

# Birth and growth of M.S. Swaminathan Research Foundation, Chennai

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**The M.S. Swaminathan Research Foundation (MSSRF) set up as a not-for-profit scientific trust with M. S. Swaminathan as the Founder-Chairman in 1988 is dedicated to sustainable agriculture, natural resources management and rural development. Relevant science and ecotechnologies are harnessed for fostering human livelihood and conservation of nature. MSSRF has developed biovillages and modern ICT-based Village Knowledge Centres (VKCs) for skill and knowledge empowerment respectively of the rural communities. Ecotechnologies are the resultant of lending frontier technologies with traditional knowledge and ecological prudence of the indigenous communities. These have pro-nature, pro-poor and pro-women orientation. The evergreen revolution of MSSRF is designed to fight both the famines of food and rural livelihoods. As against the bureaucratic 'top-down' approach, MSSRF practices 'bottom-up' and participatory approach. The VKCs with lab to land and land to lab linkages provide solutions almost instantaneously to the problems of the small and marginal farming, fishing and landless rural families. These are briefly discussed in the paper.**

**Keywords:** Biovillages, evergreen revolution, MSSRF, natural resources management, sustainable rural livelihoods, Village Knowledge Centres,

## Genesis and growth of MSSRF

WE believe that the India's Green Revolution of 1967–68 brought about by Swaminathan–Borlaug partnership not only changed India's image then as 'begging bowl' to 'bread basket', but also Swaminathan's focus from very high quality basic to applied research with a goal of 'zero hunger' in India and the world. His having achieved excellence in basic research with relevance to enhancement of agricultural productivity would be evident from several awards and Fellowships of Science Academies including that of Royal Society, London (FRS) bestowed upon him. He has been invited Fellow of all the leading science academies of the world for over five decades. The question is what prompted him to shift his focus from basic to applied research with the goal of sustainable rural development and 'zero hunger' in the world. In the con-

text of achieving a 'zero hunger' world, Swaminathan knew that sustainable rural development to create sustainable *on-farm* and *non-farm* ecoenterprises with market linkages to generate income and then to 'access' food is a fundamental requirement. It is said that Colonel Baird Smith as early as 1856 wrote: 'Indian famines are famines work and not of food'. Hence, Swaminathan's thrust on both productivity and rural livelihood as early as 1967–68 is a clear endorsement of Baird's observation.

At this juncture, a curiosity to know when precisely Swaminathan decided to shift his focus to sustainable rural development is readily justifiable. We believe that a turning point in the shift of his focus towards sustainable agriculture and rural development took place even as the nation and its people witnessed bumper harvest of dwarf and semi-dwarf wheats in 1967–68. He was indeed happy about dramatic increases in the productivity (i.e. kg/ha), but not of what all it took to achieve it. His observations of monoculture at the cost of rich agrobiodiversity of numerous locally adapted indigenous varieties of wheat, saturating the soil with inorganic chemical fertilizers to the point of wrecking the soil microbial ecosystem and the soil health, flooding the soil with precious groundwater in the name of irrigation without adequate drainage, the exhaustion of the groundwater itself, and indiscriminate application of toxic pesticides the residue of which could be carcinogenic etc., made him refer to it as 'exploitative agriculture'. He even made it clear that it should be used only to get a 'breathing space' before turning to a more ecofriendly sustainable agriculture. What was aptly referred to as 'exploitative agriculture' was christened as 'Green Revolution' by William Gaud of the US Agency for International Development. Today, it is acknowledged world over that the Green Revolution of the 1960s and 1970s has no elements of the 'green economy' in vogue today<sup>1</sup>. And as Swaminathan<sup>2</sup> had feared, the so-called Green Revolution had progressively degenerated into 'Greed Revolution'. The yield fatigue associated with Green Revolution since 1990s confirms<sup>3</sup> Swaminathan's prophetic address as Chairman of the Agricultural Section of the 55th Indian Science Congress Session held in January 1968 in Varanasi that an 'exploitative agriculture' that leads to degradation of the ecological foundations of agriculture would not be sustainable. So, the question in his mind at that time was as to how to make agriculture sustainable. The other realization

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that had been there for over a century was that hunger in India was predominantly due to poverty (i.e. lack of money to access food in the market). And the poverty, in turn, was due to intensifying famine of livelihoods in the rural areas of India. What this meant was that productive agriculture needs to be able to widen the rural natural resource base to generate on-farm and non-farm livelihoods to generate income to alleviate poverty and enhance economic access to food security. During the late 1960s and early 1970s, we believe, that Swaminathan was pondering over ways and means to break the vicious spiral between rural poverty and resource-base degradation.

Writing the prologue in the MSSRF publication, *The Future We Want – Journey of MSSRF*<sup>4</sup> to mark the completion of 25 years of service to the society and nation, Swaminathan begins with the statement, 'It was back in 1970 that Professor C. V. Raman seeded the idea in my mind that I should be involved in establishing research and training centre in the field of applied ecology, relating to the improvement of the productivity, profitability and sustainability of small-farm agriculture'. We believe that Raman's words were at best catalytic to already ongoing ideas and analyses in his brilliant mind. In fact, Swaminathan had mentioned this casually to one of us (PCK) at his residence, 81, Shahzahan Road, in New Delhi, sometime in 1972 or 1973. In the context of this paper, it is necessary to point out that Swaminathan is a scion of an illustrious family which has played host to the Father of the Nation, Mahatma Gandhi in Kumbakonam, Tamil Nadu and therefore, it is hard to accept that he needed an advice/induction to set up an Institution such as the MSSRF. Of course, Raman's words were very encouraging and made Swaminathan to develop a blueprint of the centre/institution. While he was the Director-General of the International Rice Research Institute (IRRI) in the Philippines, he won the first World Food Prize in 1987. That enabled his decision to transform his long-cherished idea into action. Most deservedly, he also got several other prizes such as Honda Prize for Ecotechnology, Tyler Prize for Environmental Achievement, Sasakawa, Volvo and Blue Planet Prizes as well as the Indira Gandhi Prize for Peace, Disarmament and Development which all provided the necessary financial resource to set up the Centre for Sustainable Development. Both the governments of Karnataka and Tamil Nadu offered him land and facilities to set up the research centre. Considering various options, he decided to set up a Centre with major focus on the sustainable management of coastal systems. For this purpose, Chennai was naturally more suitable since Tamil Nadu has a long coastline of nearly 1000 km.

M.S. Swaminathan Research Foundation (MSSRF) came into existence when it was registered in New Delhi on 17 May 1988 as a not-for-profit scientific trust with M. S. Swaminathan as the Founder Chairperson, and

V. L. Chopra and V. K. Ramachandran as the founder trustees. Since its inception, eminent persons from different walks of life have served as Member of the Board of Trustees. And, Swaminathan holds that a trust must be trustworthy, and professional and financial integrity is non-negotiable.

It is very essential to recognize and place on record that Mrs Mina Swaminathan an eminent authority in the field of education with special reference to pre-school education Integrated Child Development Services (ICDS) as well as Gender and Development has been playing a keyrole right from the beginning in establishing the MSSRF and promoting its ethos and programmes. Swaminathan, his wife Mina, and their three daughters namely Soumya, Madhura and Nitya have put so much of their shares of money into MSSRF. It is their money gifted for public cause. In Kalpetta, Wayanad, Kerala too, the land was gifted by this family for setting-up 'Community Agro-biodiversity Centre'. The gifted land is worth huge amount of money. These are placed on record for posterity that Swaminathan and his family have made very significant intellectual and financial contributions both for setting-up and sustaining the MSSRF. Besides the family members, numerous friends, well-wishers and dedicated staff have, during the past twenty six and odd years, raised the MSSRF from small beginnings to one with expanded programmes and activities. The MSSRF has now become a 'temple' of sustainable development for achieving productivity in perpetuity and reconciling environment and rural livelihoods as well as nutrition and agriculture in a mutually reinforcing manner (Figure 1).

MSSRF is not one more non-governmental organization in the country. After reviewing the various activities of the MSSRF, Lele and Gandhi<sup>5</sup> in their report entitled 'M.S. Swaminathan Research Foundation at 21: Report of the independent program review' have also commented that MSSRF has no parallel in its entirety. It is unique since its research and development endeavours are aimed at finding solutions for the already existing, as well as newly emerging problems, often resorting to both trans- and interdisciplinary approaches. That in fact is the core strength for its recognition worldwide. Yet, another major cause of its success is its ability to convert laboratory-based scientific findings into field-level applications. Towards this activity, the MSSRF has been actively promoting participatory research with farming families on the one hand, and policy research designed to achieve synergy between grass-roots experience and public policy, on the other. Just outside of the Sambasivan auditorium there is a plaque with the following inscription:

*'M.S. Swaminathan Research Foundation Centre for Research on Sustainable Agriculture and Rural Development April 14, 1993; Dedicated to the use of science for fostering sustainable human livelihood and conservation of nature.'*



**Figure 1.** M.S. Swaminathan Research Foundation and its site research centres.

There could be no better way to emphasize that livelihoods, which are a function of economic development in a general sense, should not erode the conservation of natural resources, including all the living beings of the planet Earth. It recognizes the ‘web of life’. Right from the beginning, the MSSRF has adhered to the policy that technologies used to usher in ecoagriculture, and rural livelihoods need to have a pro-nature, pro-poor and pro-women and pro-livelihood orientation. These are called the ecotechnologies. In simple words, the technologies for rural development should not result in harmful impact on the environment as well as the rural women and men. Technologies should not also result in displacing labour from the fields and in diminishing rural livelihoods as the corporate/industrial farmings do.

Recognizing that nearly 70% of India’s huge population, now of 1.3 billion, lives in about 638,000 villages, and a vast proportion of them do not have adequate skills or literacy the MSSRF has established ‘biovillages’ and the modern information and communication-based Village Knowledge Centres (VKCs) to impart the necessary skill and knowledge empowerment respectively to the rural women and men. One may argue that MSSRF is somewhat biased towards the skill and capacity development of the rural women, in particular. We believe very firmly that had not the women been suppressed socially and economically for over several centuries, India would have become a really ‘developed’ country a long time ago. It is widely known, but seldom acknowledged that women play an important role in household food and nutrition security, children’s education and family’s economic and psychological welfare. In this regard, the contributions of Mrs Mina Swaminathan are monumental.

As it is said, ‘seeing is believing’, the empowerment of women in the MSSRF-operated villages is readily evident from their participation in all the vital decision-making processes both at the grassroot institution (i.e. Panchayat) and household levels. Given the freedom from traditional suppression, along with land right and financial support, the rural women contribute in varied ways towards sustainable rural development. This is the major lesson which Mrs Mina Swaminathan has been propagating.

The Founder-Chairman, M. S. Swaminathan has described the MSSRF (The future we want – Journey of MSSRF. Twenty-second Annual Report, 2011–12) in his words as follows:

‘MSSRF is designed as an equal opportunity centre for all socially-committed scientists, regardless of gender, age, religion, caste or community—verily a *Vasudhaiva Kutumbakam* in action. It is also a “centre without walls”, generating synergy and symbiosis in partnership with similar institutions with similar goals. Mahatma Gandhi’s advice that we should keep our windows and doors open so that fresh ideas come from all directions, but that we should keep our feet firmly on the ground, has guided the research philosophy. Above all, participatory research with tribal and rural women and men and anticipatory research to scientifically checkmate the adverse consequences of climate change and sea level rise were chosen as pathways for shaping the future we wanted.’

Running institutions sustainably is like a relay race where one runner passes the baton on to the next to pick up and run. Swaminathan stepped down as Chair of

MSSRF Board of Trustees on 6 August 2013, and Madhura Swaminathan an eminent economist has taken over. As the Founder-Chairman, Swaminathan continues with his productive work, and putting forth new ideas that are simple in 'do-how' and yet most effective in their outcome and social impact.

With this brief introduction, we would like to discuss the rationale behind the various programmes of the MSSRF. We, however, do not wish to discuss the programmes themselves in detail. They are all indeed varied in their approaches and contents, but are really converging towards the major focus of sustainable agriculture and sustainable rural development which together constitute Swaminathan's concept of an 'Evergreen Revolution', defined by him as '*achieving productivity in perpetuity without accompanying ecological and social harm*'.

Some aspects of the history, philosophy and interesting anecdotes of the MSSRF have been described in Swaminathan's own words in the book *M. S. Swaminathan in Conversation with Nitya Rao* prepared by his youngest daughter Nitya Rao, University of East Anglia, Norwich<sup>6</sup>. We found it as not only an inspiring, but also as an easily amenable source to fathom the mind of the great scientist who had a clear view of the basic and urgent needs of the society and could, therefore, mould the science and technology appropriately towards achieving the goals of MSSRF.

### Foundation of social and physical factors in the setting up of MSSRF

After 27 years of establishment of the MSSRF, many millions of minds around the world would be wondering about the key factors in the mind of the Founder-Chairman Swaminathan which influenced his decision on the goals and approaches to achieve them. We thought that an understanding of these, and placing them on record here would be very useful. Swaminathan himself has opened up his mind in several places, particularly in the 'Chairman's Introduction to the Annual Reports of the MSSRF', and in his 'Conversation with Professor Nitya Rao'. For instance, the Second Annual Report (1991–92) of the MSSRF has in its 'Introduction' a statement attributed to Rabindranath Tagore (Fireflies, 1928) which is as follows:

*'The world knows that the few are more than the many.'* This statement is elegantly illustrated by a figure in the Annual Report that shows that as of 1992, one-fifth of the human population received 62.7% of the total world income, and on the other extreme, one-fifth of the poorest received 1.4% of the total world income. The remaining three-fifths of the population share the remaining 15.9% of the world income in highly inequitable manner.

The portrait of Rabindranath Tagore in the main reception hall is verily symbolic of the mission of the MSSRF to alleviate rural poverty with social and gender equities in sharing the national income. More than the Gross Domestic Product (GDP), the Gross Domestic Happiness (GDH) would be a better yardstick to assess the contentment and happiness of the people of the nation. It is, however, a stupendous task, since no science and technology alone without the incorporation of the principles, tools and techniques of the social sciences could ever achieve. That is why the programmes and pathways towards achieving the goals are an appropriate mix or blending of the natural and social sciences. It was equally important to pay attention to the gender studies, aimed at 'voicing the voiceless' – obvious reference to women in general, and the rural women, in particular. In terms of sustainable human welfare, the scientific goals and methods should lead to concurrent strengthening of the ecological security of the rural areas and the livelihood security of the rural families.

In the 'Introduction' to the First Annual Report (1990–91) of the MSSRF, a distinction between 'Do Ecology' and 'Don't Ecology' is brought out. It explains that in industrialized nations, the goal of sustainable development is to preserve the high life-styles and high agricultural and industrial productivity already achieved. For India and several other developing countries, the goal is necessarily the eradication of poverty and improvement of food and nutrition security, rural livelihoods, productivity, profitability and stability of the farming systems based on ecological ground rules. In a lecture he delivered in 2012 on the occasion of his receiving the GITAM Foundation Annual Award (Vishakapatnam), Swaminathan has further clarified that 'Don't ecology' has to take the form of regulations to prevent unsustainable consumption, particularly of energy. The 'Do ecology' on the other hand, has to be based on education, social mobilization and regulation to overcome unacceptable levels of poverty and malnutrition. So, the Founder-Chairman has emphasized that the MSSRF's concept of sustainability has to be a dynamic one, leading to a continuous improvement in biological productivity on an ecologically and socially sustainable basis. The document *Social Vision for Science: The history of the M.S. Swaminathan Research Foundation (1990 to 2000)*<sup>7</sup> substantiates the realization of the goals and target set by the Foundation in 1989–90. It recalls that MSSRF was established at a time when humankind was facing serious ecological and social problems – growing damage to the basic life support systems of land, water, forests, biodiversity and atmosphere on the one hand and increasing poverty, large number of children born not for happiness but to inherit the poverty, deprivation and misery of the parents, as well as social and gender inequity on the other. The rapid growth in human population was not only accelerating India's 'ecological footprint' but was also leading to progressive

reduction in per capita availability of land and water. The land and fresh water are a finite resource which decrease with increasing population on per capita basis. For instance, the per capita availability of fresh water in terms of annual renewable water resources had diminished from 5694 cubic metres in 1950 to 1704 cubic metres in 2010 (ref. 8). And explosive technological development coupled with high rates of unemployment in the urban areas and intensifying famine of rural livelihoods greatly worsened the food insecurity at the individual household level of hundreds of millions of resource-poor small and marginal farming, fishing and landless rural families. Contrary to what Rabindranath Tagore would have wished, the 'jobless economic growth' has been the order of the day. All these factors led to MSSRF defining its research agenda in terms of sustainable development rooted in the principles of ecology, social and gender equity, employment/rural livelihood generation and economic viability. The fostering of a pro-nature, pro-poor, pro-women and pro-livelihood/employment orientation to technology development and dissemination in the rural areas became MSSRF's mission. And, Swaminathan has thoughtfully argued that 'If technology was an important factor in the past in increasing economic and social disparities and causing ecological harm, MSSRF's approach has been to enlist appropriate blends of traditional and frontier technologies as allies in the movement for economic and ecological well-being and gender equity.'

These abovesaid goals entail inter- as well as multi-disciplinary approaches to solve the complex, and often closely inter-related socio-economic, socio-environmental as well as eco-economic problems. Hence, from the beginning, Swaminathan ensured that the MSSRF would function on the principles of a 'Centre without walls', so as to derive maximum benefit from partnership with institutions and individuals working for similar goals. The factual situation, however, after about 26 years, is that MSSRF has become a 'Temple of learning for sustainable agriculture and rural development'. As stated earlier, the MSSRF was established as a non-profit Trust in July 1988 with the monies received over the years by Swaminathan. His personal monies donated for the cause of establishment of the MSSRF and strengthening the infrastructures and programmes include: (i) The World Food Prize, 1987; (ii) The Honda Prize for Ecotechnology, 1991; (iii) The Tyler Prize for Environmental Achievement, 1991; (iv) The UNEP Sasakawa Environment Prize, 1994; (v) The Volvo Environment Prize, 1999 and several others. Donating enormous amounts of personal monies for a noteworthy public cause by Swaminathan, his wife Mina Swaminathan and their daughters Soumya, Madhura and Nitya is an absolutely noble and benevolent action. The social and environmental outcomes of their benevolence will outlive several scores of successive generations. We also note that the benevolent action of M. S. Swaminathan, Mina Swaminathan and

their three daughters truly represent Mahatma Gandhi's dictum, 'Be the change you want to bring about.'

Chennai (then Madras) in Tamil Nadu was chosen for setting up MSSRF for the reasons that its initial focus was on the sustainable development of the coastal ecosystems, that also incorporated attention to the livelihoods in the coastal villages, and also the Government of Tamil Nadu had kindly made available to the MSSRF on 30 years' lease 2.5 acres of land in the Taramani Institutional Area in Madras for the construction of the building to house its research and sustainable development programmes. In June 1993, the Government of Tamil Nadu kindly made available another 2.04 acres adjoining the original place for further inclusion of essential activities towards sustainable development. Since at that time, several government departments did not give project research support to trusts, MSSRF had to establish a registered society called 'The Centre for Research on Sustainable Agricultural and Rural Development' under the Tamil Nadu Societies Registration Act in 1975. So, MSSRF established the Centre in March 1990.

With all these appropriately put in place, the foundation stone of the building was laid on 14 April 1991. The immediate question about the basic requirements of the building to house the programmes of the MSSRF. And Swaminathan's direction to the architect was that the building should help to 'harvest rain and sun'. So, rain water harvesting devices were incorporated in the architectural design and also a solar photovoltaic system was installed to harvest solar energy. Further, the huge glass window panes in the rooms are of help to let the sunlight into the rooms. No wonder, András Erdelyi<sup>9</sup>, the Hungarian biographer of M. S. Swaminathan gave the title, *The Man Who Harvests Sunshine. The Modern Gandhi: M.S. Swaminathan* to the biography. In the initial stages and until about a few years ago, at the main entrance of the building, two large greenhouses on either side maintained such plants which were on the verge of extinction. The idea was to generate enthusiasm to save the endangered species. Conservation of biodiversity is also necessary to ensure food security in the future. These greenhouses in the main building constantly relayed the message of purpose of MSSRF. In the nutshell, the building told the visitors what it stood for!

The beginning of 1993 saw MSSRF move into the new building; on 14 April 1993 (Tamil New Year), it was formally dedicated to the use of science for fostering sustainable human livelihood and conservation of nature. MSSRF has been recognized by the Department of Scientific and Industrial Research, New Delhi and by the Director General of Income Tax Exemptions, Government of India, for the purpose of exemption of contributions from Income Tax under section 80G and sections 35 (1) (ii) of Income Tax Act, 1961, read with Rule 6 of Income Tax Rules, 1962. The Ministry of Home Affairs, Government of India has recognized the MSSRF for receiving

funds from sources abroad under the provisions of Foreign Contribution (Regulation Act, 1976).

### **Knowledge is continuum, so also the concerted activities towards achieving the set goals**

The major thrust of MSSRF on sustainable development is to fight both the famines of food and rural livelihoods, while conserving the ecological integrity. In this regard, MSSRF is a rather uncommon and uniquely distinct non-governmental organization (NGO). Its mission is truly a culmination of the notable major awakenings in the sphere of technology development for economic growth inclusive of ecological integrity and social as well as gender concerns. Major turning points in favour of ecological dimension came in the form of the book, *Silent Spring* by Rachel Carson<sup>10</sup> in 1962, Swaminathan's reference to the chemically intensified agriculture as 'exploitative agriculture' as early as January 1968, and the UN Conference on 'Human Environment' in 1972 in Stockholm, Sweden. In the same year, Meadows *et al.*<sup>11</sup> published their then 'infamous' book *Limits to Growth*. It is a study of the patterns and dynamics of human activities on Earth, pointed toward environmental and economic collapse within a century if 'business as usual' continued. Thirty years later, much of what the book said has come true; that is also manifest in the form of 'climate change'. In 2012, to celebrate the 40th anniversary of the book, the Club of Rome, and the Smithsonian Institute hosted a symposium, 'Perspectives on Limits to Growth: Challenges to Building a Sustainable Planet', in Washington DC in 2012. Since 1989–90, MSSRF has also been involved in the mission of building a sustainable planet. The *Scientific American*<sup>12</sup>, published an article describing how environmental degradation and social problems have brought the Planet Earth at the 'Cross-Road'. Again, the work carried out by MSSRF during the previous 15 years (1990–2005) was to delay, if not avoid, the collapse of humanity and Earth. Just one year before the MSSRF was registered as a non-profit society in New Delhi in 1988, Gro Harlem Brundtland's report 'Our Common Future', was published<sup>13</sup> in 1987 by the Oxford University, UK. All these reports established that development for economic benefits must reconcile with ecological imperatives. When the ecological foundations (i.e. land, fresh water, biodiversity, renewable energy and atmosphere) are degraded and the finite resources are exhausted, there would be no human survival. And in such a horrendous scenario, the economic success would mean nothing at all. Brundtland's report is of interest for two reasons. One is that its title reminds us that notwithstanding geographic and political boundaries, the human destiny on planet Earth is ecologically intertwined. The second is that it has provided a largely valid definition of sustainable development: 'development that meets the

needs of the present without compromising the ability of future generations to meet their own needs'. This emphasizes that Earth's resources are *not* infinite, and if we use up all the resources today in our generation, the future generations will have no resources to meet their own needs. We know that in the hierarchy of basic human needs, food to quench hunger is the most basic for very survival.

At this point, a brief reference to the Annual Reports of the MSSRF starting from 1990–91 until 2013–14 reveals that there is a building-up in the progress of the programmes and continuity in the pursuit of the objectives of sustainable agriculture together with sustainable rural livelihoods. The various programmes with different designs and pathways indeed converge towards the major goal of alleviation of rural poverty and food insecurity. Further, one major observation of these seemingly divergent programmes and approaches is that all of them effectively converge to address the ecological, economic, social as well as gender dimensions of sustainable development. Unfortunately, the UN Millennium Development Goals (MDG) which ended this year had not been successful to the expected degree largely because of too much emphasis on economic dimension and too little on the ecological and social dimensions of sustainable development. Hopefully, the transition from MDG to Sustainable Development Goals (SDG) might stand to gain from the past 27 years of hard work of the MSSRF and its substantial progress in ushering in sustainable rural development, particularly in an era of climate change.

Apart from adherence to the fundamentals of sustainable development, M. S. Swaminathan, who is certainly the most knowledgeable and is among the outstanding thinkers at the global level, yet relied on consultations and dialogues to decide the programmes that would be most conducive to achieve the goals of the MSSRF. We refer to the 'Chairman's Introduction – "Shaping the Future We Want"' (22nd Annual Report of MSSRF, 2011–12). In this introduction, he explains how, based on several inter-disciplinary consultations during 1988–89, seven areas were chosen. These seven areas are: Coastal systems research, Biodiversity conservation, Biotechnology both traditional and modern, Ecotechnologies resulting from the integration of traditional ecological prudence and knowledge with frontier technologies for sustainable management of resources, creation of rural livelihoods and promotion of evergreen revolution within the 'biovillage' paradigm, Information and communication technology involving integrated use of internet, cable TV, community radio, mobile technology, print media, etc., Sustainable food and nutrition security with concurrent attention to food availability, access to food and absorption of the ingested food which is a function of clean drinking water. These areas combining goals with tools and techniques span across both natural and social sciences. These could also help in postponing the onset of

Malthusian scourge, to a far longer period of time than exploitative methods focusing only on the economic growth. The spectrum of programmes and areas chosen by the MSSRF encompass the ecological, social, economic as well as gender and equity dimensions of sustainable development. We appreciate today, about 26 years later, how prudently these programme areas were chosen as seemingly divergent pathways yet leading to sustainable rural development.

The 'Chairman's Introduction' changed to 'Chairperson's Introduction' in the 23rd Annual Report (2012–13) with Madhura Swaminathan having taken over the immense responsibility of managing the MSSRF from M. S. Swaminathan. The last Introduction by M. S. Swaminathan and the first Introduction by Madhura Swaminathan reveal a smooth transition. It is like a relay race with the Founder-Chairman smoothly handling over the baton to the successor, who receives it and accelerates towards the goal. The genesis and the growth of MSSRF towards the set goals would, of course, involve necessary readjustments from time to time to suit both the changing contemporary relevance as well as emerging challenges. In fact, Nitya Rao, in her book *M.S. Swaminathan in conversation with Nitya Rao* writes: 'His belief that livelihood security of the poor has to go hand in hand with ecological security has informed programmes at MSSRF, but with fast changing contexts, driven by many external factors – education, markets, technologies and changing aspirations – he also recognizes that needs change; hence programmes need to be reviewed periodically to check their continued relevance on the ground. Institutions, as they mature and get known, also tend to get complacent.' We do not intend to present a gist of the remarkable Introductions for the simple reason that these should be actually read, and moreover, we might not be able to do justice while abbreviating such comprehensive and analytical Introductions.

### Vibrancy and leadership of MSSRF

Way back in the 1960s when PCK was his doctoral student at the Post-Graduate School of the Indian Agricultural Research Institute, Swaminathan mentioned in one of his lectures that 'when much is given, much more is expected'. That what he said is what he has walked all his life, and that truly accounts for the global recognition and respect accorded to the MSSRF. As Homi Bhabha did, the institutions need to be built around persons with a proven track-record of performance and achievements for the country and the society. During the past 26 years of its existence, MSSRF has been vividly vibrant, constantly diligent to make notable progress every day in the areas of work chosen, and also in coming up with new ideas and innovative designs to tackle the problems and to convert the challenges into opportunities.

Needless to emphasize, the bulk of the intellectual and innovative inputs have come from just one person, M. S. Swaminathan. This statement is readily substantiated by the national and global recognition accorded to him. His several biographies include biographers from Hungary and Pakistan. Almost every leading University in the world has conferred Honorary Doctorate on him. The National and International awards won by him form a huge and highly impressive list. We have, unfortunately, limited space to elaborate these, but we refer the readers to ref. 14. In addition, the biographies written by Iyer<sup>15</sup> and Dil<sup>16</sup> provide a lot of information.

Since the MSSRF is a research foundation, its major task is to evolve appropriate solutions based on science and ecotechnology. In this important sphere, the innovative ideas of Swaminathan coming from time to time have vastly been responsible to maintain the MSSRF vibrant and relevant particularly in the context of breaking the vicious spiral between environmental degradation and accentuating poverty, and designing an Evergreen Revolution to fight both the famines of food and rural livelihoods without causing environmental and social harm. While his contributions to the creation of new ideas, public policies and institutions are far too many to be listed here, we would only present here a few of them which we believe are particularly relevant in the context of achieving a 'zero hunger' world without accompanying environmental degradation and social inequalities in an era of climate change. Some of these are as follows.

### *Transforming the Green Revolution into Evergreen Revolution*

We have already discussed that notwithstanding several immediate benefits, the 'exploitative agriculture'/Green Revolution, in the long-term results in environmental degradation, social inequities and also does not ensure food security at the individual household level of hundreds of millions of resource-poor rural women and men. Hence, Swaminathan started thinking and designing a system of ecoagriculture and ecolivelihoods for rural development. It would also need to be suitable for resource-poor small and marginal farms. In this regard, his innovative concept the 'evergreen revolution'<sup>17–20</sup> is defined as 'achieving productivity in perpetuity without accompanying ecological and social harm'. Further analyses of the inherent virtues of the evergreen revolution and its suitability for hundreds of millions of resource-poor small and marginal farms throughout the developing world<sup>21–24</sup> strengthen the view that there is hardly any better way of reconciling agricultural production, creation of rural livelihoods and conservation of the environment. In addition, it is readily compatible with the small family farms which can also raise such vegetable, fruit and other crops as to provide agricultural remedies



**Figure 2.** Biological softwares through eco-enterprise for sustainable agriculture. *a*, *Azospirillum* and other bio-fertilizers production by Women Self Help Group, Kannivadi, Dindigul District, Tamil Nadu. *b*, *Trichogramma* and other bio-pesticides production by Women Self Help Group, Kannivadi, Dindigul District, Tamil Nadu.



**Figure 3.** *a*, Inauguration of the Village Knowledge Centre, Emblem Village, Puducherry (2000), by Bruce Alberts, President, US National Academy of Sciences. *b*, Betty Alberts interacts with the community.

to nutritional maladies<sup>25–28</sup>. No wonder that Wilson, a biologist of rare distinction at Harvard University wrote in his epoch-making book<sup>29</sup> *The Future of Life*, that Swaminathan's evergreen revolution is the best option available to feed the burgeoning human population on the one hand, and save the rest of life as well, on the other.

The evergreen revolution is skill and knowledge intensive. It also requires sustainable management of resources. With a clear foresight of these, Swaminathan has incorporated the services of both traditional and modern biotechnologies and modern information and communication technologies in the MSSRF's 'biovillage' (bios=living) paradigm (Figure 2) and VKCs (Figure 3) respectively.

After receiving a copy of the book, *From Green to Evergreen Revolution*<sup>30</sup>, Obama, the US President, made a mention of the Evergreen revolution in his address to the Indian Parliament on 8 November 2010. He said, 'Together, we can strengthen agriculture. Cooperation between Indian and American researchers sparked the Green Revolution. Today, India is a leader in using technology to empower farmers...' Now, as farmers and rural areas face the effects of climate change and drought, we will work together to spark a second, more sustainable

'Evergreen Revolution'. We would draw the attention to his reference to evergreen revolution as 'sustainable', that Green Revolution was not. So, the evergreen revolution, an innovative design of Swaminathan, that is now globally acknowledged as ecofriendly is among the most noteworthy sources of strength to MSSRF. Besides, eco-agriculture, the evergreen revolution through its arm, the 'biovillages', provide training and skill empowerment of the rural women and men to adopt on-farm and non-farm ecoenterprises with market-linkages. The 'green economy' which is in vogue today, is embedded in the system of 'production by masses' of biological softwares (such as biopesticides, biofertilizers, vermiculture, etc.) and several other on-farm and non-farm ecoenterprises. The biovillages harness ecotechnologies for the sustainable use of natural resources. The ecotechnologies are the resultant of blending frontier technologies with traditional knowledge and ecological prudence of the indigenous rural and tribal people, particularly the women. Because of such blending the ecotechnologies acquire 'pro-nature, pro-poor, pro-women and pro-employment' orientation most suited for sustainable rural livelihoods and ecoagriculture. As to question how could the largely illiterate and unskilled rural women and men could be imparted



necessary training and skill empowerment, Swaminathan had conceived of a 'pedagogic method of learning by doing' – way back in 1972 (Princess Leelavathi Memorial Lecture, Mysore University, 1972). He coined the term 'techniracy' to describe it. The staff of the MSSRF train the rural women and men organizing themselves in small groups of about 8 to 12, called the self-help groups (SHGs) and provide them the capacity to adopt one or more on-farm and non-farm ecoenterprises. The power of scale comes with formation of cooperatives, etc. for successful marketing purposes.

Knowledge is power today. Way back in 1992, the MSSRF organized a dialogue on Information technology which helped to standardize methods of taking the benefits of the information age to rural families. It resulted in the establishment of 'VKCs' with computers and satellite connectivity to provide internet facilities. The term 'knowledge' was chosen in preference to Information Centre, since knowledge is the product of interaction between scientists and rural families, while information is passive and is mostly one-way communication. Thus, it is 'bottom-up' rather than 'top-down' in approach and the information content is location-specific, dynamic, demand-driven and delivered in the local language. In addition to VKCs, MSSRF initiated in 2004 a Village Resource Centre (VRC) programme jointly with the Indian Space Research Organisation (ISRO). These all facilitate a knowledge empowerment programme for lab-to-land, land-to-lab, land-to-land and lab-to-lab communications. The VKCs preferably train young rural women to acquire special computer operation skills (i.e. internet, power-point, video-conferencing, etc.) besides typing, etc. The intangible benefit of empowering young rural women is that they are no longer subservient to men, and that they become reasonably independent to participate in all the decision-making processes at home and the village panchayats. In the nutshell, VKCs bridge both the digital divide and also the gender divide.

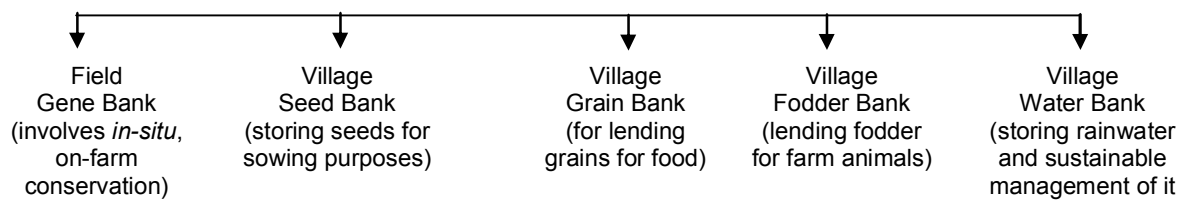
### *Linking conservation and rural livelihoods*

The intellectual and innovative contributions of Swaminathan in the realm of the biodiversity conservation programmes of the MSSRF are really simple in do-how, yet most effective in the outcome. And the success or not of an endeavour is ascertained with the most sophisticated technology available at particular point of time. For instance, the MSSRF's successful restoration of the mangrove ecosystem in the east coast of India has been assessed with the help of remote sensing in cooperation with ISRO.

MSSRF's intense involvement in reaching the unreached, voicing the voiceless and tending more ardently to the most marginalized throughout its existence has made it an institution that harnesses modern science

and technology to implement Gandhian ideals. Put in a simple statement, it is the 'Antyodaya' that aims at reaching out to the most marginalized sections of the society. These go far beyond the laboratories to the resource-poor small and marginal farms untouched by the marvels of sophisticated science and technology. In fact, these need simple, easily 'doable', yet problem-solving techniques. An example of this is the *in-situ on-farm* conservation of agrobiodiversity. Much of this sort of conservation in India and other developing countries is done by rural and tribal women at their personal cost for the benefit of the present and future generations. While national parks and bioserves are public-funded, the *in-situ on-farm* conservation has not been. Further, the extinction of landraces and indigenous crop varieties is indeed the loss of valuable genes. Extreme natural events, and/or the consumption of the seeds meant for the ensuing sowing season to quench hunger have often been. So, Swaminathan developed appropriate strategies to ensure that agrobiodiversity is conserved and even enhanced, but not lost. One is the cryogenic preservation of these and at the same time the promotion of *in-situ on-farm* conservation. Conservation is far better in the sense that it enables natural evolutionary processes (i.e. mutations, recombinations and natural selection) to go on, whereas the cryogenic preservation only extends the viability of the seeds and other propagules for considerable length of time. As to the question what if the seeds meant for sowing in the next season are consumed because there are no food grains in a few households in the village, Swaminathan has developed a system of Banks with a difference, not dealing with money, but a sequential array of seeds of landraces/indigenous varieties of crop plants for gene, seed and grains for conservation and consumption purposes. Since the ecoagriculture component of the ever-green revolution includes farm animals in the farms, fodder is also included. Freshwater in most of the villages in the semi-arid regions needs harvesting and storing of rainwater and sustainable management by the community. When all these integrated, the community gene-seed-food-fodder and water security system operated by rural women and men self-help groups (SHGs) is depicted as shown in Figure 4.

The scheme shown in Figure 4 integrates ecological security with food, fodder and water security. The community-centric ownership in rural scenario also imparts a sense of equal rights, and participation. Further, the MSSRF through the major and leading role of Swaminathan, had been involved in drafting the Act called 'Protection of Plant Varieties and Farmers' Rights' (PPVFR Act 2001) enacted by the Parliament of India in 2001. It is unique in the sense that farmers' roles as conservers and breeders are recognized in addition to their primary role as cultivators. MSSRF has also played a significant role in drafting the Biological Diversity Act – 2002. These Acts facilitate revitalization of the



**Figure 4.** The community gene-seed-food-fodder and water security system.

conservation traditions of the rural and tribal women. In 2002, a tribal women from Koraput, Odisha was trained by the MSSRF Centre in Koraput in developing Community Gene, Seed and Food Bank. She was selected for the Equator Award at the World Summit on Sustainable Development, in Johannesburg, South Africa in 2002. Besides Koraput in Odisha, the MSSRF has set-up *in-situ* on-farm conservation centres at Kolli Hills (Tamil Nadu) and Kalpetta, Wayanad (Kerala). These centres not only revitalize the conservation traditions of tribal women, in particular, but also provide recognition and economic benefits. The elegant idea of a continuum of ‘Conservation–Cultivation–Consumption–Commercialization (4 ‘Cs’)’ proposed by Swaminathan is implemented by the MSSRF.

In the sphere of reconciling conservation and development, the MSSRF has won international awards and recognitions. The ‘Blue Planet Prize’ awarded in 1996 to the MSSRF is among the most prestigious ones. MSSRF’s interventions to strengthen the conservation ethos of the tribal women in Koraput led to them winning the prestigious ‘Equator Initiative Award’ at the UN Conference on Sustainable Development at Johannesburg (South Africa) in 2002. In 2007, the tribal community partnering with MSSRF won the ‘Genome Saviour Award’ for conservation of land races from the Protection of Plant Varieties and Farmers’ Rights Authority.

#### *MSSRF: Meeting the challenge of anthropogenic climate change*

It is amazing but true that Swaminathan had been concerned with the possible adverse impacts of climate change on agriculture since late 1970s. Way back in 1988, at a Climate Conference in Tokyo, he observed that global warming and melting of polar ice and glaciers would make sealevel rise and that could result in salinization of coastal soils and aquifers. He also suggested that the genes from salt-tolerant mangrove species, genetically engineered into crop plants would provide necessary genetic shield against salinity. This suggestion has been implemented at MSSRF. Ajay Parida and his co-workers have transferred genes for salinity tolerance from *Avicennia marina* to rice crop. While this part of the work forms anticipatory research, in the sense that salinization has

not yet occurred, but the salt-tolerant rice varieties are available to ensure food security in the future, if needed. Using these drought and salt-tolerant varieties, as the source of genes, MSSRF would also facilitate ‘participatory research’ involving the farmers. The MSSRF has also identified *Prosopis juliflora* as source for drought-tolerant genes.

While the abovesaid anticipatory research activities are in the realm of modern biotechnology, the foundation has also been active in developing field level strategies to mitigate and also adapt to climate change. These have been discussed in great detail by Swaminathan<sup>26,30–33</sup>. His papers emphasize that increase in the average mean temperature of about 1°C would decrease the yield of wheat quite substantially. Based on his suggestion, MSSRF has developed methods of mitigation and adaptation to climate change in many villages. Way back in 1973s (Sardar Patel Memorial Lectures, All India Radio)<sup>18</sup>, Swaminathan developed Monsoon Management Codes such as Drought Code, Floods Code and Good Weather Code. These various codes are so designed as to reduce the loss due to bad monsoons and to maximize the gains from good monsoon period. On purely scientific side<sup>25</sup>, Swaminathan and Kesavan have elaborated the type of agricultural research needed in an era of climate change. All these reveal that MSSRF is developing science-based, socially acceptable strategies to convert the challenge of climate change into opportunities.

#### *International collaborations*

The MSSRF is a national, non-government research organization that is increasingly sought after for international collaborations. A few of these are:

- OCP Foundation in Morocco is supporting MSSRF for increasing food legume productivity in India as part of network of international organizations like ICTISAT, ICARDA, INRA France and Universities and Research Organisations in Morocco.
- LANSAs countries – Afghanistan, Pakistan, India and Bangladesh.

LANSAs is a new international research partnership exploring how agriculture and agri-food systems can be better designed to advance nutrition. LANSAs

programme focuses on policies, interventions and strategies that can improve the nutritional status of children in South Asia.

- The Myanmar Rice BioPark will help create an awareness of the importance of value addition to every part of the rice plant like straw, bran, husk, roots and grain.
- Afghanistan – MSSRF is a partner to develop the Afghanistan's first Agricultural University in Kandahar.
- China – In 1992–93, MSSRF helped the Chinese Academy of Sciences to establish Biovillages in China.

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