nursery site to initiate cultivation.

## **Observations and Achievements**

The profile of the beneficiaries analyzed showed that most of the beneficiaries have Secondary School Leaving Certificate/ Pre-Degree with age group of 30-50 years (70-90%). All beneficiaries have irrigation facilities and 70-80 % possessed land area of 20-60 cents. Approximately, 20-40% beneficiaries have a land area of 10-20 cents. Majority of the beneficiaries are generating income through cottage industries like coir spinning and few from cattle rearing. Soil analysis showed that invariably in all localities organic carbon was below 1%. It was observed that plants with tuberous roots, rhizome and succulents are found to be grown luxuriantly, if the manure will be provided.

The training on conventional propagation techniques imparted was highly useful for the beneficiaries to start the homestead cultivation (Fig.1).



Fig.1 A glance into the training imparted to the beneficiaries

Through the special training provided, beneficiaries attained leadership qualities and co-ordination capacities. Regularly, they conducted group meetings and discussed the progress of the cultivation programme. This activity strengthened the leadership qualities. The beneficiaries started cultivation by the planting materials provided and expanded the programme by collecting materials by their own effort. Periodic evaluation on randomly selected homestead cultivation field was done. When the plants were established they raised the propagules of each species to enhance the cultivation. Besides, the beneficiaries of the first phase could achieve initial income by selling seedlings and saplings to the members of second and third phase and to other people in the Panchayat.

Within a period of 15-18 months, the beneficiaries harvested tuberous roots of *P. rosea*, *A. racemosus* and rhizomes of *K. galanga*, leaves of *I. tinctoria* and sold to the domestic and local Ayurvedic units in the Panchayat. A marketing system with local raw drug shop had been demonstrated and later the group leaders have taken up the responsibilities for collective marketing of raw materials from their respective groups to the local raw drug shops. From an assessment, it is recorded that, 50 % of the first batch beneficiaries earned Rs 150-200/month and remaining 50 % generating below Rs 100 - 150 /month (Fig.2 ) .



Fig.2. A glance into homestead cultivation and marketing of the raw material

## Nursery Activities

With the installation of a scientifically organized infrastructure, (Store room with over head water tank, Potting Shed, Mist Chamber, Shade house, Barbed Wire fence supported with stem cuttings of *Gliricidia sepium*, a metallic gate, name board, irrigation facility, and electricity connection under agriculture tariff) cultivation activities were started. Before starting planting work, the weeds were removed, sprayed weedicides and ploughed well. The nursery has separate beds for each plant species and only organic manures were applied. Five beneficiaries residing close to the nursery have taken care of day to day activities of the nursery (fig.3)



Fig.3 A glance into the nursery activities and part of nursery infrastructure

## Steps taken to sustain the activity

In order to sustain the medicinal plant cultivation programme, by getting a steady income through an organized marketing, a Co-operative Society was formed for the medicinal plant growers in the target Panchayat. The instructions and guidelines were given to the leader beneficiaries and Panchayat representatives to submit projects to the funding agencies of State and Central Government. The assets created will be handed over to the Panchayat with the completion of the Project.

## Findings

- A Lab to Land programme implemented successfully with the involvement of R&D Institute, Panchayat and People participation.

- Routine works of women beneficiaries do not get affected.
- Beneficiary spends only an hour/day for irrigation, manuring etc.
- Minimum care required for homestead cultivation.
- Organic farming makes the produce readily acceptable to the market.
- Assured supplementary income to the tune of Rs. 150-250/month
- The programme is participatory, democratic and operated through consensus to make the participants entrepreneurial, empowered.
- After the project expiry, activities become self sustainable
- The Co-operative Society formed as part of this programme will open up a viable marketing linkage

### **Acknowledgements**

The author is thankful to DBT, Govt. of India and KSCSTE, Govt. of Kerala for the financial support and Director TBGRI for extending all the necessary facilities.

### **References**

1. Anonymous (2008) International Workshop on Empowerment of Women through Science and Technology (14-16 December), Tehran, Iran.
2. UNDP, 1997. *Human Development Report*, Oxford University Press, New York.
3. Venkateswaran, S. 1992. *Living on the Edge: Women, Environment and Development*, Friedrich Ebert Stiftung, New Delhi.
4. EIU, 1997. *India Nepal: Country Profile*, The Economist Intelligence Unit, London.
5. The Hindu news paper –April 09 2008
6. Annie Abraham, S and Meena Bhai, M (2003) Sustainability of medicinal plants in Kerala Economic considerations in Domestication and conservation of Forest resources, Department of Applied Economics, CUSAT.
7. Suneetha , MS and Chandrakanth, MG (2002) Trade in Medicinal plants in Kerala-Issues, Problems and Prospects , *Journal of Medicinal and Aromatic Plant Sciences* 24: 756-761
8. Ajith Kumar R (2003) Potential of medicinal plants , Kerala Calling

## **WOMEN EMPOWERMENT THROUGH ENERGY CONSERVATION PROGRAMMES AND INCOME GENERATING ACTIVITIES**

**Shri. K.M. Dhareshan Unnithan**

*Director,*

*Energy Mangement Centre,*

*Thycaud (p.o), CV Raman Pillai Road, Near Police Ground,*

*Thiruvananthapuram- 695 014.*

*E-mail: kmdunnithan@hotmail.com*

---

**(1) Energy Clinic** : Energy Clinic is a unique and powerful awareness programme on domestic energy conservation. It enables to provide wide awareness about energy conservation practices in the domestic sector focused in the grass root level especially in rural areas. The energy conservation awareness among rural families helps to improve domestic budget, little leisure time for housewives, reduces drudgery of women, and reduces pollution and all these contribute to the national development. A notable feature in the cultural background of Indian homes is that women are the mangers of energy, water and sanitation. Hence this programme is demonstrated and implemented through women volunteers who are the change agents. By mere awareness of energy efficiency and conservation practices 10- 15% of total energy can be saved. The energy clinic provides valuable information to the rural population on energy conservation, energy efficiency equipment and right methods of energy usage to reduce energy wastage.

**How it works?** Women volunteers are selected from all the districts and the Technical Experts in this field give them effective training. These trained volunteers organize energy clinics locally- ensuring rural women participation. The volunteers deliver talk on energy conservation and explain with demonstration how to achieve energy conservation in homes. Though it is a voluntary activity, they can be paid a minimal honorarium for traveling and other expenses. In each clinic housewives can discuss their doubts regarding operation of many electric gadgets and home appliances and way to conserve energy and and save money. The Self Help Groups formed under Kudumbasree units are also given awareness to promote energy conservation for the benefits of the future generation too. So that the message of energy conservation can reach every nook and corner of the State and the grass root level.

**Experience of EMC:** EMC started the Oorja Clinic programme in the year 1997 and at present have 283 trained volunteers spreading all districts in Kerala. Each volunteer are

conducting two awareness programmes in a month and the centre pays Rs. 250/- for each Clinic as honorarium. Government of Kerala issued a circular to LSGs to co-operate with these volunteers to conduct programmes and to pay 150 for each Clinic. These awareness programmes helps reducing the peak load demand.

## **(2) Fabrication and propagation of Thapabrani- the thermal cooker**

Low income people spend up to 25% of their monthly income on cooking fuel. Usually they use inefficient cooking devices. Hence a large amount of energy as well as cost for fuel is getting wasted. This implies that energy efficient gadgets are inevitable to reduce energy consumption. Rural people prefer low cost energy saving devices. The use of Thapabharani reduces energy consumption; reduce the environmental pollution by increased usage of fuel for cooking (firewood). Fabrication of this device can create employment opportunities to women and improve their quality of life. This gadget will improve the kitchen environment, which is very vital for the health and wealth of the women folk. Total time at the fireplace can be reduced and the total duration of cooking can be reduced. It will result in providing more leisure time to the poor rural women. It also helps to generate income to the rural women groups through its fabrication and propagation. This helps to enhance energy conservation with direct benefits to the beneficiaries by reducing monthly energy costs, better environment due to lower consumption of fuel and also due to less pollution, better health conditions to the rural people, social upliftment, national savings by way of fossil fuel saving, direct employment and income generation and above all helps poverty alleviation and women empowerment process.

This cost effective energy saving and environment friendly thermo-container is capable of saving around 75 percent of cooking energy while cooking rice, grams and similar foodstuffs. Women volunteers are selected from all parts of the State for fabrication and dissemination of the gadget. The volunteers were selected in association with the local Governments, leading women groups, Women self help groups and prominent NGOs in the concerned districts. Training for the fabrication of the gadget were provided to the volunteers and they were identified as trainers to the local area for providing further training to the women groups engaged in the fabrication of the gadgets and to turn themselves into entrepreneurs. Women volunteers were also trained to conduct awareness classes in selected panchayats for educating the rural women about the opportunity and need for energy conservation and application of this device for energy conservation in their daily lives.

## **Conclusion**

Though energy conservation is a broad science, it is yet to be educated and popularised in India especially in rural areas. The dissemination/extension is the key element in diffusion of innovative technologies in rural areas rather than developing the technologies. Hence by co-ordinating these two faces of rural energy technology aspects, EMC has devised the technology of thaapabharani and Energy Clinic for proper dissemination of energy conservation technologies. This technology happened to be a very effective one which has already been proved its effectiveness not only in energy conservation but also in increasing employment opportunity and poverty alleviation. EMC has developed, propagated and transferred this technology for the benefit of the domestic housewives especially for the rural areas. This technology is one of the most effective instrument especially an improvement in the technology of cooking stove which has got significant positive impact on improving the health of the households, reducing the drudgery of cooking and also increasing the employment opportunity and thereby reducing poverty. Both the programmes are found to be very successful in the context of Kerala and hopefully the similar programme can be further replicated in other parts of the country with or without regional modifications. Similar efforts are found highly essential in the energy conservation sector for the national development angle.

### ***Brief Profile of Energy Management Centre***

Energy Management Centre (EMC) is one of the important research and consultancy organisations in India involved in different aspects of energy management, policy and planning. Energy Management Centre, Kerala, an organisation registered under the Travancore-Cochin Literary, Scientific and Charitable Societies Act of 1955 with Reg.No: 139/96, came into existence on 07-02-1996. The office of the organisation is at T.C.20/1441, Poojappura-Karamana Road , Karamana P.O, Thiruvananthapuram, 695 002 .

The Centre is an autonomous body under the Department of Power, Government of Kerala, devoted to the improvement of energy efficiency in the State, promotion of energy conservation and encouraging development of technologies related to energy through research, training, demonstration programmes and awareness creation. The centre is networking with institutions within and outside the State for research and training. The Centre is a multifunctional organisation with multifaceted activities. For the administration and smooth functioning, there are various Divisions with focused activities. R&D Division devoted for research activities in the energy field, Small Hydro Power Division for development of environmentally benign small hydro power generation, Industrial Energy

Efficiency Division for the efficiency improvement programmes and other related energy conservation technologies and activities for the industrial sector, Rural Energy Division for the integrated rural energy planning, technology development and management, and other infrastructural Divisions like Computer division, Library, and administrative departments. For any energy related solutions, please contact : The Director, Energy Management Centre, Karamana, Trivandrum – 695 002, Kerala, Ph. 0471-2345597, 2345578,

(E-mail : [emck@vsnl.com](mailto:emck@vsnl.com), Website : [www. Keralaenergy.org](http://www.Keralaenergy.org))

## **WOMEN IN WATER MANAGEMENT CHALLENGES AND OPPORTUNITIES**

**Dr. George Chackacherry**

*Scientist & Officer-in-Charge,*

*CWRDM Sub Centre,*

*Neyyattinkara,*

*Thiruvananthapuram.*

*E-mail: chackacherry@yahoo.com*

---

The Nairobi Forward-Looking Strategies for the Advancement of Women adopted by the third International Women's Conference by the United Nations held in Nairobi in 1985 said, 'women should be integrated into modern technology programmes that introduce new crops and improved varieties, rotation of crops, mixed farming, mixed and inter-cropping systems, low cost soil fertility techniques, soil and water conservation methods and other modern improvements. In this connection, women's involvement in the construction, management and maintenance of irrigation schemes should be promoted'. This has been reiterated by the Platform for Action framed in the UN Women's Conference held in Beijing in 1995 also (Chackacherry, 1997). Despite the emphasis on involving women and people from the lowest community level in water management efforts, women are globally left out of the management of the water resources, yet most women's and poor men's activities particularly in the developing countries involve the use of water. There is need to mainstream gender in water resources management in order to give adequate consideration to the roles, needs, access to and control over resources and decision-making of both women and men (Kabonesa and Happy, 2003). Women constitute the largest group of direct users of water and beneficiaries of improved water services. Women, because of their domestic roles, are a mainstream interest group in water management. When water resources management is part of the unpaid, informal economy, governed by traditional male/female norms, women are the responsible parties. But once it enters the paid, public domain, it becomes subject to hierarchical rules which state that men are managers and women carry out the decisions they make. The reasons attributed for this are: (i) Women are severely overburdened by the double responsibilities of household work and economic effort; (ii) The cards are culturally stacked against women's participation in public decision-making bodies; (iii) Patriarchal relations also express themselves in control over land rights; (iv) These patriarchal patterns also inform official decision-making at national level; (v) Women often lack skills relevant to participation, partly because of their lower access to

education and resulting lower self-confidence; (vi) Women often lack technical skills required for concrete participation; and (vii) Women are often absent from managerial, engineering and policymaking levels of society (Kabonesa and Happy, 2003). Even a people-centered approach does not automatically ensure that women and men's different needs and interests are reflected in development or conservation programming. If there is no explicit confrontation of gender equality issues, there will be no guarantee that women will receive the resources needed to contribute to development or conservation of the environment. True sustainability of these programs will only be achieved when women receive an equitable share of development and environmental resources and benefits (WWC, 2000).

Because of the differences in production, labour, responsibilities and resources, women and men have different interests in and benefits from the availability, use and management of water. As a result they often have different criteria to evaluate the adequacy, equity, timeliness, convenience and quality of various interventions (Zwarteveen, 1994). However, there appears to be a consensus that women must be involved in water resources management if there is to be sustainable development. It is believed that the systems would then become more efficient, user-focused, financially viable and environmentally sustainable - and economic production would improve. So would payment of costs, since women value water as an input to their economic activities, as well as to the health and well being of their families, and are often willing to pay fair costs. Hence, many water management programs now place a focus on 'women's involvement'. But this raises a problem. Such programs often seek to alter women's conditions and positions without taking into account the larger social picture: the entrenched and dynamic power relations that are capable of negating any gains women may achieve. This can simply result in more burdens being placed on the backs of women (Kabonesa and Happy, 2003). However, in the last decade planners have come to recognize the value of participatory approaches, and more recently participatory approaches with a gender focus, throughout the water sector. In the water sector, it is generally assumed that women manage water at home, while men are in charge of public management of water and water-related human practices.

Integrated Water Resources Management (IWRM) offers an opportunity to create a paradigm shift in water resources management. The global environmental crisis, growing poverty in urban and rural areas, and continued gender inequalities all point to the need for a different governance approach to water use and management. In the area of water resources management, an uncoordinated and sectoral approach has resulted in

environmental degradation from over-exploitation of water resources, inappropriate allocations among competing uses, inequitable distribution of benefits and burdens, and inadequate operation and maintenance of infrastructure. Inadequate involvement of both women and men has hindered programmes and projects aimed at addressing sustainability in water resources management. Community participation and management approaches have failed to address these issues, largely because communities are often seen as a collection of people with a common purpose. The reality is that a community is not a collection of equal people living in a particular geographic region. It is usually made up of individuals and groups who command different levels of power, wealth, influence and ability to express their needs, concerns and rights. Communities contain competing interest groups. Where resources are scarce, there is competition for supplies, and those at the lowest end of the power spectrum - poor women and men - will go without. Unequal power relations place women in a disadvantaged position. Experts from a hundred countries and representatives of eighty international, intergovernmental and non-governmental organizations, who attended the International Conference on Water and Environment (ICWE) in Dublin, Ireland, during January 1992, saw the emerging global water resources picture as critical. The statement adopted by this Conference, which is called Dublin Statement, was based on four guiding principles, one of which emphasizes the role of women in water management. The four principles are: (i) Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment; (ii) Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels; (iii) Women play a central part in the provision, management and safeguarding of water; and (iv) Water has an economic value in all its competing uses and should be recognized as an economic good. Accepting the pivotal role of women as providers and users of water and guardians of the living environment, ICWE has pointed out that this has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of women involvement in water management requires positive policies to address women specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them.

Participation of women in water resources management improves project performance and improves the likelihood of sustainability. It has been found that women's participation was among the variables strongly associated with project effectiveness. Although research has tended to focus on the water supply and sanitation sector, the same trend can be seen in

other water sectors as well. During a recent study, it has been found that majority of the 100 minor irrigation schemes commissioned under the Kerala Community Irrigation Project (KCIP) since 1994, still running efficiently only because they are operated and maintained by the women folk. In the Water User Associations (WUAs), formed prior to the setting up of the irrigation systems, spouses of landholders were given membership. Since almost all the landholders are men, their women got chance to be inducted as members in the WUAs. Since the men, who have other avocation for their livelihood, have almost ignored their small piece of land, gave way for their women to actively participate in the meetings, decision making process, and O&M of the systems. Their thrift groups are very active and have good bank balance. Considering the impact of the KCIP, where active members in the WUAs are mostly women, the model evolved for the implementation of Participatory Irrigation Management (PIM) in Kerala, also accepted giving membership to spouses in the WUAs. In addition to giving automatic membership in the WUAs, one-third of the leadership positions in all the three tiers of the PIM structure have been reserved for women. Earlier studies under KCIP and recent study have endorsed the fact that men do not have any problem for their women involving in the operation and maintenance of the irrigation systems. While the pilot projects of PIM are carried out (2004 – 2007) at two irrigation projects of Kerala, women have been in lead role even in the rehabilitation programmes of the systems (Chackacherry, 2009). In fact, the state has the distinction of having the highest male and female literacy rates which continued in the 2001 Census, according to which, 94.2 percent of the males and 87.7 percent of the females are literate in the state. The gap between male and female literacy is low at 6.5 percentage points against the 21.6 percent point gap at the national level. People of Kerala, both men and women, according to Saradmoni (1981), look upon education as a ladder which would help them get a secure employment. In fact, most of the Kerala women tend to have more decision making authority within the households, and be more knowledgeable and assertive about their family (Chackacherry and Sudhamony, 1995). Women occupy a better status in Kerala than in other parts of India. Kerala women have more influence over their own lives and those of their families than most women elsewhere in the Country (Jeffrey, 1993).

As part of a project on intergraded development of women in the agro-economic, water management and sanitation activities, a Gender Assessment Study (GAS) was conducted in Alappuzha District (participating 500 women in five gram panchayat wards), mainly to document and understand the roles of both women and men in the locality within the social context (CWRDM, 2004). The analysis gave light to the fundamental questions of who does or uses what, how and why, and who benefits and how much. Domination of men in the

families was conspicuous when we analyzed the access and control pattern. As noted in Table 1, women have less access and control over land, men's wage, household income, etc. However, it is encouraging to note that majority of them have definite access and control over the wages they earn. About 40% of women have access and control over knowledge and skill development efforts. In majority of the households decisions are taken jointly by husband and wife (Table 2). A conspicuous upper hand is taken by husband or male member of the family only in the case of decisions with regard to food pattern, major purchases, and farming. Activity profile prepared during GAS for understanding the time allocation and division of labour of men and women within the households showed striking difference. When 98% of women are waking up during 5 – 6 AM, and engage in cooking, cleaning, washing, etc., except 4% of the men, all others are sleeping (28%), relaxing (40%), or visiting the nearby tea shop (24%), during the period. When about 20% of men are sleeping at 6 – 7 AM, most women (82%) are engaged in kitchen related activities, and child care/care of elderly. A negligible percentage of men only are seen helping their women in kitchen/child care/care of elderly. Drinking water collection is also the sole responsibility of women. When men find lot of time for relaxing and taking rest, it is not the case with women. Based on the above findings, strategy of the project was evolved. Discussions were conducted with both men and women. Initially, more focus was on men. Result was that, though it was very difficult for the women to spare time for development activities initially, after a few interventions, the project staff did not find any women complaining about lack of time. On the other hand they were enthusiastic in participating in various activities (Chackacherry, 2005).

Even though, water is a commodity equally priced to both men and women, women's participation in the management of water resources projects has not been recognized at all. The officials, experts, men water users, etc. do not usually see women as independent group with unique needs, problems and satisfaction related to water. Women play a very important role in water management, but it is indirect, invisible and unrecognized. As yet, the women do not show aspirations to play any further role in water management. Women are often less informed about technical projects because project staff and village men consider this a male topic. Many of the problems in water management could be controlled if women are equipped sufficiently. For example, if the women are properly trained on the need and methods of control, it is sure the problem of excessive irrigation could easily be minimized.

**Table 1. Access and control over resources**

<b>Resource</b>	<b>Gender</b>	<b>Access (%)</b>	<b>Control (%)</b>
Land	Male	52.90	79.50
	Female	47.10	20.50
Cattle/poultry	Male	8.20	20.80
	Female	91.80	79.20
Men's wage	Male	100.00	76.90
	Female	0	23.10
Women's wage	Male	0	39.30
	Female	100.00	60.70
Household income	Male	74.10	73.20
	Female	25.90	26.80
Credit	Male	79.90	80.80
	Female	20.10	19.20
Knowledge/skill	Male	60.80	62.80
	Female	39.20	37.20

**Table 2. Decision making in the households**

	<b>Husband/ male head (%)</b>	<b>Wife/female head (%)</b>	<b>Jointly by husband &amp; wife (%)</b>	<b>Children (%)</b>
Utilization of income	5.00	5.70	83.30	6.00
Schooling of children	6.00	6.30	82.70	5.00
Attending social gathering	0.70	7.70	86.00	5.60
Medical treatment	6.30	9.80	78.30	5.60
Food pattern	48.30	8.00	37.00	6.70
Major purchases	46.70	7.30	38.70	7.30
Household farming	41.50	11.40	31.80	15.30

**References**

Chackacherry, George. 2009. Experiences of Participatory Irrigation Management Efforts in Kerala State, Proceedings: National Seminar on Participatory Irrigation Management, Aurangabad, March 2009.

2005. Involving in Development Activities by Rural Women in Kuttanad; Some Gender Aspects, in Proceedings: Kerala Environment Congress, Kochi, Kerala, India, pp 142-148.

1997. Bringing Women to the Mainstream of Agriculture: A Strategy, Kerala Sociologist, Vol XXI, No.2.

Chackacherry, George; and K L Sudhamony. 1995. Involvement of Women in Agriculture: Experiences from Kerala State, India. International Congress on Agrarian Questions, The Netherlands.

CWRDM. 2004. Integrated Development of Women in Kuttanad through Agro-Economic/Water

Management/Sanitation and Hygiene Activities, Final Report submitted to the Department of Science and Technology, Government of India.

Jeffrey, Robin. 1993. Politics, Women and Well-being, Oxford University Press.

Kabonesa, Consolata; and Margaret Happy. 2003. The Gender Gap in Water Resource Management in the Nile Basin Countries: The Case for Rural Women in Uganda, Seminar on the Role of NGOs and Media in the Nile Basin Initiative, Kyoto, Japan.

Saradmoni, K. 1981. Divided Poor: Study of a Kerala Village, Ajantha Books International, New Delhi.

WWC. 2000. Mainstreaming Gender in Water Resources Management: Why and How? Background Paper for the World Vision Process, World Water Vision.

Zwarteveen, M. 1997. 'Water: From Basic Need to Commodity: A Discussion on Gender and Water Rights in the Context of Irrigation,' *World Development*, Vol.25, No. 8.

## **NATIONAL SEMINAR ON CAREER IN SCIENCE FOR WOMEN- CHALLENGES AND OPPORTUNITIES**

### **RECOMMENDATIONS**

1. Science and Technology policy may be revised incorporating gender aspects. The State Science and Technology Council may take lead to formulate guidelines and set targets to increase participation of women in science and technology on a mission mode.
2. A separate cell may be constituted in the Council to serve as a nodal agency for implementing programmes aimed at increased participation of women in S&T.
3. Before implementation of all development projects and programmes, Gender Assessment Study and programmes may be conducted and they may be fine-tuned accordingly.
4. Participation of women may be ensured in all natural resource management projects and programmes. Necessary interventions and special training programmes may be imparted for bringing women to the forefront.
5. Steps may be taken to provide S&T inputs for the projects and programmes related to rural technology for women.
6. A Status Report on women scientists of the State may be prepared.
7. Programmes may be initiated throughout the State, from the school level, to motivate girl children to opt for a career in Science.

