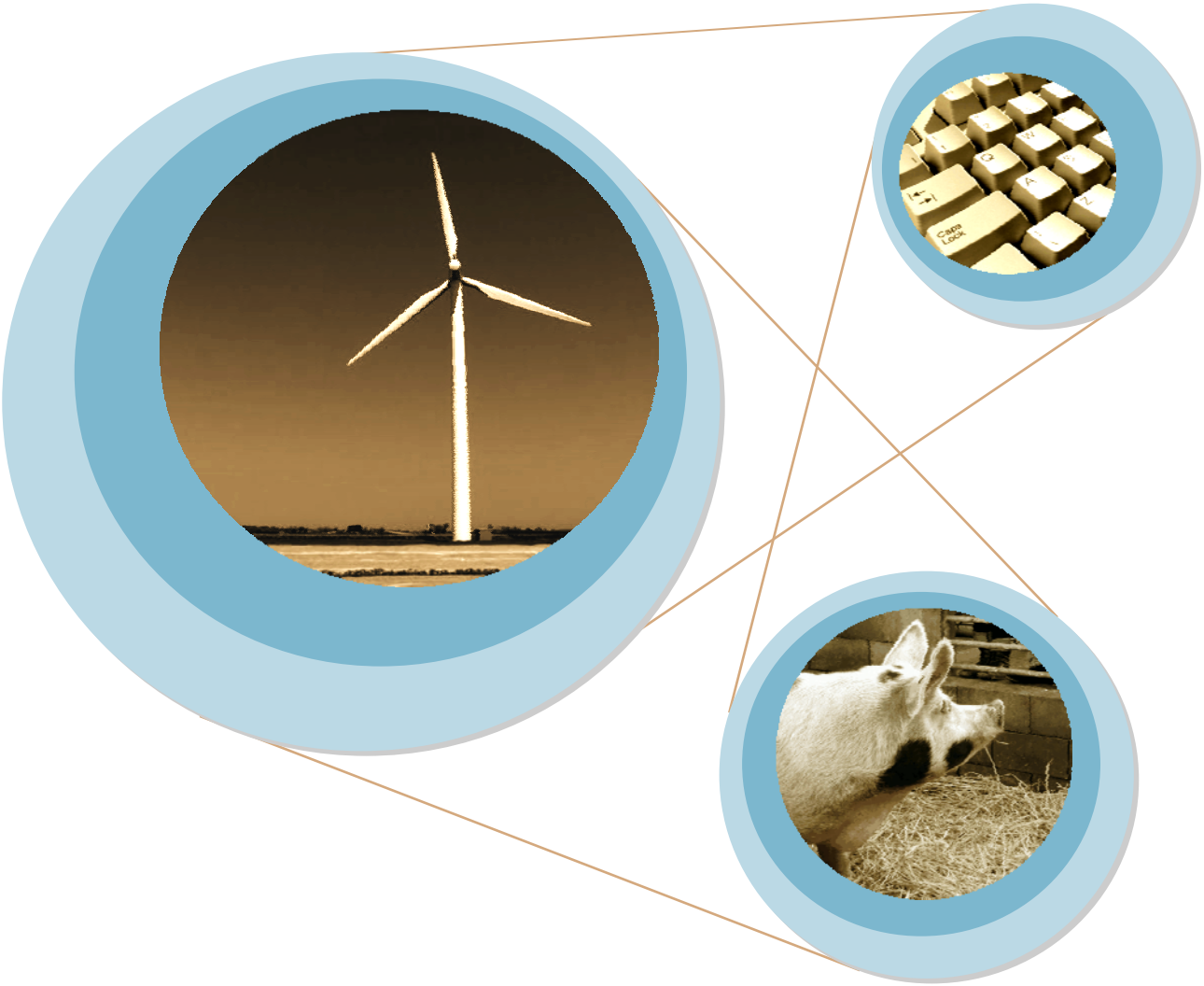

The Future Is Distributed

A Vision of Sustainable Economies

iiiee The International Institute for Industrial Environmental Economics at Lund University

MESPOM

Masters of Environmental Sciences, Policy and Management

The International Institute for Industrial Environmental Economics

at Lund University

"The Future is distributed: a vision of sustainable economies" is a collection of case studies on distributed economies, a concept describing sustainable alternatives to the existing business models. The authors of this publication are international Masters students of the Environmental Sciences, Policy and Management Programme at the International Institute for Industrial Environmental Economics at Lund University in Sweden. The aim of their work is to demonstrate that local, small-scale, community-based economies are not just part of the theory, but have already been implemented in various sectors and geographical settings.

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Preface

Pollution levels and natural resource use have risen tremendously with the large-scale industrialization of the past centuries. The accompanying centralization has led to social and economic structures that are highly unsustainable. This is exemplified by extensive urban areas with large concentrated populations leading to huge environmental impacts. Industries have grown into massive large-scale operations, increasing the distance between supply and demand while concentrating environmental impacts in a small area.

With increased appearance of severe environmental problems, the search for system changes has become very urgent. This search has led to the concept of distributed economies, an alternative structure for society and economy with rather small-scale businesses in a local economy context, leading potentially to a more sustainable social and economic structure.

This publication demonstrates that distributed economies is not just a theory, but is already practiced in many parts of the world. It holds eight case studies from the energy, food and internet sector showing that system changes are not limited to only certain sectors or regions, but are feasible in various contexts.

The case studies are selected to create awareness of alternative systems and to inspire developing small-scale, distributed operations in more locations. Where possible, the case studies have been compiled based on study visits and are complemented by literature research. In case large distances and time restrictions did not allow for such field research, information has been collected through telephone interviews, news articles, documents from involved organizations and scientific literature.

The report first introduces the concept of distributed economies, including its background and principles. This is followed by eight case studies, starting with those related to food: slow food, organic farming, coffee production and milk production. The report then deals with distributed energy and includes cases of biogas production, wind energy in a small island community and building-integrated wind turbine systems in urban areas. Finally, internet is presented as a way to support distributed economies. General, overarching principles are provided in the conclusions. Each of the case studies introduces one or more specific projects, which is followed by an analysis of its social, economic and environmental aspects.

Compilation of these case studies would not have been possible without the cooperation of Anders Elmqvist, Malmö Municipality, Maths Ericsson, Home Energy AB, Mohd. Ashraf, National Cooperative Development Cooperation, Lina Sanchez, BDC-Cenicafe, Anders and Karin Berlin, CSA Ramsjö, Niklas Wennberg, Stadsjord, Sofia Kapla, Stadsjord, Karin Grundberg, Grön kultur Högsbo, Rebecka Milestad, Swedish University of Agricultural Sciences, Rolf Axel and Mathias Nordström, Ängavallen and Christer Ohlsson from Mossagården. We are very grateful for your assistance!

Enjoy the reading of the inspiring case studies and help spreading them!

The Team

The authors of this publication are currently studying in the MESPOM programme at Lund University, which will result in a Masters of Environmental Sciences, Policy, and Management. MESPOM is a two year interdisciplinary programme run through four host institutions, Central European University (CEU), Budapest, Hungary, University of the Aegean, Lesvos, Greece, Lund University, Lund, Sweden, and Manchester University, Manchester, United Kingdom. In the second year, part of the MESPOM programme operates through the International Institute for Industrial Environmental Economics (IIIEE) at Lund University. This publication is a part of the IIIEE Strategic Environmental Development course which has chosen to investigate the theme of Distributed Economies.

Thomas Lindhqvist and **Mikael Backman** are the courageous team leaders of this project. Although both hail from Sweden and teach at IIIEE, their research interests diverge; Thomas specializes in product policy, while Mikael explores tourism and island sustainability projects.

Annemieke van den Dool specializes in sinology and hails from the Netherlands, **Erin Marchington** is a Canadian environmental chemist, and **Ralph Ripken** from Germany has a background in business administration, but they came together to study alternative food systems.

An industrial engineer from Taiwan, **Aishan Hsieh**, and a Russian physical geographer, **Maria Petrasova**, together learned about organic farming.

A Croatian forester, **Dinko Bilić,** a Medical Doctor from Tajikistan, **Anastasiya Idrisova**, and Colombian environmental scientist, **Andrés Peña**, investigated sustainable coffee production.

Vaseem Ashraf has travelled from India where he was a mechanical engineer to work with **Natalia Capelán,** a biologist from Spain, to study cooperatives and small-scale dairies.

Chunsheng Yao from China and **Tatirose Vijitpan** from Thailand explored a rural development distributed economy case study, but have backgrounds in geographical information systems and environmental science.

Mònica Coll Besa from Spain, **Jesse Eckert** from Canada, and **Vaida Pilibaitytė** from Lithuania have backgrounds in environmental science, human geography, and environmental journalism, but all share an interest in distributed energy generation.

Sujie Min from China studied international trade, but now is an expert on small-scale wind energy.

An environmental scientist from China, **Linfeng Lu**, looked into internet-based distributed economies.

Introduction

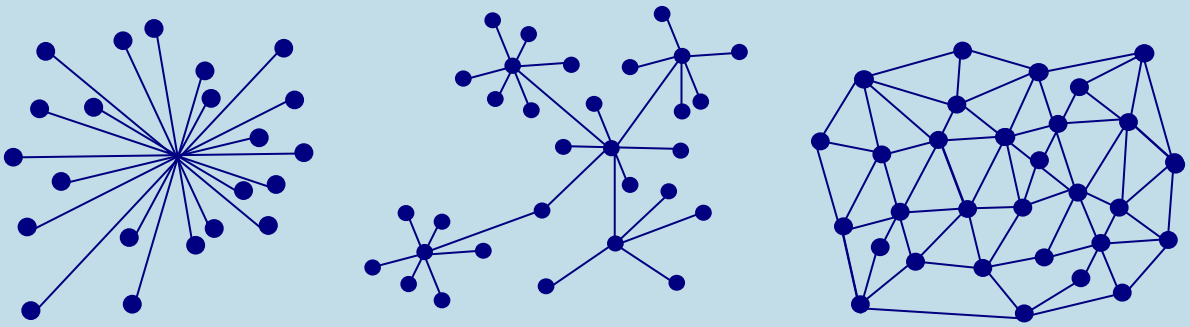
As the world is challenged with tackling the current global environmental and economic crises, many have come to question whether or not the current economic systems can meet global needs while remaining sustainable. The current system has largely been driven by a concept called "Economies of Scale", the idea that production costs per unit declines as output increases, thus making larger industrial production more attractive and profitable. The belief in this approach has created an industrial production system that is largely dominated by mass production and concentrated industrial cores.

There are a number of critiques to the current approach, concerned with its effects on both micro and macro levels to human as well as environmental systems. It has been argued that workers, communities, and the environment, both in developing and developed countries, suffer at the expense of companies that are not rooted in communities and search the globe for cheap labor and resources, as well as low environmental standards.

Furthermore, up to now, the system has been highly dependent on cheap oil and has led to the present (unsustainable) production and consumption patterns. In addition, fossil fuel reserves are expected to diminish in the near future leading to increasing oil prices, which could lead to the collapse of the current system. Given the pending crises that may occur, one must ask "what are the alternatives to the current production system?"

Distributed Economies (DE) is a concept that has been developed as a response to the current industrial production systems, that promotes the development of small-scale, decentralized, flexible units that are synergistically connected with each other and make use of local resources [1,2]. Also, DE strives for innovative regional development strategies. In this context, "regions" are defined as small-scale operating entities that are brought together into networks offering the advantage of being much more flexible and resilient to respond to change.

Furthermore, this system can allow local communities to have a larger sense of ownership and more power in guiding these schemes. It is through small-scale production units that local efforts can be made in order to guarantee progress, wealth and quality of life [1]. This is achieved by finding a balance between efficiency and quality, where businesses are driven by priorities such as *good environmental performance*



Centralized Decentralized Distributed

and local peoples' preferences, and values such as *social well-being and quality of life* [1,2].

From the environmental perspective there are both benefits and drawbacks to each form of industrial production systems. Large-scale production can be more energy intensive and require large quantities of raw materials that need to be transported over long distances, increasing costs, energy use and greenhouse gases. However, it can be argued that large-scale production produces negative outputs that are localized, potentially increasing the feasibility of pollution control. On the other hand, small-scale production units can be supplied with local resources, thus reducing the environmental impacts from transportation and delivery of raw materials and products; however, it should be noted that the arguments listed above are context specific and not necessarily universal.

The case studies presented in this publication are examples that highlight some of the key elements that can be attributed to the DE concept [2]. Some of these elements are listed below:

- increased local use of renewable resources;
- wealth creation for a higher number of people;
- decreased pollutant emissions and waste generation at the local/regional level;
- added value benefits maintained in the regions;
- increased share of non-material (e.g. information, know-how);
- higher added value material resources;
- diversity and flexibility of economic activities;
- increased diversity and intensity of communication; and
- collaboration between regional activities.

It is hoped that this publication will demonstrate to the reader the viability and benefits that DE can offer, as well as the importance that DE could play as an integral part of the solution, as efforts are made to create new sustainable production systems.

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Alternative Food Systems in Distributed Economies

By Annemieke van den Dool, Erin Marchington & Ralph Ripken

Photos by Karin Berlin & Mattias Enebjörk

When McDonald's planned to open a new restaurant at the Piazza di Spagna – a famous square in the heart of Rome – Carlo Petrini organized a protest. Armed with bowls of *penne*, the protesters made a statement against the global standardization of food, the loss of food heritage and rapidly decreasing diversity [1]. This was the beginning of the Slow Food movement, which is now a well-organized global network that is active in over 40 countries. The name "Slow Food" stems from its dissatisfaction with "Fast Life, which disrupts our habits, pervades the privacy of our homes and forces us to eat Fast Foods" [1]. The movement promotes Slow Food as a sustainable alternative. Slow Food is good, clean and fair food.

Distributed economies and Slow Food

The concepts of distributed economies and Slow Food have multiple overlaps. In fact, Slow Food is the embodiment of distributed economies in practice. Both concepts prioritize quality over financial gain, but keep its financial viability. Consequently, the profit per service sold is relatively high. At the same time, there is a strong focus on diversity and an aim for sustainability.

Slow Food is a comprehensive set of ideas that has been put into practice in various ways, among which are Community Supported Agriculture (CSA) and Urban Farming (UF). Both have proven to be very relevant in the Slow Food concept because they greatly depend on local community involvement, aiming at the creation of new "food communities" on a local scale and new "food networks" on a larger scale [2].

Community Supported Agriculture

Community Supported Agriculture reflects the Slow Food concept of consumers being co-producers. Consumers are well-informed individuals that know how and where the food is produced. Within a CSA project, consumers commit to financially support a farmer for a certain period of time. It is also common that members work a few days at the farm during their time as shareholders.

Like Slow Food, CSA intends to decrease transportation distance. CSA schemes are typically implemented in a local or regional context with maximal 50-100 km between the farmer and members.

Urban Agriculture

Urban farming implements the Slow Food concept of shortening the food supply chain. City farming reduces the need for transportation of food from outside the city. It brings food production to the consumers, who then have the opportunity to learn more about

where and how their food is produced or even to participate in growing food and raising animals, again empowering them to become co-producers rather than just consumers. Urban agriculture projects draw on local skills, knowledge and diversity, which reinforces the Slow Food idea of conserving local culture, especially local food heritage. There are different ways of practicing urban farming, including roof top farms and community gardening.

Community Supported Agriculture

According to the Soil Association of the United Kingdom, CSA can be described as a "partnership between farmers and consumers where, at best the responsibilities and rewards of farming are shared". This means that in comparison to the "normal" way of purchasing agricultural products in a supermarket, a direct connection between the farmer and the people eating his products exists [3]. The people or households participating in the scheme normally buy shares at the beginning of the season in the scheme which gives the farmer sufficient capital at the beginning for growing the vegetables etc. [4]. "Buying of shares" means that a contract between the participants and the farmer of six months to one year is established and production risks are shared. Normally the food is grown organically or even in a biodynamic way and the members of the scheme normally decide together with the farmer what is grown and under which environmental conditions [3,4]. The general idea is to reconstruct a local food system based on good farming practices for the farmer with involvement or at least a stronger connection of its members while allowing the farmer a sustainable income.

Different CSA schemes

Is has to be emphasized that each CSA is different in the way it is organized, but all CSA are similar in the motivation to provide an alternative local food system [3]. They can be categorized according to who drives the organization of the scheme: the farmer, the community or a co-operative of farmers. The CSA scheme of Ramsjö is an example of a farmer driven scheme.

The first CSA's were organized in Japan and in Europe in the 1980s and the first CSA in the USA was started in 1985 [5]. In 2004, one scheme existed in Sweden, around 50 in France, 90 in England, 500-1000 in Japan and over 1700 in the United States [4].

The literature provides several studies of the motivation of people to join CSA schemes, the main reasons stated are: quality and freshness of the vegetables, support for local farmers and concern for the environment [4,6].

Case study: CSA in Ramsjö

The information for the case study on the CSA in Ramsjö is based on an interview with the farmers Karin and Anders Berlin [7].

Anders and Karin Berlin are running the farm since 1975 as Anders took over the farm from his parents. Since 1989 they are certified as an organic farm under the KRAV label. A trip to a CSA farmer in Washington State in the United States gave them the idea around 1999 to transform their 50 hectares vegetable farm in a community supported agriculture scheme. They started the scheme in 2001 with the participation of two families and had 25 members in the first year.

The scheme grew to 120-130 active members in 2009 that invested into a share of the scheme in the beginning of the year. After a report in the local newspaper in 2003 about the scheme, the number of members doubled. The CSA scheme provides up to 50% of the income of the Berlins, ~25% are from long-term contracts with restaurants etc. and the remaining 25% from additional sales.

Anders Berlin with a box of harvested carrots

Motivation and drivers

Two main motivations were driving Karin and Anders to switch to a CSA scheme. First, for them it represents a "healthy economic system", "supporting sustainability in farming" and second, it is very valuable for them to be able to provide families with healthy and nutritious food.

For the members of their scheme the main reason to participate is the possibility to purchase local and organic vegetables or simply "the wish to buy good vegetables".

How does it work?

Active members buy a share in the CSA scheme at the beginning of the year and commit to receive 15 baskets of seasonal vegetables over the period from August till late November. For new members a possibility to opt out after four baskets exists, as the barrier for new members to invest about 340 EUR is high. In the beginning of the year a meeting takes place with all active members and the farmers in order to decide on the vegetables that should be grown and in which quantities. They deliver to five different delivery points such as a garage of members, where the members pick up their box once a week. In order to reduce transport emissions many members pick up several boxes for other members.

In addition to the active members, the farm has around 300 passive members that can buy surpluses if they exist or come for special "pick-up yourself" vegetables like beans this year. But the most important members are the active ones that have been part of the scheme over years and spread the word.

For the Berlins the economic stability of their farm improved since they started the CSA scheme, as they receive a working capital from each share of 340 EUR from the active members at the beginning of the year. According to Anders they are one of the only vegetable farms North of Skåne, the southern region of Sweden. It allows them for better work planning and increases the income security. Therefore the scheme allows for a vegetable farm in Uppland (region around Uppsala) "to stay alive" despite the food market constraints.

Future development

Anders and Karin are expecting to grow slowly over the next years to 200-300 active members to enlarge their safe income base. In spite of their limited time, they are running the farm on their own together with volunteers and they intend to convince other farmers in Sweden about the benefits for farmers and members of CSA. Despite of the barriers, Anders expects that more CSA schemes will evolve over the next decade.

Barriers to CSA in Sweden

According to Anders, CSA is not very well-known as an alternative food system concept, and organic boxing schemes like Ekolådan and its competitors are taking over the market of organic vegetables and fruit making it more difficult for new CSA schemes to evolve.

Boxing schemes require less or no involvement for the consumer and it is therefore more convenient to switch to organic vegetables in a boxing scheme compared to CSA.

No national organization like the Soil Association in the UK is promoting CSA and supporting evolving CSA schemes.

Sustainability overview

From an economic point of view, the CSA scheme allows farmers like Berlins to ensure their existence as a vegetable farm in the region of Uppland. Under normal market conditions without the income stability ensured by the CSA scheme, it is questionable whether the farm would still exist. Therefore the scheme allows local farmers in a regional context to stay in the market and contribute to a distributed economy.

As CSA schemes are only producing organic and seasonal food, the environmental impacts are reduced. If transport distances for the distribution are optimized, CO_2 emissions of the local CSA scheme are potentially lower than these of a mainstream food system [8].

CSA schemes have two main social benefits: the consumer is actively connected with the farmer and the existence of local, small-scale farmers is ensured. But in the case of Ramsjö mainly higher income families can afford participating in the scheme, which raises questions of social justice.

Urban Agriculture

Urban Agriculture is "the growing of plants and the raising of animals for food and other uses within and around cities and towns, and related activities, such as the production and delivery of inputs, processing and marketing of products" [9]. Many cities have vacant and underutilized private or public land not suitable for building projects, which could be used permanently or short-term for UA projects [9].

Different urban agriculture schemes

Many different kinds of intra-UA projects exist, including: community gardens, home gardens, institutional gardens (run by a school or church), nurseries, roof-top gardens, cultivation in cellars and barns (mushrooms, earthworms), urban orchards, etc. [9,10]. There is a diverse range in land, resources and technology required, as well as stakeholder and community involvement.

Although largely a recent phenomenon, UA has appeared over time in cities when food shortages occurred [10]. Four forces are proposed to have shaped UA: continuity of historical practices, the industrial agriculture revolution, post-World War II rapid urbanization, and the increase in the lower-income segment of urban populations [11]. It was estimated in 1996 that 800 million people were involved in UA worldwide and provided approximately 15% of food consumed in urban areas [11].

Since 2007, over 50% of the world's population live in cities [9], which places pressure on agricultural systems to provide food to urban areas. Benefits are context dependent, but could include: increase in urban food security and nutrition, local economic development, positive social aspects, and contributions to urban environmental management [9,11].

Urban farm in Högsbo, Göteborg

Case study: Högsbo Stadsjord

The information for this case study is based on interviews with Niklas Wennberg, Högsbo Stadsjord project leader, and project volunteers Sofia Kapla and Karin Grundberg [12,13].

The UA project in Högsbo was initiated by an interreligious organization along with two local universities and the city of Göteborg. Niklas Wennberg, an environmental scientist, proposed the UA concept to the organizations in 2007 and then became project leader of "Stadsjord", which means "soil in the city". The unused green space beside the Högsbo Kyrka (Church) was proposed for the UA project. Permission to have livestock and an UA project was granted by the city. Wennberg spearheaded the use of pigs to cultivate land in preparation for agriculture and Grön kultur Högsbo, an Organic Gardening Association, was formed to implement gardening after land cultivation. Another stakeholder involved in the project is Familjebostäder, the local Högsbo building association, who donated construction materials.

Motivation and drivers

The primary goals of the collaborating organizations that initiated the project were to create a more sustainable city, promote integration of all members of society, and raise awareness about climate change. Growing food in urban areas was viewed as optimal to achieve all of these objectives. The motivation of local community members is widely varied from environmental interests to community building; participants range from young families to older people and although predominantly Swedish, ethnic backgrounds vary.

How does it work?

Three pigs of a special breed from Skåne, southern Sweden, were purchased privately by Wennberg to prepare the lawn beside the Church for agriculture in March 2007. In a fenced area, the pigs act to work up soil, remove weeds, and input nutrients. Volunteers are responsible for feeding the pigs; the local ICA supermarket and community members donate food and special pig feed is purchased.

Once the land has been prepared, the pigs are moved to adjacent areas to begin land cultivation; prepared land is transformed via horse and human tilling and construction of plots into useable garden space. Garden space is separated into individual private plots and public garden spaces; planted seeds must be GMO-free and only organic fertilizers are permitted. Currently 22 plots are in use with more in development.

Meetings of the Grön kultur Högsbo and stakeholders are held frequently and project decision making is done collectively. In Sep-

Collection container for pig feed

tember 2009, project members participated in a local market where they sold the food from their harvest.

Individuals in the community can obtain a garden space by becoming a member of Grön kultur Högsbo, paying a small membership fee and yearly fee of 100 SEK (9.5 EUR). This, along with some external funding, was used to purchase an irrigation system and to buy pig feed. All other resources are donated.

Future developments

Although the Högsbo Stadsjord project has almost reached capacity, Wennberg is keen on implementing the idea in other parts of Göteborg and Sweden. The integration of bees, other livestock, and more workshops into the project is also possible. The project has received widespread attention in the Swedish Church community.

Success factors and barriers to UA in Sweden

According to Kapla and Grundberg, the key success factors of an UA project, such as Högsbo Stadsjord, include the involvement of local people who see the project as their own, a clear concept of project goals, and clear assignment of responsibility. They also believe that the somewhat passive Swedish culture may be a barrier to the initiation of UA projects, as well as land availability, and ineffective communication between stakeholders.

Long-term viability and transferability

The Högsbo Stadsjord project should be active as long as community members are involved; the long-term viability of the project is dependent primarily on volunteer action and Grön kultur Högsbo membership fees. Transferability of the project will be dependent on several factors: presence of interested and knowledgeable stakeholders, availability of land, and cooperation of local community members, governments and organizations.

The success of the Högsbo Stadsjord project also appears to lie in having strong and motivated leadership.

Sustainability overview

From an economic point of view, the Högsbo Stadsjord project appears to be member-supported once implemented and therefore sustainable; the small yearly fee ensures accessibility for all social classes. Start-up costs for construction materials and pigs relied on private funding and donations, but overall the costs are minimal. The project has the capacity to contribute to the local economy through sale of locally produced food.

The Högsbo Stadsjord project is environmentally sustainable because it is promoting local food production, reducing the need for transportation, packaging, and cooling. UA also have the potential to improve the urban microclimate and maintain biodiversity [9].

The potential for UA to make use of traditional waste materials, such as compost and wastewater, also contributes to sustainability.

Although environmental drawbacks are minimal, groundwater contamination via animal manure or fertilizers, reduction in urban vegetation and selection of environmentally sensitive land are concerns [9].

The community building and social integration effects of the Högsbo Stadsjord project are evident. The project also increases awareness of food production and animal husbandry, "reconnecting" people with nature in an urban setting and acts to combat poverty [9]. Social drawbacks of UA projects mainly concern health risks associated with animal husbandry.

Common Success Factors

The CSA scheme in Uppsala and the urban agriculture project in Göteborg show similar requirements for success. These factors are the minimum prerequisites for transfer to other regions or countries.

First of all, there should be a committed leader who is strongly motivated and is able to dedicate a substantial amount of time.

Secondly, as these projects rely on small-scale local networks, there must be a committed community that is motivated, willing to dedicate time and effort and willing and able to cooperate.

Thirdly, there must be some land available that is suitable for farming. Land availability might be challenged by ownership arrangements and local regulations.

And finally, the leader or the community must possess a certain amount of farming knowledge or must be trained to acquire farming knowledge and skills.

Apart from these four ingredients for successful transfer, there has to be a certain level of awareness of the concepts of urban farming and CSA. The lack of exactly this factor is also one of the reasons why both concepts are not more widely spread in Sweden. At the same time, the establishment of such projects depends on a certain level of out-of-the-box thinking, creativity and entrepreneurship.

To note, both CSA schemes and urban agriculture do not require extensive external funding, but rather rely on a synergetic network of members that dedicate time, effort and finances. In the CSA case study, the financial input comes from CSA members, while in the urban agriculture project in Göteborg, the limited need for materials and financial support is satisfied by the various organizations involved.

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Small-Scale Organic Farming in Skåne

By Aishan Hsieh & Maria Petrasova

Photos by Helen Ashdown, Maria Petrasova & Chunsheng Yao

In Skåne, southern Sweden, agriculture and farming businesses have thrived for centuries, largely due to the high quality of the region's soil [1]. But in recent years a new small-scale eco-friendly business network has been booming, with the aim of providing customers with products of high quality, while respecting the environment. From coffee shops and farm stores to beekeepers, the businesses have shown their particular strengths [2]. This article will describe two successful case studies, which were founded during the 1970s and 1980s: Ängavallens Gård and Mossagården. Although they are different, both have demonstrated best practice in developing organic food and striving towards sustainable development.

Ängavallens Gård

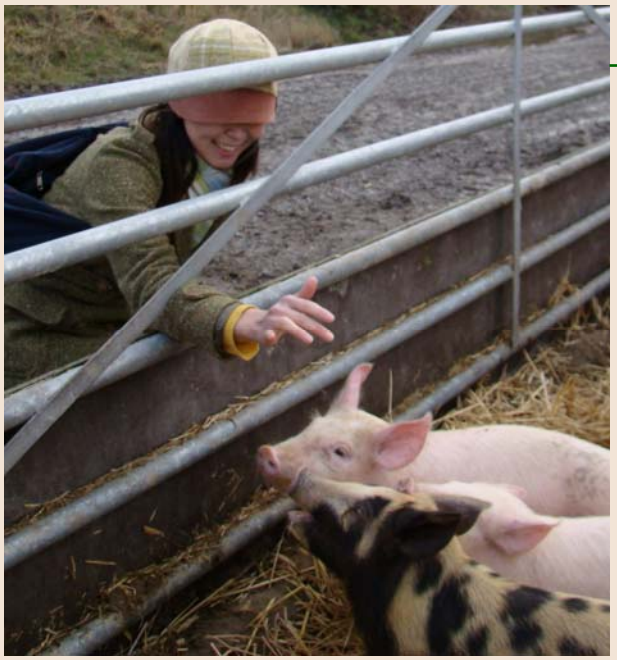
If you are walking towards Ängavallens Gård, you will probably see the pigs running around and digging in the soil. You cannot help but wave at them and say hello and, at that moment, it seems we (people and animals) are really at one with nature.

It was the main idea of Rolf Axel Nordström, the founder of Ängavallen, to create a farm different to the industrialized way of rearing and supplying meat. The animals at Ängavallen live in natural conditions, are well treated and are slaughtered in a humane and dignified manner. This dream started with the story about three friends and how they should care of each other (Nasse – a pig, Tasse – a dog and Lasse – a boy), which Rolf wrote when he was eight. Later after his studies in an agricultural university, where he saw industrial animal farming, he decided to realize his dream by setting up his own business, and in 1971 he bought Ängavallens Gård. In 1974 he purchased his first pig [3,4].

But fulfilling his dream was full of obstacles and challenges from industry colleagues, municipal authorities and others, including his own father who did not believe the business would succeed. But Rolf was determined to keep his focus. He told us to ignore when people talk negatively behind the back and to only address real problems.

Rolf was a city boy and grew up in Malmö. He says he would probably not be like he is today if he had come from a farming family because of all the rules and restrictions for existing farming practice [3,4]. But he never gave up on his dream. He took one step at a time and managed to overcome the barriers, including

The view of Ängavallen from the motorway



Piglets at Ängavallen

finance (bank loans, fees), organization and other problems, such as finding traditional Swedish breeds appropriate for outdoor conditions. Through his breeding strategies, Rolf managed to reach a high immunity level among his pigs (only 5% on average suffered from diseases annually) [3,4].

The main principle of Ängavallens Gård is "from land to table" or "organic from field to fork", which means that everything is produced organically in the farm (including fodder); animals are slaughtered in their own slaughterhouse and meat is delivered to the consumer in the restaurant or in the farm shop [3].

The current farm is the result of Rolf's 35 years of hard work. He has often had to work 90 hours a week without any holidays. Today it is an organic farm with 20 employees, including four family members, and an area of 140 hectares. There are more than 500 animals: 150 Swedish Red Poll cattle, 120 Linderöd pigs and 250 Swedish Forest Sheep. There are also a farm shop, herb garden, 19th Century Park, summer cafe, first class hotel, gallery, restaurant and recently-opened bakery. They will shortly open a dairy and cheese production plant [3,4].

Social aspects

Ängavallen is a unique example of humane husbandry, where animals live natural lives in outdoor conditions. For example, female pigs have on average 1.3 farrows per year compared with double figures in industrialized production and live 12-14 years. No mutilations, such as castration and horn removal, are allowed. The animals are slaughtered without stress in accordance with animal psychology. The main rule is that they should not understand (see, feel or smell) what is going to happen. It can take up to 40 minutes to slaughter one pig and, on average, Ängavallen slaughters two pigs per hour compared with 400 pigs per hour in industrialized production [3,4].

Ängavallen HälsoDjur® certification adheres to higher standards than KRAV, which allows for an industrial slaughter process and labelling meat organic even after the use of antibiotics as long as a certain amount of time has passed. At Ängavallen, animals treated by medicines and antibiotics are never slaughtered for their meat, and milk is not used for food production. The animals are only fed 100% organic homegrown vegetables. Such high quality standards guarantee value for money for customers [3,4].

And, according to the comments of customers, they do notice a big difference. They say the meat is much tastier than industrially processed

One type of pig breeds at Ängavallen

Ängavallens Gård shop

meat, although the cost of Ängavallen meat is about three to four times higher than in the supermarket.

In the Ängavallen restaurant, the dishes are cooked with imagination and according to original recipes. It has received many awards, including Sweden's Best Restaurants Diploma and Scania culinary delights [3].

Ängavallen also contributes to the development of other activities that support local tourism and community. It caters for wedding receptions, organizes park picnics, conferences, golf and cooking courses and traditional farming activities such as cheese-making and sausage-stuffing [5]. However, there is no community involvement in the business. Rolf believes that it is very difficult to control collective activities and, thus, a very high risk for the brand: "It takes 20 years to build the high quality trademark and 10-20 seconds to destroy it" [4].

Rolf actually believes people should change their consumption habits and eat less meat, more vegetables and root crops. So while conducting his business, he is simultaneously trying to change consumer thinking [4].

There is no doubt that this innovative and entrepreneurial approach is vital for encouraging and developing local economies [6].

Environmental aspects

The growth of industrialized agriculture, where quantity and profit are the priority, has caused many problems, such as eutrophication due to over-fertilization, sickness among animals and the spread of chemicals. But at Ängavallen, environmental protection and living and working are in harmony with nature. Traditional animal breeds are used as are the types of grain best suited to the soil and climate, so they resist disease without the need for medicines [3].

This natural philosophy is not only applied in the treatment of the animals, but also in the training of employees. In comparison to the extreme functions of industrialized machinery, the natural process of breeding, lactation and utilizing the meat are preserved at Ängavallen. As regards the personal training, the chiefs need to participate in the bread production as well as in the sausage process [3].

At the farm, environmental impacts are always considered and minimized by continually improving methods and procedures. This includes getting the food from the land to the table via its environmentally friendly production system, the eco-label products supplied wherever possible within a short distance (less than 20 km), Ängavallen's own heating system that delivers heat from ground soil, renewable sources of electricity via hydro and wind

Swedish Forest Sheep at Ängavallens Gård

Garden at Ängavallens Gård

power, animal manure used as natural fertilizer and other wastes dealt with by municipality waste management systems. And in future Ängavallen is aiming to become even more self-sufficient and plans to utilize the manure for biogas production [3].

Economic aspects

Ängavallen's first class hotel opened in 2002 with eight rooms and now has 19 rooms. Rolf says the hotel business, which has a 50% booking rate, contributes to the profitable business. The business currently has a turnover of about 2 million EUR and the breakeven period was in 2001. The toughest period was in 1999 during the global financial crisis. But Rolf was backed by what he says are the two most important choices in his life which are spouse and bank. Even today he maintains a strong dialogue every month with his banks about the financial progress of the farm business [3].

The variety of high-quality products and services is the key strength of Ängavallen Farm. The food, atmosphere and philosophy behind Ängavallen have been recognized with many awards. Ängavallen HälsoDjur® and European eco-label are well-known trademarks delivering the ethical quality that is important to customers. Clients recognize this and are willing to purchase new products, such as dairy or bakery services [5].

Ängavallens Gård has received some European Union help, including a 30% subsidy covering the new investment cost in the dairy production plant. It has also received some additional funding support for its small-scale food production and original breeds for endangered species. But, unfortunately, the Swedish Government is not particularly interested in Ängavallen's business philosophy. It took Rolf seven years to get permission for the business and at the outset the inspection fee for his slaughterhouse was 1100% higher than the industrialized model. Even today, he pays 400% more than his colleagues in the industry. But Rolf has faith and confidence in his own business. He pointed out the current organic market in Sweden is about 1% to 2% and is estimated to grow to 10% in the next five years and about 25% in the next five to ten years [3].

Mossagården

Mossagården was opened as a family business in 1987 for the organic cultivation of vegetables and root crops in southern Sweden. Parents Marianne and Bengt Olson run the agricultural side of the business, while daughters Hanna-Metta and Ebba-Maria operate the stores and the vegetable subscription via the internet. The range and customer base have steadily increased due to the growth of e-commerce. Christer Ohlsson joined Mossagården in 2001 as one of the managers. Christer and Ebba both previously worked in the transportation business and came up with the idea for home delivery using vehicles on biogas [2,7].

Environmental aspects

In 2008, Mossagården was awarded Region Skåne prestigious environmental award for its commitment to the cultivation of organic vegetables, the spread of the same all over Skåne and to other parts of Sweden, and the efforts made to deliver information about organically

grown vegetables. Mossagården's organic methods use the manure of animals (pigs, sheep and horses) to fertilize the soil, without resorting to artificial fertilizers. Its varied crop rotation is another natural way of reducing problems with weeds, pests and diseases. Mossagården's planting methods are structured over an eight year period. It means that a crop only returns on the same piece of land once during that time period, with the exception of grass that can be grown several years in a row. In the mean time, to reduce the use of fossil fuel, a solar panel for heating is currently under construction and a biogas plant is also on the future agenda. Furthermore, to reduce the environmental burden, all food orders are collected every Sunday and delivered every Thursday and Friday by the biogas vehicles to various delivery points. In Lund, there are about 40 to 45 delivery points and Mossagården also has a contract partner for all delivery in Lund by bicycles. It also focuses on minimizing waste by recycling; for example, the paper delivery box is recycled through a Swedish payback system [2,7].

Economic aspects

Mossagården delivers about 900 organic boxes per week to parts of the Skåne region. It also has a long-term contract with the municipalities, private companies and schools. The company is continuing to grow and from 2006 to 2007 the business actually doubled. To meet customer demand and low cultivation during the winter, Mossagården has a few partnerships in the Skåne region, Italy, the Netherlands, Ecuador and Spain for other organic food supply. To reduce the environmental impact of transportation, the delivery in European countries is arranged by train and truck [2].

As for governmental financial support, the small-scale business funding is applied under the European Union budget plan every year. However, the annual fee for KRAV-certified organic farms is a huge burden for organic businesses. The system is different from Denmark, where the Danish Government absorbs the cost [2].

Social aspects

Mossagården not only sells locally-produced food, but also follows customers' needs. The order of fruit, vegetables and other organic products via the internet makes buying organic food much more convenient and easy for customers. The food price in Mossagården is similar to the organic food price in supermarkets [2].

The organic method of producing vegetables is more labor-intensive than the conventional industrial process, so it can provide seasonal employment. Mossagården tends to employ cheaper staff from other countries (like Po-

Blender bicycle at Mossagården

A goat at Mossagården

land) and also uses volunteers through the WWOOF scheme (World Wide Opportunities on Organic Farms). Mossagården usually has about 50-60 volunteers every summer. It is a great opportunity for people, mostly students, to learn about the organic lifestyle and share a wonderful experience [7,8].

Also, since 2008, Mossagården has hosted a summer musical festival (mostly Swedish bands), where they sell organic food, beer and wine and showcase an eco-friendly way of life. The event has attracted up to 2000 guests from all over the world. These events are good opportunities for communication, raising public awareness and developing local tourism [7,8].

Mossagården farm also houses an array of different animals, including goats, pigs and horses. These are mainly to produce fertilizers, but are also for educational purposes; for example, the pigs belong to the endangered Swedish traditional breed [7].

Mossagården also puts weekly news on its website, which includes a lot of information for customers about organic food, such as recipes and various tips on how keep vegetables and fruits fresh [8].

Conclusions

From these two case studies we can conclude that there are different characteristics that make them both viable and successful. But we can also see why they are vulnerable in many ways:

- The difficulty of competing with large industrialized businesses, which have strong and established links with industrial slaughterhouses and food retailers [9];
- Lack of consistent funding support for long-term planning, including the set-up of infrastructure, inspection costs, the organic process and small-scale operation [3,7,9];
- The risk of disease is a major threat to future operations due to the high organic standards that do not allow use of pesticides for vegetables and medicines for animals [4];
- Organic methods are labour-intensive [3,4].

Although both cases are not very profitable for their owners, they have overcome many difficulties through their history and continue to develop in different directions in the pursuit of

financial stability. In the case of Ängavallen Gård, it is increasing the variety of products and improving its planning and strategies for breeding. As for Mossagården, it is following the needs of customers by importing and selling vegetables other than their own. It is also involving more volunteers for seasonal work at the farm. Both cases are also looking to become more self-sufficient in terms of energy and transportation (heat, electricity and biogas production).

In terms of transferability to other areas, the barriers and opportunities were identified as follows.

Barriers

- expertises for animal breeding and preventing disease [4];
- higher standard for meat production and high operational cost of slaughterhouses [3];
- domination of large-scale businesses and customers' willingness to pay for higher-priced products [9];
- difficult to be the best in each area (variety of products and functions). It is also easier to start a new business if you have a well-known brand [4];
- lack of state and municipality support. No subsidies for organic food production and difficult to secure bank loans [4];
- cultural mentality. New ideas in Swedish culture are not always accepted, especially in the farming community [4]; and
- legal and organisational barriers. It is difficult and costly to get permission for farm activities since small-scale companies have to fulfil the same legal and other requirements as industrial farming [4].

Opportunities

- the community-based farming and co-operative network boosts the expertise of farmers for different breeding of animals, organic cultivation, transportation system, and establishing own food chains [4,9];
- the long-term policy support for small-scale business, organic and local production [9];
- driving market forces for high-quality and healthy products and provides the benchmark for different quality standards to customers; and
- establishing good relationships and interaction with customers by knowing their preferences, gaining instant feedback and providing added value and satisfactory services.

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Sustainable Alternative to Coffee Production

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Photos by BDC-Cenicafe

Do you like to drink your coffee enjoying the nice view of landscape, which is buzzing with insects and birds? Perhaps, you should know the truth – the second most traded commodity in the world is often not nice to the environment.

Coffee is the second most traded commodity in the world after oil and its derivates. In 2007, the value of exports was around 12.7 billion USD. In 2008, the European Union (EU) was the biggest importer of coffee (66%) followed by the United States (US) (24%) [1]. However, a growing production and a stagnant demand, following the fall of the International Coffee Agreement in 1989, caused an excess of the grain in the market. The inherent consequence was the collapse of the price. It has been estimated that the producer's share in the retail price fell in average, from 20% to 13% between 1989 and 1995 [2]. This situation especially affected small producers (farms less than 3.5 hectares), heavily reliant on coffee as source of income. Countries with low levels of technified production processes and a narrow share of the global market were hit the most [3].

One of the responses to the crisis has been the appearance in the market of small-scale produced sustainable coffees. This differentiated products started to supply new market niches. Their emphasis is the sustainability and quality as part of the added value of the product. Sustainable coffees include among others:

- *organic* – use of methods to preserve soil, no use of synthetic chemicals;
- *shade-grown coffee* – traditional cultivation in the shade, that is, in the forest; and
- *fair-traded (FT)* – purchase of coffee directly from producers, excluding middlemen.

Third parties certify these denominations, allowing producers to obtain a premium [5]. The demand for these differentiated products has grown rapidly and constantly, especially in the US and Europe. Meanwhile, in 2008 the share of FT and organic coffee in the global market was no more than 1% and 2% respectively [1].

Production of sustainable coffee represents a real life example in which the concepts and principles of *distributed economies* can be applied. It creates welfare for the small-scale producers by adding a value to the product, brings social benefits, and contributes to the environmental protection. At the same time it is not the solution to the coffee crisis *per se* in the long term. A more integral approach is required to address the issue of overproduction and the consequences for small farmers.

Sustainability Overview

"While other types of coffee may also contribute positively to sustainable development, organic, fair-traded and shade-grown coffee possess intrinsic qualities that most closely fulfill the balanced social, environmental, and economic requirements necessary for sustainability" [4]

Economic perspective

The World Bank and the International Coffee Organization recognize that sustainable coffees and participation in certification schemes offer attractive benefits for small-scale producers and the industry due to *increased sales and higher profits* compared to conventional coffee [4].

Sustainable coffees receive premiums according to the certification type. This ensures that the price is always above or at least similar to the base market price (conventional coffee). In the case of *organic coffee*, the premiums depend on different factors: quality, the origin (altitude of the plantation, soils, reputation of the producer), and situation on the market, among others [1]. Between 2003 and 2007, the average organic premium was 0.25 USD/pound. This value is just added to the base market price, so the total compensation follows the general market trend (see Figure 1).

Unlike organic, Fair Trade (FT) coffee offers a minimum fixed base price. Currently, it is between 1.15-1.21 USD. Additionally, FT offers a premium for social development of the community involved in the production (0.10 USD/pound) [6]. Under the FT scheme, every time the base market price is above that of FT, producers are paid the price of conventional coffee in that moment.

During the period 2000-2005, FT prices were several times higher than the base market price (up to 180%), which was certainly beneficial for those in the FT scheme [1,7]. For growers of conventional coffee, the price hit rock bottom in October 2001 (0.43 USD/pound). A value well below production costs that left many farmers in absolute poverty. During the period 2006-2008, there was a recovery in the price of conventional coffee with values higher than those of FT (Figure 1). However, as a result of the global economic downturn (fall 2008), the base market price fell again [1].

The above is a clear description of the extreme volatility that characterizes the trade of coffee for producers. A look back to the situation since 1989 confirms the unpredictable long-term behaviour (Figure 1). Any projection can change quickly due to stochastic events [7]. However, in all these cases the FT *price was guaranteed,* helping farmers during times of low

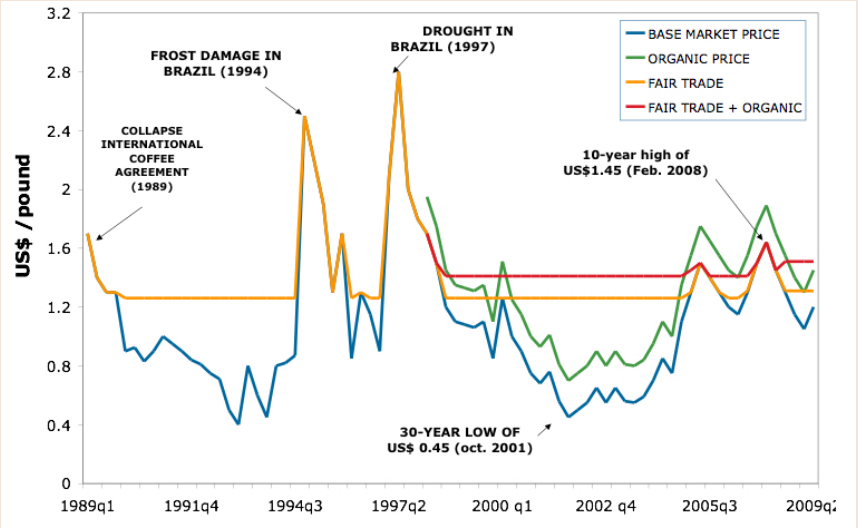

Figure 1. Coffee prices during the period 1989-2009. FT coffee increased premium in 2007 from 1.25 USD/pound to 1.31 USD/pound. Organic premium was assumed as 0.25 USD/pound.

Adapted from [6,7].

market prices [7]. This is probably the most attractive benefit for small-scale producers.

Compared to the previous two, shade-grown coffee certification (for instance by Rainforest Alliance) is relatively recent with relatively marginal volumes but with an increasing trend. Usually, the premiums paid to producers fluctuate between 0.10 - 0.20 USD per pound [4].

It is important to mention that the above categories are not mutually exclusive. In 2008, 52% of the FT coffee sold worldwide was also organic (84% came from Latin America) [1]. When FT is also organic, additional 0.20 USD/pound is paid to producers [7]. Additionally, in most of the cases FT is produced in shade-grown cultivations [1]. However, there are still no payments from FT for shade-grown coffees.

Market potential. Unlike the stagnant behaviour in the sales of conventional coffee, the segment of sustainable coffees exhibits a dynamic strong growth (up to 30% annually in both FT and organic) [1,4]. However, their current share in the main coffee markets still remains low. Of the total traded coffee in both the US and Western Europe, just between 2% and 3% corresponds to organic coffee and only 1% to FT [1]. With a growing level of consumer awareness, it is expected that the demand will continue increasing [4]. For instance, FT accounts for 20% of the market share in the UK alone, but in other European countries such as France, Netherlands, Sweden, the share is less than 7% in their domestic markets [1].

One trend that is gaining force is to have more than one certification. The most typical is FT that is also organic. This can constitute one of the key strategies for increasing farmers' incomes [1,4]. Additionally, aspects such as quality can be enhanced. In 2004, the International Coffee Organization set target quality standards for export coffee. This is important since along with ethical considerations (social and environmental) quality constitutes one of the main reasons for consumers to pay an increased price [1]. Compliance with those quality standards is essential for sustainable coffees to remain competitive.

Limiting factors. Access to certification is one of the relevant aspects. Fair Trade certification is assumed not directly by the producer but by the FT organization [3]. This has allowed cooperatives to join the scheme. However, organic certifications require farmers to assume the cost of the process [5]. Considering that many farmers (and cooperatives) have narrow profit margins, this constitutes a barrier.

Premiums do not necessarily ensure a good economic situation. Of 1.55 USD/pound FT pays for organic coffee (10% higher than the current 2009 value), a farmer in Central America is left with just 0.50 USD/pound after paying cooperative fees (FT is paid to the cooperative not the individual producer) and farming expenses [8]. Some researchers estimate that at least 2 USD/pound should be paid to the farmers to be above subsistence [8]. However, it is argued that an increase in the minimum price above 2 USD/pound would reduce the number of coffee growers covered by the FT scheme. In the same sense the Fair Trade Labeling Organization chief operating says the strategy of FT is to go into the mainstream to increase the market for the farmers in the program (e.g. by targeting big retailers such as Starbucks) [2].

It is generally conceded, that FT and other certification schemes are and have been beneficial for small-scale farmers, especially during low price periods. However, they are not the solution to the coffee crisis. A more systematic approach including diversification of activities for farmers is crucial to reduce the dependence and vulnerability from the volatile market.

Social perspective

"It's got a little better since we sold our coffee to the fair trade market. We have clothing, food. We can buy things we would not before" [9].

Shift from traditional small-scale coffee farming to the commercial large-scale production affected local farmers not only in economical terms, but socially as well. Their livelihood conditions have worsened due to the large amount of pesticides used, and partly because of the reduced funding for healthcare, educational and other public services due to privatization of government institutions [9]. Return to the traditional shade-grown production allows to improve social conditions, as it brings various benefits to the farmers, starting from improved health conditions and to the conservation of traditional knowledge, and contributes to their welfare. The benefits arise from the shift to organic production and reduced volume of chemicals used, involvement in the fair trade and cooperatives, better stewardship of natural resources, and from other factors, including educational activities, that usually accompany projects on development of traditional coffee farming.

One of the main social benefits is the improvement of the *health condition* of the farmers due to the reduction and elimination of their exposure to toxic pesticides used for commercial growing [10]. Another benefit is improved *access to forest timber and non-timber products*. As shade-grown coffee farming protects biodiversity and forests, it provides access for local people to valuable materials, essential to sustain their livelihoods, such as firewood, medicinal plants, construction materials, fruits and other goods [11]. For instance, in some farms in Costa Rica 10% of the farm revenues comes from the sale of fruits [2].

One of the important factors in small-scale production that significantly contributes to the *social welfare* is the participation of farmers in different cooperatives and certification schemes. Coffee is one of the first internationally traded commodities where the cooperative efforts were undertaken to address socio-economic concerns [12]. Cooperatives allow small-scale farmers to get better price for the coffee, increasing their income. They also provide access to credit and technical assistance [13]. The cooperatives are governed democratically directly by farmers who decide on the best

Fair Trade & Education [13]

A case study from Nicaragua has shown that cooperatives participating in the Fair Trade schemes have higher level of the formal education, than those selling coffee into conventional markets. For the primary schools (7-12 years), the attendance rate was 94% in households selling to Fair Trade Market, and 71% selling for the conventional. These figures for secondary schools (13-17 years) were 84% and 53% respectively; while for the youths who completed primary education (18-25 years), 27% and 11% respectively.

It has been explained by the strong commitment to education demonstrated by the leaders of the Fair Trade cooperatives. Nearly half of the households affiliated with such cooperatives received support for their education. This figure is significantly less for the households affiliated with the cooperatives selling coffee to the conventional market – only 20%. Such significant difference can be explained not only by leaders' commitment, but also by higher profits in cooperatives involved in the Fair Trade.

way to manage collective resources in order to improve welfare, both of the whole community and of each family [14]. The common resources can be invested by the cooperative in different community services, such as healthcare, education, water supply and other services.

Participation in different certification schemes, like organic coffee, Fair Trade, Rainforest Alliance, Bird-Friendly and others is an important prerequisite for improving farmers' welfare. It aids not only in economic gains, through the improved access to international market and avoidance of the middlemen, but also in overall improvement of *life quality* [12]. One of the examples is the Rainforest Alliance Certification for the organically produced coffee which among other targets aims to improve living conditions for farm workers by providing fair wages, decent housing and access to drinking water and sanitary facilities, as well as healthcare, transportation and education [11].

Among other social benefits of traditional shade-grown coffee are the *increased opportunities for recreation and ecotourism* [10] that could also increase revenues for local communities by bringing additional sources of income and *conservation of traditional knowledge* through application of historically established practices.

Though the small-scale production of coffee and its combination with cooperatives and certification activities could bring a number of social benefits, there are number of challenges as well. Cooperatives are not the ideal organizations that always benefit those who work harder. Corruption cases among leaders of the cooperatives and use of common funds for personal profit are not rare [14]. The fact that cooperatives do not operate under a formal legal system also creates problems due to controversies within and outside the organization [14].

Environmental perspective

The majority of the coffee nowadays is produced under the open sky with removed canopy. This conventional production allows higher yield than the shade-grown farming [2]. However, higher yield in this case creates negative environmental impacts, including soil erosion, water pollution, deforestation and loss of biodiversity.

Shade-grown coffee is a traditional way of production with different levels of shading, from rustic plantation to traditional and commercial polyculture, which allows protection of biodiversity and valuable ecosystem services.

Rustic type of plantation is the type with the highest shade multilayered canopy. It has more potential for biodiversity conservation, but is least present in practice due to the lowest yields. Yields are maximized in the range of 35-65% of forest cover [2].

Commercial and traditional plantations are the most common in practice, as they have higher yield (but less shade). The difference between them is that in commercial plantation indigenous tree species are removed and replaced with commercially beneficial, such as nitrogen fixators that enhance coffee production, or various types of fruits. From the point of view

Conventional coffee plantation

Shade-Grown Coffee & Environmental Benefits[15]

In Mexico, the first country ever that exported organic coffee and one of the world's largest coffee producers, there are still substantial number of traditional farmers that practice sustainable agricultural practices. Traditional shaded plantations are *rich pools of biodiversity*. Number of plant species in shaded plantations ranges from 90-120 in different layers, supporting various wildlife. In several plantations in Chiapas, 609 arthropod species were discovered, many of which were parasites and predators on pests in plantations and are important for *prevention of pest outbreaks*. In addition, 180 species of birds were registered throughout the year. Mexico is an important territory for *migratory species* of which some are considered to be endangered. The same plantations are habitat for 24 species of mammals and 16 species of reptiles and amphibians combined. Traditional plantations also support rich soil fauna, decreasing the need for artificial fertilizers.

of biodiversity, these types are far less detrimental than the monoculture types [15].

Generally, the less disturbed the plantation is in terms of removal of forest cover, greater is the *diversity of wildlife*. It is observed in all layers of the forest, and includes the *soil fauna*. Earthworms and nematodes act as natural fertilizers as they degrade dead organic matter and bring necessary nutrients to the soil. Diversity of wildlife also includes species that are predators and parasites of coffee pests, thus preventing pest outbreaks. Multilayered canopy enables higher retention time of rainfall, filtration of water and prevention of surface runoff, preserving water. From the environmental perspective, rustic type of plantation would be ideal. However, some authors argue that commercial polyculture is comparable with rustic plantations in every aspect when it comes to bird species richness [16].

Shade-grown coffee plantation

In addition, shaded plantations are *conserving diversity of genes* as well. In order to be viable, populations need to be connected with ability to exchange genetic material. In some examples from Chiapas (Mexico), genetic diversity is even higher than in undisturbed forest, as birds and pollinators exert different patterns of behaviour [17].

Shaded coffee plantations are one of the best examples of sustainable agriculture. They preserve biodiversity and indirectly, many other aspects of healthy and functional ecosystem. The trade-off between yield and benefits might not be obvious in short term, but in the long run, preservation of habitat would outcome the costs of mitigation measures.

Conclusions

Sustainable coffee production represents an alternative to small-scale farmers to reduce the undesired economical, social and environmental effects of the conventional system. In economic terms, the system of higher prices, an increasing demand and a stable income (FT scheme) constitute some of the incentives to

cope with a highly volatile market. In social terms, some of the schemes ensure that part of the revenues is invested in the community to increase living standards. Access to public services, reduced exposition to chemicals and access to timber and non-timber products are part of the social benefits. In environmental terms, return to traditional "under canopy" coffee production represents additional benefits. They include the preservation of habitat in hotspots of biodiversity and the indirect control of pests and diseases, among others. However, it is important to increase the awareness among the consumers and to ensure the quality of the product in order to foster consumers' willingness to pay for a differentiated product. Additionally, such aspects as capacity building should be reinforced in communities to improve their managerial skills and avoid lost of benefits because of the corruption or mismanagement of related issues. In summary, sustainable coffees have the potential to be financially viable with an enhanced social welfare and preservation of biodiversity and the environment; but there are also some key challenges, which should be addressed.

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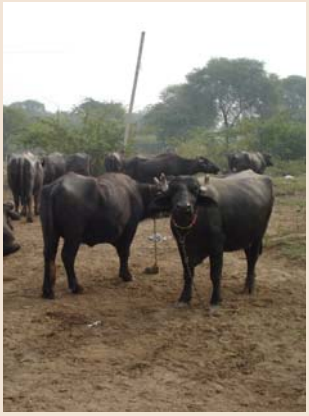

Milk Co-operatives & Small-Scale Dairies

By Vaseem Ashraf & Natalia Capelán

Photos by Mohd. Ashraf

The aim of this short study was to dissect the milk sector in India from the point of view of distributed economies and how sustainable development can be achieved by way of the three pillars of sustainability. The milk sector in India comprises of formal (organised) and informal sectors.

The Formal Milk Co-operative Sector

Milk co-operatives in India have been attributed as one of the major factors in the growth and development of Indian milk industry. During the 1950s and 1960s, the development in the sector was stagnant [1].

The Operation Flood (OF) brought major changes in Indian dairy policy. The programme had three phases of development starting from 1970 till 1996 [5]. The main objectives of OF were: (a) integration of rural milk producers with the urban consumers by way of pricing, procurement, processing and marketing, and (b) investment of public in the milk processing sector through co-operatives in the form of chilling plants, milk processing and product manufacturing plants [1,2]. The Government of India also took an active interest in the promotion of milk co-operatives, which have been immensely successful, especially in the western part of India. The organised/formal sector of dairy industry in India handles around 20 million litres of milk per day in over 400 plants [3].

The milk co-operatives in India comprise of three-tiered structure (also called "Anand Model") [4] (Figure 1). The primary function of the village level entities is to collect the milk from the milkmen and further sell it to the district level societies, thus ensuring a handsome remuneration for the farmers. The village co-operative societies are managed by the members drawn from the milk producers themselves.

The next level in the co-operative structure is the District Milk Unions, which are responsible for collecting milk from a number of village co-operative societies. It is at this level that the milk is processed, pasteurised and further made into various products such as cheese, butter, ice-creams etc. Other services such as veterinary support, artificial insemination, cattle feeding and training of members is also the

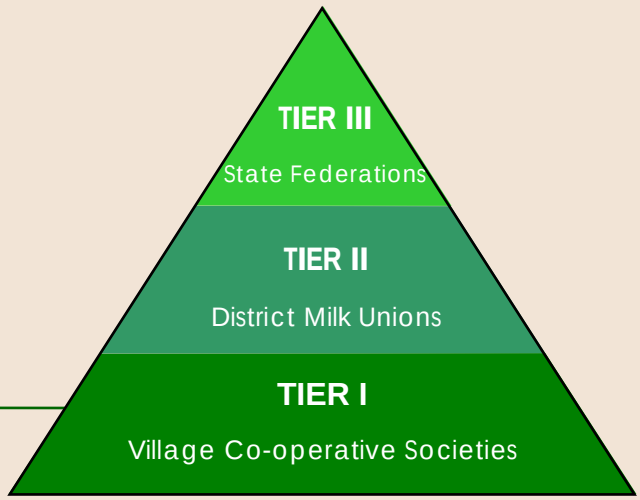

Figure 1. The three tier model of milk co-operatives in India

function of these regional level unions [2]. These milk unions have the milk chilling plants owned and managed by the members themselves. They also have an organisational structure, in which the members from the village societies are represented.

The apex level in the milk co-operative sector in India are the state level federations who are responsible for overall marketing and setting up distribution networks at the local, regional and national levels. They too have an organisational structure headed by a Managing Director and assist the milk unions with technical and other socio-economic needs, together with the fixation of prices of various milk products and the production decisions thereon.

Amul: The role model in the success of milk co-operatives

Anand Milk Union Limited (Amul) is the milk union in the Anand district of Gujarat, a state in India. Even though formally formed in 1946, the actual co-operative movement in milk paced in 1970s, with the Government of India providing fillip to the co-operative movement through the OF; also called the White Revolution. The initiating point of the development was Amul, which had shown the benefits of existence of milk co-operatives. Through OF the Government intended to replicate the Anand model in other cities and towns of India and form a sort of national milk grid, just like the one was formed through the Amul in Gujarat [5].

Amul comprises of an organised grid of 13 co-operative unions at the district level, which has around 2.8 million members from 13 328 villages collecting 8.5 million litres of milk a day [6]. The network is interconnected to facilitate the optimum production, distribution and utilisation of milk by the co-operative authorities. Amul also caters to cattle feed manufacturing capacity of around 3500 tons per day [6].

So, what made the Amul milk co-operative movement so successful that it has given the multinational companies a run for their money?

The case of Amul illustrates how the decentralisation of management could promote the empowerment and participation of the poor and marginal milk farmers. It could also facilitate in the skill development by way of engagement of rural communities and providing means of employment to them. This restricts urban migration, thereby preventing the formation of urban slums and reducing poverty conditions [7].

The Small-Scale Informal Sector

Historically the dairy sector in India has been characterised as an unorganised activity, mainly consisting of small producers with one to three milch animals, scattered through the country. Most of the milk produced is consumed in the farms in a proportion that varies among different states and animal herd size. The rest of the milk is distributed either through the informal (75%) or formal sector (25%) and sold as liquid milk or in the form of milk products (see Figure 2) [8].

Milk collection in a village

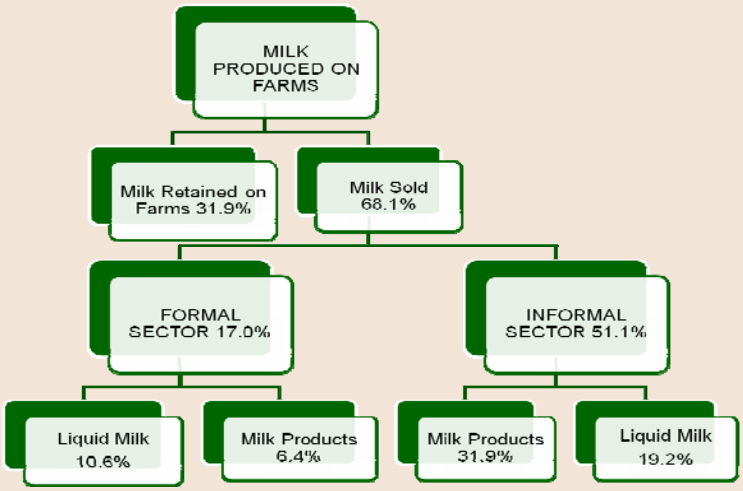

Figure 2. Disposition of Indian Milk Production in 2005.

Adapted from [8].

The vast informal sector is in place partly because the consumers are seldom willing to pay higher prices for pasteurisation and packaging, as it may increase the milk price by more than 100 percent. Also, it is widely believed that milk and milk products are of better quality when bought from reliable local vendors instead of the formal channels [9].

In the informal sector, the farmers can sell the milk directly to the consumers or to a "milkman" who re-sells it to consumers, creameries, sweet shops or restaurants. The system thus could be quite well-organised, even with a relatively complex net of market agents [8]. There has been a laissez-faire approach by the Government in the operation of the informal milk sector to satisfy the interest of both small farmers and resource-poor people [9].

Structure and description of informal milk sector

Dairying in India is a part of the farming system. The cattle feed is primarily obtained from agricultural residues such as paddy straw and ground nut straw, while the manure ends up as a valuable resource in the form of fuel and fertiliser. A small-scale milk production system ensures that the farmers get regular incomes (one third of their total incomes) in contrast to uncertain earnings by way of growing seasonal crops. Also, livestock can be sold in times of crisis, which acts as a security buffer for them.

A study carried out by the International Farm Comparison Network (IFCN) in 2004 divides the small-scale dairy farms into mainly four main types depending on (a) location of the farm, (b) farm size and (c) the production systems employed. Results show that dairy farms with herd size larger than 20 animals are uncommon in the informal sector, even though it constitutes the largest growth in terms of milk production [10]. Significant are the non-cash benefits in the form of milk for the internal consumption and manure used as a fuel, accounting for one quarter of the total household income. With regard to the milk production costs, the study has shown that there are also differences among such farms. The land-owning farms that grow crops and forage can produce milk at around 15 USD/100 kg milk while the landless farms near urban areas have

A local creamery unit

Local milkman supplying milk

to bear an additional 8 USD/100 kg milk as they have to purchase all the feed. However, the higher milk prices in the latter compensate the additional costs [10].

The Nature Fresh experience

Nature Fresh is an entrepreneurial project in Thodupuzha town of Idukki district in Kerala, India run exclusively by 28 women members. Each woman member owns one or more animals. On an average one animal produces 11 litres of milk per day. Some members of the unit also market the milk themselves and sell it in morning from 5 am -7 am.

The system is organised and all the bottles of the distributed milk are numbered so that any complaint by the consumer could be tracked and pinpointed. The venture was given approval by the local village head. The village administration also supports the venture by way of providing loans to the unit so that the members could buy things such as scooters and cows. The consumers of Nature Fresh are quite satisfied with the quality of the milk and support the all women initiative. Nature Fresh has future expansion plans so that the yield of milk could be increased through the existing system.

Small-scale dairy units like Nature Fresh exist throughout India, but may not get the attention of media because of several factors such as unorganised set-up, scattered operations, remote locations, hygiene etc. But, there exists a lot of scope for such unorganised small-scale dairy sector units to function as an organised entity.

Sustainability Overview

Amul has been cited as one of the most successful co-operative movement in India. The networking of milk farmers has mainly been responsible for it. This has augmented the milk supply, leading to an optimised production and thus an overall social and economic welfare. Similarly, brands such as Nature Fresh have changed the scenario in milk production, processing and distribution at the local level through which socio-economic benefits have been achieved.

Social aspects

The success of co-operative movements like Amul and ventures like Nature Fresh have brought many social benefits not only for the farmers who are involved in them, but also for the consumers who can now obtain a variety of milk products with ease at various local and regional levels.

India, being a highly diverse, multicultural and stratified society, has many instances where the poor have been excluded from the mainstream and social structure. Even though it is not a panacea for addressing the social inequities, the

milk co-operative movement and the smaller scale dairy ventures did provide a social recognition to the marginal and mainstream excluded people. The barriers to class, caste and power were diminished as a result of the farmers' involvement, thereby leading to various synergies [11].

The dairy sector in India, in particular the formal one, was also instrumental in the generation of gainful employment providing subsidiary occupation, especially for the women and weaker sections of the society, leading to redistribution of rural income.

The aim of OF was not to eradicate poverty and generate employment, but millions of landless (21%), marginal and small farmers (66%) were benefited from it. Also, 70% of the participating households in the movement had just one or two milch animals [12], like the ones in the case of ventures like Nature Fresh.

Through OF, Women Dairy Co-operative (WDC) societies were also encouraged making women financially independent and leading to the employment generation for women. With OF, 5% were approximately women who did not have to go out of their homes to search for jobs [12]. In case of Nature Fresh, which is an all women's venture, it has been shown that gainful employment of women is possible at the grassroots level. Women were also shown the process of Artificial Insemination (AI) that helps them to better understand their own lives and assume better control [12].

The engagement of qualified veterinarians in the milk co-operatives for the treatment of animals leads the farmers believe about the benefits of modern medicine and better care of their animals. This leads to better milk yields, higher returns and improved social standings.

Other notable benefits of the co-operative and small-scale dairy units include cleanliness, hygiene, sanitation, hard work and discipline in the farmers when they feel convinced that their involvement would serve them well and bring fruits. Thus, an overall improvement in the quality of their lives, which is difficult to quantify in figures [12].

Economic aspects

Prior to 1970s, the milk sector in India was not conducive to dairy development because of the subsidies provided by the Government and there were no incentives for the milk farmers to produce more. OF sought to address these issues and came out with higher offer prices for the milk produced, which guaranteed the farmers higher remunerative returns, leading to an overall satisfaction in their quality of lives. In small-scale dairy units such as Nature Fresh, economies of scale are achieved when the farmers collectively integrate their activities in the milk production, processing and distribution.

Since the rural poor is composed of many categories such as the old, the infirm, the tribals, small farmers, artisans etc., the overall increase in incomes due to the milk production brought a lot of economic positives leading to an overall socio-economic development.

Ventures, such as Nature Fresh, can offer inherent advantages of being small-scale, such as optimised investments, more flexibility in operations, greater innovations in production, processing and distribution, integration of common operations, better utilisation of resources and wastes etc.

Environmental aspects

In the case of small-scale dairy units, there are some positive environmental spin-offs in terms of energy and resources consumption, such as lesser requirements for refrigeration and pasteurisation, less use of transport, elimination of packaging material, less waste generation and optimum utilisation of limited resources,

Dung cakes used as cooking fuel

thereby leading to lower Green House Gases (GHGs) emissions. Also, it has been observed that inter-crop rotation by the milk farmers can increase the yield in milk production from 4 kg to 6 kg a day [8]. This could lead to increased fertility of soil by way of increased nitrogen fixation by the leguminous crops.

There are several positive effects of an organised milk co-operatives sector too. When the various entities of smaller co-operatives are interlinked to one another, there could be an overall lessening of the environmental impacts. However, no extensive research has been done in India on the possible environmental consequences of the milk co-operatives. Nevertheless, one can possibly observe and qualitatively assess the tangible environmental benefits on account of optimum utilisation of common resources such as transport, storage facilities, chilling plants, marketing and distribution network etc. All this pooling of activities makes it possible for the milk farmers to organise their activities in a sustainable manner. For example, instead of the farmers having their own chilled plants at the smaller level, it is always advisable to make use of a larger chilling plant which collects and stores the milk from many smaller co-operative societies. This results in lesser electricity consumption and use of less refrigerants, which are potential GHG. There is a problem of methane emissions from the dairy farms, which is a potent GHG [11]. However, the negative effects are offset by the use of dried cattle excreta as a fuel by the milk farmers in almost entire India.

Link to Distributed Economies

From above, we can observe that both the formal and informal milk sector in India have certain commonalities from the point of view of distributed economies.

Some of the fundamental concerns of the distributed economies, which are addressed by the milk sector in India are wealth creation for large number of people, diversification of needs and wants, new consumers and behaviours, symbiotic relationships, flexible and small-scale production systems, socio-economic and ecological diversities for efficient production systems, new producer-consumer relationships, improved quality of life, new innovations and integrated designs, collaboration of collective spirit, link between inter and intra regional resources etc.

A woman carrying dung for making dung cakes

Conclusions

Both the formal and informal milk sector in India could be considered as decentralised approaches in the integration and networking of small-scale milk producers. As outlined in the paper, the overall aim of the decentralised approach was to bring the rural milk farmers into the mainstream by connecting them with the urban systems. This also enabled consumers to have quality milk products at an affordable price. This not only enhanced the remunerative returns to the farmers but also facilitated in the overall upliftment of the rural farmers by way of socio-economic development, women empowerment and bringing the economies of scale in milk production. This enabled India to become the largest milk producing nation in the world. Such co-operative models have the scope of being implemented in other parts of the world too. However, one has to take into consideration the regional, local and national situations before replication and making it economically viable. There are also certain trade-offs that should be taken into account, such as prices, efficiency, flexibility etc. between the two sectors for obtaining an overall benefit.

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Rural Development: Pig-Biogas-Fruit System in China

By Tatirose Vijitpan & Chunsheng Yao

Photo by Lars Hansson

To reduce the energy shortage that rural households face, a number of renewable energy technologies have been developed in China. The family-size anaerobic biogas digester (hereinafter as bio-digester) is one of the important renewable energy technologies. In fact, China has a long history in the research and use of biogas and the use of hydraulic digesters has been in place for almost one hundred years [1]. The number of household biogas plants in China is the largest in the world and they can be found all over the country [2]. About 26.5 million biogas plants have been built by 2007, able to produce 10.5 billion m^3 of biogas [3].

Besides reducing energy shortage, the construction of a household bio-digester is also believed to increase the farmer's income and improve the environment. During the decades of biogas development, different models have emerged in different parts of China, combining biogas technology, agricultural production and environmental protection [4]. The pig-biogas-fruit eco-agricultural model is one of them. It is popular in southern China [5], where there is a warm climate and a long history of animal husbandry and fruit farming.

The development of the pig-biogas-fruit eco-agricultural model in southern rural areas began in the 1980s. The bio-digester is relatively cheap in terms of construction costs. It is also simple to maintain and can be used for a long time [6]. The bio-digester, which is usually 8 m^3, is built underneath the pigpen and toilet with a sewer linking them together (see Figure 1). Human excreta, urine, pig dung and food leftovers are washed down to the bio-digester to be fermented. Biogas from the digester is used for cooking and lighting in the farm house through a pipeline. The residue of the biogas production can be used as fertilizer and pesticide for fruit trees and vegetables. The liquid residue can also be used to raise pigs and can accelerate the pigs' growth [7]. Biogas production serves as a key link between fruit farming and animal husbandry.

Advantages of the System

Economic benefits

The use of a bio-digester can reduce the consumption of fossil fuels such as coal or liquefied petroleum gas (LPG) for cooking, which are in a limited supply in rural areas. Farmers also do not need to pay for the raw materials for the bio-digester. It has been found that some households do not need coal for domestic use at all after installing biogas [8]. Second, the use of the residue of the digestion process

Rural area in China

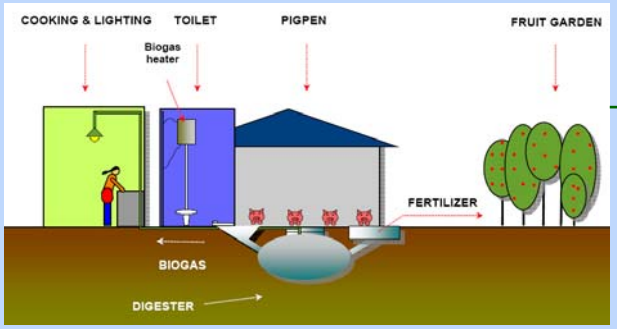

Figure 1. Pig-Biogas-Fruit Model in Southern China Adapted from [9].

can reduce the cost for commercial fertilizers and pesticides, because the residue can be used as a pesticide and is also a fertilizer of high quality [6].

Moreover, the use of residue as a fertilizer, which contains high proportions of nitrogen, phosphate, potassium etc., can improve soil quality and fertility [10], and thus increase the production of fruits and vegetables without additional cost. Besides, pigs fed with the residue not only grow faster, but also need less feedstuff [7]. Therefore, the use of the bio-digester can increase farmers' income on fruit farming and animal husbandry.

Environmental benefits

The use of the household bio-digester can greatly improve the environment. First, the use of biogas reduces the use of coal, which avoids CO_2 emissions, as well as CH_4 emissions from fermentation of manure. Thus, it positively contributes to climate change mitigation. Furthermore, it also reduces SO_2 emissions and thus benefits the local and regional environment [11]. Further, it can reduce the use of firewood in some rural areas, and thus protect the local forest. For example, in Ganzhou, Jiangxi Province, 25 tons of firewood can be saved by a 6 m^3 bio-digester each year [4]. In addition, the use of residue as fertilizer and pesticide can decrease the application of chemical fertilizers and pesticides, which is beneficial to the local ecosystem [8]. Lastly, the reuse of animal and human wastes also protects the water resources nearby from the waste contamination via storm runoff.

Social benefits

The application of a household bio-digester also creates significant social advantages. First, the use of a bio-digester will improve the indoor living conditions considerably, since a new kitchen with the biogas cooking appliances, a toilet and a pigsty will be installed and properly managed. All this will greatly decrease the indoor emission of particles [12]. Second, the bio-digester can kill the parasites and pathogens, as well as, inhibit the breeding of mosquitoes and flies. As a result, it can reduce the occurrence of infectious diseases and the contamination of drinking water, and improve the farmers' health [12]. Third, the use of biogas will replace the use of firewood, thus reduce the time needed to collect firewood [6].

Challenges of the System

Although the pig-biogas-fruit system has a great number of advantages, it has been found that the majority of biogas users only use biogas for lighting and cooking. The residues from bio-digesters have a low level of use in China [13]. In 2005, only 37.3% of the total rural household users used multi-purpose technology for biogas [3]. There are three major challenges for the current system.

Low awareness on comprehensive biogas use. Most biogas users do not know how to combine biogas technology with eco-agricultural technology, since they have not received technical training [12]. This has been confirmed by [6] who found that bio-digesters are mainly regarded only as an energy source.

Lack of follow-up services and management. It is reported that the development of household biogas mainly emphasizes construction of new facilities. Many household biogas projects in rural China have broken down be-

cause of poor follow-up services and management. In 2007, only 60% of bio-digesters in China's rural areas were operating normally [14]. Biogas technicians are in short supply and farmers are even unable to install biogas equipments correctly [12]. According to [5], it is also found that the farmers do not have sufficient knowledge on how to use the residue.

Cold temperature. The rate for biogas production increases with the increase of temperature, with the minimum suitable temperature at 10 °C. However, in northern China the daily mean temperature is lower than 10 °C during the winter (November to March), which is not appropriate for biogas production [12]. An inclusion of a solar-heated greenhouse into such a pig-biogas-fruit system is suggested as a solution for northern China. The use of the greenhouse can increase the temperature of the biogas digester during cold weather, thus improving the biogas production [12]. Nevertheless, more ways on improving the system for colder communities need to be further investigated.

Discussion

The pig-biogas-fruit system, with the household biogas production as the key element linking animal husbandry and fruit farming, has a number of characteristics of distributed economies.

Small-scale vs large-scale

Although the pig-biogas-fruit system based on single household biogas production has a lot of advantages, it is argued that large-scale biogas production may provide biogas with lower cost due to the economies of scale concept. However, with regard to pig-biogas-fruit system, household biogas production is better than large-scale production in terms of the following aspects:

First, the large-scale biogas production needs more complicated technology and much more initial investment, which are main barriers for implementation in rural areas of developing countries;

Second, large-scale biogas plants need much more raw materials such as crop residue, animal and human waste etc., which require transportation. In addition, the distribution of its product (biogas) and by-product (residue) also require transportation. The extra transportation not only needs more energy, but also creates risks of causing pollution, thus increasing the production cost for local farmers;

Third, the benefits of large-scale biogas plants may benefit only a few people rather than spreading through the local farmers like household-scale ones;

Fourth, the building of large-scale biogas plants may not encourage the full use of biogas and the residue, since biogas might be perceived as the only product;

Fifth, the set-up of large-scale biogas plants does not require the renovation of toilets, kitchens, etc. of individual households, thus would not greatly improve the indoor environment and the quality of life of local farmers.

Link to distributed economies

The pig-biogas-fruit system supports the distributed economies characteristics in several ways. It maximizes the use of locally available resources in a sustainable manner. Wealth creation from the fuel, pesticide and fertilizer cost savings, as well as, more income from better growth of fruits and pigs are created to a large number of people, that is, the local farmers. It is also an effective way to decrease pollutant emissions and waste generation. Better living conditions can also be evidently perceived after the biogas system is installed, thus the occurrences of illnesses are substantially decreased [5]. In all, it provides a higher quality of life to local farmers.

Transferability

The pig-biogas-fruit system has proven its viability in the south of China. The concept of the system can be transferred to other rural areas where animal husbandry and agriculture can be integrated with the biogas production. However, depending on local legislation, important issues need to pay attention, such as toxicity of the residue for using as fertilizer. Thus, harmful organisms removal processes of the residue for composting purposes might be needed. Education on waste separation, especially with hazardous materials, must be properly given. In addition, for colder regions, other components, for example greenhouses and insulation, are required for the more effective fermentation process.

Conclusions

The pig-biogas-fruit system used in rural China makes the integrated and comprehensive use of biogas at the household level and the biogas serves as the key element linking the animal husbandry and fruit farming. The use of pig-biogas-fruit systems in rural China accords with the principles of distributed economies. In short, it is economically viable and profitable. Moreover, it has significant positive environmental and social effects in local rural areas and improves local farmers' quality of life.

In terms of future study, more research should be done on the collaboration among local farmers in order to share the knowledge, reduce the cost, and increase the sale of their agricultural products. The relationship between the production of local organic food and the system should be further explored. Since such system is not suitable for cold areas, studies on the adaptation of the system according to local conditions need to be put into practice. The transferability of the system to other countries can also be an interesting topic in the future.

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Spinning It Samsø Style

By Mònica Coll Besa, Jesse Eckert & Vaida Pilibaitytė

Photos by Samsø Energy Academy

Once a meeting place of Viking ship builders, home to growers of a delicious early potato, today it is an island drawing renewable energy tourists from around the world [1].

It is the achievement of Søren Hermansen, an enthusiastic local teacher turned into a globe-trotting "green oracle", and other Samsingers, inhabitants of the Danish island of Samsø [2].

Little more than a decade ago it resembled other islands worldwide – dependent on oil brought in by tankers and electricity delivered via cable from the mainland despite abundant indigenous resources.

But in 1997 it won a competition to become Denmark's Renewable Energy Island and pledged to transform its energy system to a 100% green within a decade, a target fulfilled even sooner [3].

An ambitious experiment, met with some reluctance among conservative islanders, step by step developed into what is seen today as a unique community involvement model for a sustainable energy system, based on local resources and existing technology [2].

Local leadership, ownership and commitment from authorities proved to be Samsø's formula for success [4].

We believe that the Danish island's achievements may serve as an inspiration for the future concepts of distributed sustainable energy generation systems.

Energy island in brief

Country: Denmark

Area: 114 km²

Population: 4000

Households: 2500

Economy: Farming and tourism

Energy self sufficiency: 100%

Electricity generation: 100% renewable

Heating: 75% renewable

Transport: fossil fuels offset by offshore wind

Mainland grid connection: yes

Energy generating technologies:

Eleven 1 MW onshore wind turbines

Ten 2.3 MW offshore wind turbines

Four biomass plants, 7 MW total

2500 m² of solar thermal panels

160 m² of solar PVs

Individual heat pumps, furnaces and boilers

Electricity demand: 28 000 MWh/year

Electricity surplus: 10%

Investments over 10 years:

8 M EUR national and European Union subsidies

47 M EUR local investment

55 M EUR total investment

Ownership: local cooperatives and private

Households with own energy systems: 10%

CO_2 emissions (energy): -15 000 t/year

[4,5,6,7,8]

Søren Hermansen

Director of Samsø Energy Academy

We are not hippies. We just want to change how we use our energy without harming the planet or without giving up the good life [2].

You have to think locally and act locally, and the rest will take care of itself [1].

In contrast to other islands that rely on governments' subsidies to reduce energy costs, Samsingers were paying a lot for energy, as household electricity prices in Denmark are among the highest in the world due to high taxes on fossil fuels. Furthermore, the energy system is decentralized and various support schemes for renewables exist [3]. The country has a long tradition of community ownership and civic engagement as well. This has contributed to the success of Denmark's Renewable Energy Island Project together with public participation and organization of ownership that takes various forms in Samsø [9].

Community involvement

A large network of different actors was involved and continues to support the project in many ways. In addition to the administrators of the energy project, local citizens, farmers, small businessmen, the municipality, and the national government take part [3].

Experts agree that trust and close relationships also played an important role [10]. Although many were conservative and reluctant to engage from the very beginning, they were eventually persuaded by their leader Hermansen, who was active in building social capital[1] of the community, establishing and heading Samsø Energy Academy in 2007 that became a meeting place for local residents and tourists [9,10]. Furthermore, everyone had a chance to get involved in the decision-making process from the very beginning. The public took part in meetings where decisions were made regarding energy for electricity, heating and transport and technology alternatives, infrastructure, costs, payback times, and avenues for participation. Additionally, different information campaigns and activities took place including training, house calls by energy advisors, open house visits, and working groups with the municipality, project managers, and utility firms [3,11]. The municipality took part by not only encouraging participation, but also providing fiscal incentives to those willing to install renewable energy individually [12]. Local authorities were also involved in bringing together different actors and founded the Samsø Energy Company together with the Farmer Association, Samsø Energy and Environment Office, and the Commercial Council [10].

Although some training was needed in order to involve local craftsmen in energy projects, islanders already had most of the capacity needed to participate. This fact has also contributed to the increased acceptance and the sense of belonging to the initiative [9].

Electricity production

High acceptance of wind energy among the locals is arguably first, and foremost, due to a better acceptance of renewables in Denmark as compared with other countries. In addition to deciding about the choice of technology, Samsingers also had the possibility of buying shares or even investing in their own green electricity sources. Project developers closely cooperated with banks in order to obtain loans. This led to increased private investment rates as the sense of ownership resulted in greater social acceptance [9].

The distribution of electricity on Samsø is managed by a cooperatively owned local utility.

[1]Analytical framework emphasizing relationships and trust among social actors.

Electricity is supplied by 11 land-based wind turbines and 10 offshore installations [6]. Nine land-based turbines are owned by local farmers, while the other two – by local cooperatives. When it comes to offshore wind, the municipality of Samsø invested in five turbines, three are owned by small local businessmen and the remaining two belong to cooperatives – comprising of local residents and non-islanders who have some relation to Samsø [4]. Electricity demand is fully met by the land-based turbines and the offshore wind park generates surplus that is exported to the mainland via cable [4].

A small share of electricity is also generated from private installations of solar photovoltaics (PVs). The Samsø Energy Academy has 100 m² of PV panels integrated on the roof. The main barrier for further expansion of solar power is high production costs per kWh compared with other technologies [6].

District heating

Samsingers were also engaged in the set-up of the new decentralized district heating system. Meetings were initiated by various energy organizations where promotion tasks were distributed among groups of active local representatives. They were responsible for collecting signatures from individual home-owners who agreed to participate in the new system. Newly constructed buildings had an obligation to join the scheme, other citizens could decide if they wanted to. A strong financial incentive was tied to the early sign-up as the difference in membership fee was almost 500 times greater (10 versus 4700 EUR after construction) [6].

The municipality granted mortgages to help financing the construction of the three new plants in addition to the grants from the Danish Energy Authority [6].

Today, different forms of ownership exist between the four plants. The local utility company initially owned the only plant on the island, but currently operates a new one as well. The third plant is owned by a private investor, while the remaining one is cooperatively owned. The biomass for the plants – straw and woodchips – are supplied by local farmers and the prices for consumers have been much lower from the very beginning as compared to the system based on fossil fuel [6].

Søren Hermansen

Director of Samsø Energy Academy

The attitude is that it is okay with wind turbines as long as they are far away, but not in our town. The most important reason for such attitudes is that it does not give any meaning to me because [...] I do not get the surplus, and the wind turbines are not here for me, rather it is some company from Copenhagen or Oslo that owns them [9].

Room for improvement

Efforts to promote clean transportation and reduce energy use have been less successful [3]. Islanders continue to use conventional fuels for their cars, but resulting emissions are more than offset by the offshore wind park. An initiative to encourage farmers to use rapeseed oil for their tractors was started in 2003, but only

three locals participated. The durability of engines and the price of rapeseed oil, which is subject to high taxes, are listed as limiting factors. Attempts to introduce a fleet of electric cars on Samsø also failed due to low demand, absent infrastructure such as batteries, maintenance services, and other administrative barriers [6].

The failure to change behaviour to save energy is linked to the overall success of the initiative. Islanders appear to be susceptible to the so-called "rebound effect", since they continue to consume as much energy as before, because they are using cleaner and more efficient technology [3].

Main success factors

Samsø has an inherent advantage of abundant local resources for green energy generation. But many agree that without a local pioneer like Hermansen, who had a vision and the drive to push it forward, and the ability to communicate and relate to island networks, Samsø would not be what it is today.

Moreover, the islanders have a strong sense of community, and when they were given various opportunities to participate and engage in decision-making, this created a sense of community ownership over the process. As more and more inhabitants became involved, social pressures to join instead of "free ride" also helped to empower participants.

However, several other socio-economic factors and assistance of regional and national authorities have to be taken into account as well.

For instance, locally shared economic benefits of the new energy system were crucial to its success. The project has brought financial benefits to many Samsingers in a number of ways – employment, investment returns, and increased number of tourists. Another prerequisite for economic viability of such investments is the existence of long term feed-in tariffs for renewable energy [4].

Transferability

To what extent can the lessons learned from Samsø be used to recreate this experience elsewhere?

When considering other islands, many of the key elements might be in place: local resources and close ties among social networks, businesses and institutions. But other important elements may or may not be present; such as leaders with the wherewithal to utilize local knowledge and ability to build trust. Furthermore, cultural diversity, skills, infrastructure, government support, legislation, availability of incentives or funds, and business commitment, can all be limiting.

Cecilia Andersen

Resident of Agerup

Visiting other homes with renewable energy installations is a really good idea, especially homes that resemble your own. Ask them about their own experiences and assessment of the pros and cons. [...] For example, we didn't realize that there has to be room for firewood indoors, near the fireplace, certainly much more than the few pieces of wood shown in the advertisements [7].

Jørgen Tranberg

Owner of a 1 MW wind turbine

It has been a very good investment. It has made my bank manager very happy. But none of us is in it just for the money. We are doing it because it is fun and it makes us feel good [2].

This said, there has been a growth in the "100% renewable energy island" phenomenon, and the "Cradle to Cradle Islands" project, which is aimed at innovative and sustainable solutions for the North Sea region, is a good example of its proliferation [13]. Over 20 communities are taking part with an equal focus given to energy, water and waste, thus pushing the bar even higher than the initial goals of Samsingers.

But while the experience of Samsø may be inspirational to other islands, can it be replicable in the mainland, especially considering current trends of mass urbanization?

To date there is no urban metropolis that is completely energy self sufficient. Some countries like Iceland, Maldives and Costa Rica have hopes of becoming carbon neutral and their reasons behind such plans vary greatly; from the availability of local green resources to the imminent threat of climate change [12].

There are some districts such as the Western Harbour in Malmö, or small cities such as Vauban in Germany, that are supplied by 100% renewable energy, and larger municipalities such as Copenhagen have announced their ambitions of becoming carbon neutral [14].

An urban environment may not contain many of the necessary attributes of an island such as small, closely knit communities, access to natural resources and an inherent need to be energy independent.

But a city may share some commonalities: dependency on fossil fuels, leaders and networks, defined by socio-economic factors and government support.

Distributed Energy Generation

Barriers

Access to local conventional energy sources
Multiple disconnected actors
Infrastructure
Cultural diversity
Capital investment cost
Transient population
Behavioural patterns
Institutionalized skills and capacity
Corruption
Changing policies
Low social capital

Drivers

Access to local renewable sources
Local leadership and vision
Fiscal incentives
Strong cultural identity
Local ownership
Rooted community
Local participation traditions
Local skills and capacity
Strategic planning and transparency
Long term policy and laws
Institutional trust

Some islanders chose to invest in private solar PV panels

A number of success factors mentioned above appear transferable to the urban context, especially if applied on a neighbourhood or a district scale. But given the absence of typical islandic drivers such as low diversity and rooted community, the main focus areas of an energy project might be different.

For example a larger city would require multiple leaders from diverse backgrounds with strong belief in the success of the project, and the ability to motivate their stakeholders and coordinate more complex networks in a more dynamic environment when compared to an island. Coordinating, involving, and gaining support might be the biggest challenge facing cities.

Another challenge to be addressed is access to energy sources and technology to meet more diverse and greater urban energy needs. What is considered a local energy resource in an urban environment would differ, and perhaps require more innovative and technologically complex solutions. For instance utilizing waste heat from public spaces or generating energy from household waste and applying the concept of industrial symbiosis. Existing infrastructure can also predetermine technology choices and limit the development of alternative energy systems.

Local as well as national governments' commitment has a key role to play in making these projects attractive and economically feasible for all actors, and not only favouring large utility companies as it is often the case in urban areas.

Søren Hermansen

Director of Samsø Energy Academy

I think it would be much harder to make the same project some place in the middle of Jutland because people do not have the same sense of belonging to a place [5].

Sustainability Profile of Samsø

Environment	Society	Economy
Reduced air pollution	*Model community: pride*	*New jobs*
CO_2 emissions (energy):	*Increased "social capital"*	*Locally distributed benefits*
-15 000 t/year [4]	*Increased versatile capacities*	*Energy tourism*

Conclusions

To conclude, the story of Samsø shows that small energy companies who encourage local participation and ownership eventually gain greater acceptance for new sustainable energy projects. Local distribution of economic benefits has also proved to be driving community involvement, while environmental benefits seem to be a positive externality, but not necessarily the main driving force.

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Small Wind Energy:

Building-Integrated Wind Turbine System

By Sujie Min

In the context of the increasing energy demand and the global concern about climate change, seeking for clean energy alternatives for greenhouse gas emission reduction has been put on the top of the agenda. This will become more pressing especially after COP 15 – the United Nations Climate Change Conference in Copenhagen in December 2009. Wind energy stands out with the characteristics of a zero-cost resource, emission-free, clean and with an outstanding capacity of power generation.

Small wind energy, with the capacity of 100 W-50 kW [1], through the function of small wind turbines, plays an irreplaceable role in micro-generation under circumstances where large wind solutions are constrained by a series of factors including geography and land-use planning, wind conditions, substantial investment, grid connection, policy support, noise pollution, aesthetics, etc. As one of the good manifestations of distributed economies, small wind energy largely contributes to the local economy, society and environment in a sustainable way. The emerging building-integrated wind turbine system, with the wind turbines incorporated into the built environment, that is situated close to or mounted on buildings [2] is gaining the spotlight recently and is getting prepared for a new development and deployment in the near future. The case study on the application of the building-integrated wind turbine systems in the City of Malmö, Sweden, is selected in order to have a deeper look at how this flexible, networked, small-scaled system works as a new renewable solution to benefit the local communities in respect of life quality improvement, energy saving, environmental awareness enhancement, social welfare increase, climate change mitigation, economic growth, and local sustainable development.

The methodologies applied in this paper are mainly qualitative research methods including interviews, analysis of documents and materials, field notes, and site observation [3].

Influence factors

The efficiency of the building-integrated wind turbine system greatly depends on the following influence factors: urban wind conditions (wind speed, wind power, stability, etc.), site wind conditions, building aerodynamics, wind turbine design and performance, good planning [4], measurement and assessment technology, policy support, grid connection, and building permit. Besides, factors like safety, noise, vibration, bird protection [5] should also be taken into consideration aiming for a more comprehensive perspective.

Case Study

Considered as a uniquely placed city with the leading wind power by Per-Arne Nilsson, Head of the City of Malmö's Environment Department [6], with the annual average wind speed of 4 m/s in the urban area of Malmö and with more abundant wind resources located in the southern and western area [7]: Malmö is exploring every possibility of making the best use of this clean wind energy. The building system is one of the fields where actions are taken to

Figure 1 Three selected alternative demo sites for small urban wind energy in Malmö

Adapted from [9]

attain the goal of decreasing the carbon dioxide emission by 25% by 2010 compared to 1990 set in the climate change programme of Malmö [8]. It is still in the consideration process whether the building-integrated small wind turbine system will be emerging as one of the solutions for low-energy houses in Malmö, and yet to be proved with more strong facts.

Demo site

It is planned to build a demo site consisting of 5–15 small wind turbines with good wind conditions in Malmö for the purpose of good experience and practice demonstration, education and research. Originally, three alternative places are considered regarding the wind conditions: City Hall, Heleneholm and Svågertorp in Malmö (see Figure 1). The site of Svågertorp wins with its fair wind conditions (see Figures 2 and 3).

Benefits

Planned and purchased in such a way so that it meets a series of standards including *Sweden Planning and Building Act* (1987:10), EN 61400-2:2006 *Design Requirements for Small Wind Turbines* and IEC61400-11 *Wind Turbine Generator Systems-Part 11: Acoustic noise measurement techniques*, etc., the demo site in Svågertorp will be economically, socially and environmentally beneficial:

Economically, although the energy produced by the small wind turbines are small and has less contribution to the grid, compared to the large-scaled wind energy, and its cost-effectiveness has yet to be proved with more experiment and tests, it has the potential of being an clean energy alternative in the urban area in the future.

Socially, in the context of perfect wind conditions and implementation on a large scale, this small wind energy system will energize the local community by helping positively affect the mindset and environmental awareness of the local population about wind energy and build

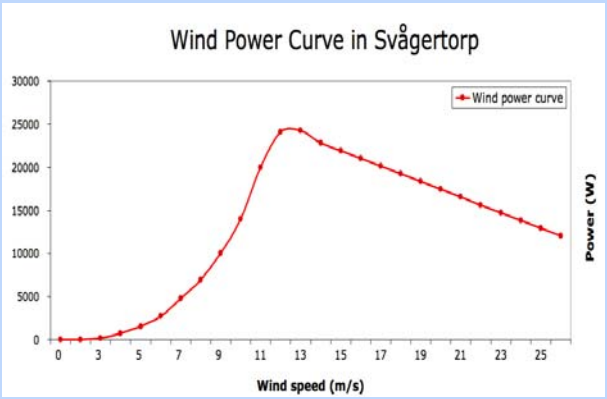

Figure 2 Wind power curve of a typical 25 kW wind turbine. Adapted from [9].

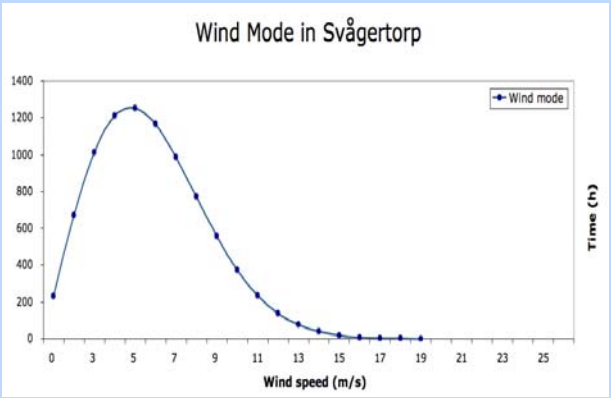

Figure 3 Wind conditions in Svågertorp Adapted from [9].

their own small wind system where there is good wind condition, thus transfer to the use of clean energy and reduce the dependence on conventional energy. With the increasing clean energy demand, successful education and research demonstration, it has the potential to be promoted on a large scale in Malmö in the future with adequate support from the successful experiment and test [10].

Environmentally, if this small wind energy system can be implemented on a larger scale in the future, it will not only contribute to CO_2 emission reduction, climate change mitigation at local and regional level, but also save energy, explore clean and convenient energy alternatives, which are more acceptable as an environment friendly solution.

Link to distributed economies

In a building or a small and medium sized community, where a wealth of wind resource is accessible, where a big-scaled wind farm is restricted to the wind conditions, land use, investment and cost, where daily energy consumption per building is increasing, where energy saving and emission reduction are integrated into the city and building planning, the building-integrated wind turbine system is a possible solution. In the case study, it is found that in the wind season, mostly in winter, the wind is more capable to push the building-integrated wind turbine system to micro-generation, which is more technologically feasible, economically effective, socially acceptance and environmentally friendly than a large centralized wind generation system. The main features of distributed economies are discussed hereinafter related with this system. .

Flexible and small-scale [11]**.** As a technologically innovative system, building-integrated small wind turbine can be flexibly mounted on any building with optimized wind conditions and be repositioned with dynamically changing wind conditions of the building. Instant results of its performance can be observed through its quick response to the wind in a short-range timeframe, which contributes to the in-time market response.

Diversification of needs [11]**.** The diversified blades of building-integrated small wind turbines are designed based on different wind conditions and energy demands of different buildings. This idea of design is not only from the designers, but is also encouraged to be inspired by different consumers based on their various needs. A win-win situation then becomes possible to strengthen the positive interaction between suppliers and consumers as well as to tailor to the needs.

Symbiotic relationships [11]**.** The coexistence of competition and cooperation between different but interlinked small wind turbine producers would lead to a more mature and active market featured with more resource flows and highly efficient production and distribution processes. Besides, if benign communication and collaboration channels could be established between them, then they will facilitate the competition for serving the local consumers high qualified turbines.

Life quality improvement [11]**.** The integration of creative design and production and innovative technological advancement impelled

Energy Ball® V200 used in Eltecno i Vellinge AB, Sweden

by updated aerodynamics research, bring in the improved performance and added value of the building-integrated small wind turbines, resulting in better service integrity and quality of life for the consumers and the local community.

Fostering new relationships [11]**.** Although it has smaller scale of economies and distribution system, the building-integrated small wind turbine system is fostering a new producer and consumer relationship different from any other in history, taking well care of each consumer's needs and thus being able to expand the local, regional, even global wind market share.

Social and ecological capital as an advantage [11]**.** The more widely promotion of successful experience and practice of the building-integrated small wind energy will create unprecedented economic value and human capital, which is attributed to giving full play of the role of the social and ecological capital as an advantage through wise design and well-developed product strategy.

Conclusions

In the context when climate change is put on the agenda, seeking for clean renewable alternatives and reducing greenhouse gas emission will become a global trend. The building-integrated small wind turbine system is gaining momentum with optimized energy output, minimized cost, and high energy efficiency. Still, as an emerging issue, further detailed feasibility studies on the building-integrated small wind turbine system need to be conducted in a more comprehensive way in the future for an overall systematic and critical review.

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Internet-Based Distributed Economies

By Linfeng Lu

Distributed economy is a new concept that needs more research. The internet is a quite useful tool to promote and apply distributed economy in different areas. This article is going to describe four examples of internet-based distributed economy. These are small local internet media, online classes, small local online printer bookstores and small local e-shop service stores. Their benefits to environmental, economical and social sustainability will be evaluated, and finally the article will discuss what we should do in the future.

A decentralized economy, which consists of individual or small producers, adds local or unique values to their products or service to meet diversity needs of customers and contribute to the sustainability and quality of life.

Small local internet media

Internet media, such as blogs and podcasts, is decentralized communication. The users could also become the contributors and all the internet media is connected by the network, through which an individual could expose himself and receive the information he wants. This is different from the traditional mass media, which is a centralized, one-way communication.

The traditional mass media always bundles a lot of information that listeners do not want to know and thus waste their time. Large amounts of newspapers and magazines become waste without being fully read. Moreover, the media has mainstream bias, which means they would like to gather the information from various influential media and report similar things. This is not efficient in terms of utilization of resources and energy. Traditional forms of media are also controlled by interest groups, so it is not easy for normal people to express themselves freely.

Now small local internet media seems to be a more popular solution. They provide local news and service, which local people are interested in and where they have the possibility to contribute. They also renew the information much faster than the traditional mass media. The local producer and service provider may prefer to buy the advertisement service from them as they are much cheaper and effective than the centralized traditional mass media. This is more environmentally friendly compared to the printed media, which consume lots of paper and ink. The local internet media also satisfies the diversity needs of the users and provide a communication platform for the local people to know each other.

Online Class

Now with the help of the internet, training and education that could before only be done on a large scale, like university and training schools, could be decentralized.

People with knowledge or skills could deliver them through online training without investing a large amount of money to build training schools, which they could not afford otherwise. In some rural areas where not many tourists or people would like to go, the local people may have some special traditional skills like music instruments, folk dance, making handcraft cooking that is exclusive and many people would be interest to learn. If they deliver their knowledge and skills through an online class to earn extra income, this will certainly benefit the local economy. This will also reduce the cost for the students and their carbon footprint, therefore benefiting the environment. When the local knowledge or skills value is delivered to other economic regions, not only will this preserve culture and tradition, but also connect the different economy regions as a whole.

Small local online printer bookstore

This idea is driven by the newspaper print shops. Because of transportation issues, it can be difficult to deliver newspapers on time. So there are local shops to print newspaper immediately for the customers when they order.

The small local bookshop may offer the service for the customers to print the book they want through internet. Basically the bookshop could access databases that include huge amounts of literature. The customers could read them online in the shop and choose which book they want to print. This will certainly support the small local bookshop and benefit the local economy. Due to the limitation of the capital capacity and limited area, the small local bookshop cannot store a lot of literature, so if the customer needs some books that are not common, they have today to drive long distances to a big bookstore. The local printshop will help the small local bookshop save space for storage and reduce their risk with investments as some books on their shelves cannot be sold out. The carbon footprint of the consumers is also reduced. The material for printing the books may

be local. As this system welcomes more writers to put their literature in the database, this also offers a good chance for the unknown writers to show their work to the interested readers. Since the printer bookshop only prints the books the customers order, it is more resource and energy efficient.

Small local E-shop service store

This idea is inspired by the travel agency service. The travel agency uses the internet to check all the flight alternatives and the price, and to package them to meet the individual tourist needs.

Now, with the help of the internet the local small producers could also sell their products online internationally at affordable costs. However, the problem is that there is too much information and too many choices on the internet. This makes the consumers enough confused that they have no idea what to choose to meet their needs. While the small local shop could use their professional knowledge and skills to help the customer order the products they really want. They could ask for the preferences of the customers and according to their criteria search the internet. As customers' needs are diverse, this might also benefit the small producers because their products are more specific. The local shop could also help the customers communicate with the producers, so the producer could incorporate the customers' needs into the product design and production stage. The small local shop could also ensure the product quality using their professional knowledge. This will benefit the local economy as the small local shop could sell more products than they have in the store and they do not need to store the products that they cannot sell out. The consumers do not need to drive long distance to buy the products they need, or waste a lot of time in front of the computer. On the contrary, they have more choices and can more easily get the products that could meet their individual needs online with the service of small local stores, especially favoring the local small producers or second hand markets. It also helps the consumer adapt a more sustainable lifestyle.

Conclusions

In conclusion, internet-based distributed economies justify their feasibility and benefits and open a new age for the sustainability of our society. It benefits the environment, local community and economy a lot. Especially in terms of reducing carbon footprints and improving the resource and energy efficiency. There are definitely more examples that need to be explored in the internet-based distributed economy. What we need to do is to think about how to balance the large-scale and small-scale economy in the future.

Conclusions

As seen from above, distributed economies is an evolving concept which could be applied and possibly replicated in a variety of economic sectors. In the past there were economies that were distributed and interconnected, but here the point has been to demonstrate the re-emergence of the concept and the elements behind the concept by showcasing various model case studies.

The case studies presented in this publication, representing various small-scale economies such as dairy industry, micro wind generation, integrated use of biogas, sustainable energy systems, coffee plantations, slow food and so on, signify that essential elements of distributed economies can be seen in a range of sectors at this time, addressing the overall aims of the three pillars of sustainability.

However, the concept does not offer tailor made solutions. Local economies have their own characteristics that will shape the form or the elements of distributed economies that would be viable and relevant. So rather than replicating solutions the process would be closer to adapting approaches from one locality to the conditions of another. The case studies presented here offer some valuable insights and ideas for replication, adaptation or transferability.

There exists a lot of scope in exploring the concept further as not enough research has been carried out in this area before. It is hoped that this document will serve as a seminal foundational work for further research in the area of distributed economies for those interested in exploring its finer dimensions.

Afterword

We are pleased to have been able to introduce the concept of Distributed Economies as the theme for the autumn 2009 Strategic Environmental Development course and thus link the education to an important research theme of the IIIEE. This publication is the result of the efforts made by the students and we hope and believe it will be inspiring for others interested in sustainability approaches.

We have been privileged to have a number of key researchers in the area address the students and in various ways contribute to this publication; in particular, Professor Allan Johansson, who coined the concept while working at the IIIEE. We are grateful to him, Dr Peter Kisch, Dr Murat Mirata, Professor Han Brezet and Professor Chris Ryan for generously sharing their knowledge and experiences with us.

A university course has its limitations and it was a daunting task to also develop a publication. While the publication is a true team work, there are always individuals contributing with special devotion and sharing particular skills and experiences, and who deserve special recognition. Very special thanks to all of you!

Mikael & Thomas

International Institute for Industrial Environmental Economics – IIIEE – Lund University, Sweden

With the firm conviction that prevention is better than cure, the Institute is engaged in multidisciplinary research activities with the overall ambition to develop strategies and policies that further systems of production and consumption that support sustainable development.

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"I have no doubt that it is possible to give a new direction to technological development, a direction that shall lead it back to the real needs of man, and that also means: to the actual size of man" ***Kirkpatrick Sale***

"Small is Beautiful […] Wisdom demands a new orientation of science and technology towards the organic, the gentle, the non-violent, the elegant and beautiful" ***E.F. Schumacher***

"(Re)localization is going to be the big story for this millennium. It can meet the challenge of getting biodiversity from farm to plate, to save energy, to cut "food miles" ***Tim Lang***

"Growing evidence suggests that every dollar spent at a locally owned business generates two to four times more economic benefit – measured in income, wealth, jobs, and tax revenue – than a dollar spent at a globally owned business" ***Shuman H. Michael***

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