

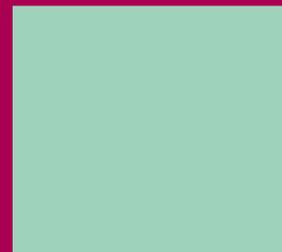
www.unep.org

United Nations Environment Programme
P.O. Box 30552 Nairobi, Kenya
Tel: (254 2) 621234
Fax: (254 2) 623927
E-mail: cpinfo@unep.org
web: www.unep.org



United Nations Environment Programme
Division of Technology Industry and Economics
Production and Consumption Branch

Product-Service Systems and Sustainability



Opportunities
for sustainable
solutions



United Nations Environment Programme (UNEP)

Division of Technology Industry and Economics (DTIE)
Production and Consumption Branch
39-43 Quai André Citroën
75739 CEDEX Paris
France

Ezio Manzini
Carlo Vezzoli
Interdepartmental Research Centre Innovation for the Environmental Sustainability (CIR.IS)
INDACO - Politecnico di Milano University
Via Durando 38/A
20158 Milan
Italy

International Institute for Industrial Environmental Economics (IIIEE)
Lund University
P.O.Box 196, Tegnersplatsen 4
221 00 Lund
Sweden

Authors

The text has been written by **Ezio Manzini** and **Carlo Vezzoli** based on knowledge and information acquired by the CIR.IS Politecnico di Milano and on a series of workshops, expert meetings and review contributions organised for this publication by UNEP and by CIR.IS. A preparatory article *Product-service Systems: Using an Existing Concept as a New Approach to Sustainability* (Manzini E., Vezzoli C., Clark G. 2001) anticipated this publication. **Ezio Manzini** wrote the chapters: **1. What are Product-Service Systems?**, **5. Product-Service Systems and the current economic transitions**, **6. Potential benefit for all: Developed and Developing Countries**, **7. The dilemma of the rebound effect**, and **11. A promise of sustainable innovative ideas**. **Carlo Vezzoli** wrote the chapters: **2. Why consider Product-Service Systems as a new approach to sustainability?**, **3. What motivates a company to consider a Product-Service System?**, **4. Undertaking profitable and competitive business and reducing environmental impact**, **8. Barriers to adopting Product-Service Systems**, and **9. What are the next steps for companies?**. The introductory chapter (*Historical perspective: from cleaner production to sustainable consumption*) was prepared by **Garrette Clark** and **Anne Solgaard** (UNEP).

The following case studies have been written by **Carlo Vezzoli**:

- The *AMG: solar heat service, 2001*
- The *Kluber: S.A.T.E. movable laboratory, 2001*
- The *Allegrini: Casa Quick, 2001*

The following case study has been written by **Annamaria Formentini**:

- The *Eureka: toy library, 2001*

The following case studies were prepared by **Carlo Vezzoli**:

- The *COVIAL: a co-operative of 'Vinicola Aurora'* case is based on work by **Dijon de Moraes**, 2002
- The *AutoShare: car sharing service* case is based on work by **Martin Charter**, 2000
- The *Odin: organic vegetables subscription system* case is based on the publication: Goedkoop, M., van Halen, C., te Riele, H., and Rommens, P. *Product-Service Systems, Ecological and Economic Basics*. VROM: The Netherlands, 1999
- The *Greenstar solar e-commerce and community centre* case is based on work by **Martin Charter**, 2000
- The *Virtual Station: virtual office service system* case is based on work by **Andrèa Franco Pereira**, 2002

Acknowledgements

This booklet has been compiled as a result of many contributions:

A Workshop on Product-Service Systems held by UNEP DTIE in Paris, June 2000

An Expert review panel held by UNEP in Cologne, including:

Erik Brandsma - Sustain SA, Stockholm, Sweden
Martin Charter - Centre for Sustainable Design, United Kingdom

Garrette Clark - UNEP DTIE Production and Consumption Branch, France

Harry te Riele - Storm Consultants, Amsterdam, Netherlands

Chris Ryan - RMIT, Australia and IIIEE, Lund, Sweden
Ursula Tischner - Econcept, Cologne, Germany

Expert review contributions from colleagues in developing countries have been provided by:

Uday A. Athavankar - Industrial Design Centre, Indian Institute of Technology, Bombay, India

Zhao Jianghong - Hunan University, Changsha, China
Benny Leong - The Hong Kong Polytechnic University, Hong Kong

Cleophas L. Migiro - Cleaner Production Center, University of Dar es Salaam, Tanzania

Dijon de Moraes - University of Minas Gerais State, Belo Horizonte, Brasil

Andrèa Franco Pereira - University of Minas Gerais State, Belo Horizonte, Brasil

Final revision has been undertaken by:

Bas de Leeuw, **Anne Solgaard** and **Garrette Clark** - UNEP

Oksana Mont - IIIEE

Julia Haake - O2 France

Operational responsibility:

Anne Solgaard - UNEP
Annamaria Formentini - CIR.IS

English text revision by:

Barbara Hammond (barbara.hammond@re-edit.com) and **Garrette Clark** - UNEP

CONTENTS

3	Why this booklet?
3	Historic perspective: from cleaner production to sustainable consumption
Part 1: In Theory	
4	1. What are Product-Service Systems ?
5	2. Why consider Product-Service Systems as a new approach to sustainability?
7	3. What motivates a company to consider a Product-Service System? <i>Services providing added value to the product life cycle</i> <i>Services providing final results to customers</i> <i>Services providing enabling platforms for customers</i>
10	4. Undertaking profitable and competitive business and reducing environmental impact <i>Enhancing operating and eco-efficiency</i> <i>Improved strategic positioning</i>
12	5. Product-Service Systems and the current economic transitions
13	6. Potential benefit for all: developed and developing countries
14	7. The dilemma of the rebound effect
15	8. Barriers to adopting Product-Service Systems
16	9. What are the next steps for companies
17	10. UNEP is taking action
18	11. A promise of sustainable innovative ideas
Part 2: In Practice	
18	Allegrini: Casa Quick
20	Kluber: S.A.T.E movable laboratory
21	COVIAL: a co-operative of 'Vinicola Aurora'
22	AMG: solar heat service
23	AutoShare: car sharing service
24	Odin: organic vegetables subscription system
26	Greenstar: solar e-commerce and community centre
28	Virtual Station: virtual office service system
29	Eureka: toy library
For more information	
30	About the UNEP Division of Technology, Industry and Economics
30	Institutions
31	Bibliography

Why this booklet?

Since 1989, the United Nations Environment Programme Division of Technology Industry and Economics (UNEP DTIE) has been working to improve current production processes through its cleaner production activities. UNEP DTIE has been a key contributor to the international discussion arena since the United Nations Conference on Environment and Development (UNCED) held in Rio (in 1992) in the debate about how best to reach sustainable production and consumption. Initially activities focused on influencing the supply side of the economy – how goods and services are produced and delivered. In 1998 the UNEP sustainable consumption programme was established focusing on the demand side of the economy and taking a life cycle approach. Sustainable consumption activities aim to facilitate better information on consumer needs, trends and behaviours, and UNEP has completed studies on youth and lifestyles, on the question of a global consumer class, and completed work on UN consumer guidelines.

UNEP seeks to inspire stakeholders by exposing and developing business opportunities, focusing on Life Cycle Design, product-service systems and local initiatives. The sustainable consumption programme facilitates two multi-stakeholder initiatives. Firstly, the advertising and communication initiative through which there is an attempt to work out efficient communication strategies in co-operation with the advertising industry. Secondly, the Life Cycle Initiative, a joint initiative under the common platform of UNEP and the Society of Environmental Toxicology and Chemistry (SETAC) on best practices for a life cycle economy. The Life Cycle Initiative encourages an Integrated Product Policy (IPP), by bringing together efforts from all stakeholder groups. Finally, UNEP has taken on the responsibility of promoting a global understanding of sustainable consumption, organising workshops around the world to stimulate debate on different regional and national priorities.

Promoting an understanding and greater use of life-cycle thinking provides a significant opportunity for change. Taking into account the total costs (economic, social and environmental) of a product – from all the phases of its life-cycle, from material extraction to ultimate disposal – enables decision-makers to reach informed decisions. Within this context, the concept of Product-Service Systems (PSS) – promotes a focus shift from selling just products to selling the *utility*, through a mix of products and services while fulfilling the same client demands with less environmental impact. This business approach has recently received increasing attention as a new way to apply an existing concept, to both achieve economic gains whilst reducing environmental impacts.

Given that the concept of PSS is beginning to 'catch on' and gain attention, it is time for UNEP to contribute to, and influence the progress of PSS, to ensure that in concept and application it incorporates the idea of sustainability. In this context its potential is not generally understood by the public and private sectors or

civil society. This booklet is intended to contribute to the dissemination and the discussion of the PSS concept as a promising approach to sustainability. The ultimate goal must be to achieve *Sustainable Product-Service Systems*.

This UNEP publication is targeted at industry and government, academia and civil society to explain PSS – their potential benefits and limitations – in the sustainability context – using real company examples. To prepare this booklet, UNEP has drawn on the knowledge and experience of PSS experts to flesh out the concept of a sustainable PSS, to collect case studies of PSS in practice, to begin to document both its benefits and the hurdles which need to be overcome in its application, and to suggest ways forward in its development.

Historic perspective: from cleaner production to sustainable consumption

To understand the relevance of PSS as a new application, it is useful to revisit its development. The traditional approach to environmental management has evolved from *pollution control*, the *end-of-pipe* approach, to preventive or *cleaner production* approaches. The latter is defined as the continuous re-design of industrial process and products to prevent pollution and waste generation at their source and minimise risks to humans and the environment. This approach was applied initially to industrial processes (hence *cleaner technologies*) and then, to be more inclusive, to the industrial products themselves (hence *cleaner products*). Recently, it has become clear that such interventions have to be more *radical* than just the re-designing of existing products in order to catalyse a transition towards a sustainable society. In fact, many schools of thought hold that for a *sustainable society*, we need to move towards a point where we are reliant on 10% of the resources that are consumed by industrialised countries today (*per capita*). To make this shift, radical changes are needed. This means the transition has to occur also at a broad system level, since the potential environmental improvement is greater. Changes need to occur at the consumption level, by moving the demand for products and services towards different, more *dematerialised* consumption patterns. This introduces relatively new interlinked issues into the global debate on sustainable development: the need for *system innovation* and the co-related need for *sustainable consumption*. The focus needs to be on not only products and services, but also the way that consumer needs and wants are defined and/or fulfilled and the ways companies and other stakeholders define their roles and relationships. Generally speaking *sustainable consumption* implies a departure from current accepted standards of living (and the economical patterns they are based on) that are directly linked to increased material and energy consumption.

The *Product-Service System* concept is a possible and promising business *strategy* potentially capable of helping achieve the leap which is needed to move to a more sustainable society.

1. What are Product-Service Systems?

A *Product-Service System* can be defined as the result of an *innovation strategy*, shifting the business focus from designing and selling physical products only, to selling a system of products and services which are jointly capable of fulfilling specific client demands.

The example below outlines the essential differences between product selling systems (traditional product sales) and Product-Service Systems.

Fig. 1. Characteristics of traditional product sales vs. product-service systems sales

Traditional product sales	Innovative alternatives: Product-Service Systems	
Consumer buys a washing machine to clean cloths in house/hotel.	Consumer rents a washing machine to clean cloths in house/hotel.	Client buys a service from a company (laundry) to clean cloths (Company determines best equipment and methods based on client's needs).
Client owns, uses and stores washing machine. Consumer is responsible for maintenance and the 'quality' of the cleaning.	Company retains ownership of washing machine and is responsible for maintenance. Client is responsible for use and 'quality' of cleaning.	Company owns, maintains and stores the cleaning equipment including washing machine. Company is responsible for 'quality' of the cleaning.
Initial investment for consumer could be considerable.	Consumer costs are spread over time (they pay a low initial deposit and then pay per wash).	Consumer costs are spread over time (they pay per wash).
Consumer ultimately disposes of washing machine and buys replacement.	Company is responsible for disposal and has incentives to prolong use of product, reuse component and recycle materials.	Company is responsible for disposal and has incentives to prolong use of product, reuse component and recycle materials.

The example illustrates a new interpretation of the concept of *product* – moving from the product as the physical result of an industrial process of production, to a new meaning in which the *product* of a company (or an alliance of companies) is an integrated whole of mutually dependent products and services, that focus on meeting some specific customer demands.

Shifting from products to a PSS enables the company to move progressively towards a new way of interacting with its clients. What the company or an alliance of companies conceive, produce, and deliver, is not simply material products, but in fact, a more integrated solution to a customer demand, producing a satisfactory utilitarian result.

In the above example, the company which sells a full cleaning service (instead of just a washing machine) extends its relationships with the customer beyond the product sale, with a continuous interaction in the use phase, by acquiring and delivering competencies in cleaning, maintenance and service quality. In addition, the company has the potential to take a role in the end-of-life of the washing machine by re-manufacturing the machine or recycling its materials.

On the customer side, the underlying assumption (in this change in the company-client relationship) is that users are not really wanting a product or service per se, but rather what these products and services enable a user to achieve. This *utility*, however, has to be investigated thorough market research. Marketing efforts have to be closely linked to these, which then, in turn, could lead to an increase in market share or open new markets for the company.

On the provider's side PSS require the development of new relationships and forms of partnership among the stakeholders of a value production chain. In other words, new interactions are mandated with the client, and innovative partnerships are needed with other producer/suppliers, public bodies or not for profit organisations. Hence, introducing PSS requires communicating and providing information to 'new' stakeholders. Thus with this approach, the producers or the service providers, extend their interests beyond their usual boundaries, in terms of both product life cycle phases (pre-production, production, distribution, use and end-of-life) and connections with other products and services, which, taken together, will result in an integrated solution for the customer.

In fact, in industrialised countries, the shift towards producing and delivering PSS is already underway. The agenda now, is to discuss whether the PSS concept can be considered a promising initiative in terms of its influence on sustainable production and consumption patterns, and whether it is relevant now, for both industrialising and industrialised countries.

2. Why consider Product-Service Systems as a new approach to sustainability?

It needs to be stated at the outset that PSS do not necessarily lead to sustainable solutions. They only have the potential to do so: in other words, PSS offer us a useful and promising concept to move in the direction of sustainability; but this potential must be verified on a case by case basis. It is only when a PSS actually assists in re-orienting current unsustainable trends in production and consumption practices, that it can be referred to as a *Sustainable Product-Service System*.

However an attraction of PSS is that its underlying features (as described below) readily lend themselves to the potential of more sustainable solutions.

In a traditional market, the range of stakeholders who take part in the whole process connected to product and service selling tend to optimise their own 'segment' of the process. They are responsible for their phase

of the cycle. Typical stakeholders will operate as discrete entities as shown inside the ring in figure 2 - the raw materials and energy suppliers, the producers, the retailers, the consumers/customers and the end-of-life managers, all make up part of the life cycle framework. Even the design function (encompassing all those involved in the product or service development process) which is situated in the centre to emphasise that it can influence the resource optimisation in other phases (e.g. a washing machine will consume less depending on not only the way it is used but also on the technology used in the original design and production) does not of necessity have to consider the links to all other parts of the value chain.

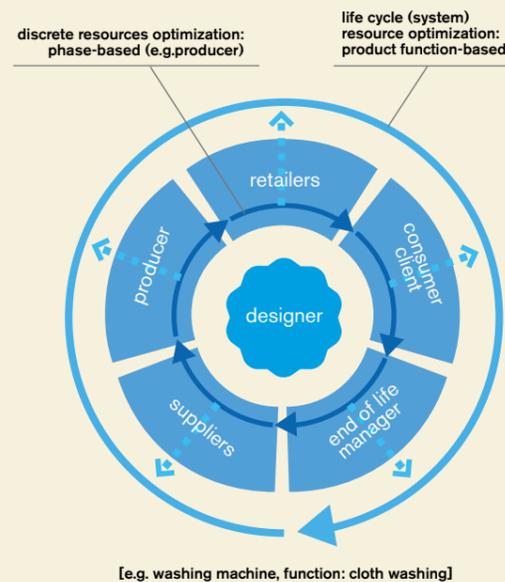
In contrast, the PSS approach, which takes as its starting point the goal of achieving an integrated functional solution to meet client demands, moves away from phase based servicing and discrete resource optimisation, to system resource optimisation which is utility based. The resulting PSS can produce synergies in profit, competitiveness and environmental benefits, because of the opportunities which arise from broadening the system to be optimised (see the outer ring arrow of figure 2). In other words, the potential eco-efficiency of a PSS relies on system optimisation (in resource use and emissions) because of the stakeholders' convergence of interests.

In the traditional model there is no necessary coincidence between economic value for individual stakeholders and overall systemic resource optimisation. For example, the producer of a washing machine may be financially motivated to develop a product which uses the minimum amount of raw materials and supplies in the production processes (see the inner arrows of figure 2) but has little incentive (unless influenced by environmental legislation or consumer demand) to incorporate environmental features which will reduce energy consumption, in use, or to extend the product or material life (by e.g. component re-use or recycling).

Conversely, the adoption of a PSS business model implies new types of stakeholder relationships and/or partnerships, new convergence of economic interests, and a concomitant systemic resources optimisation

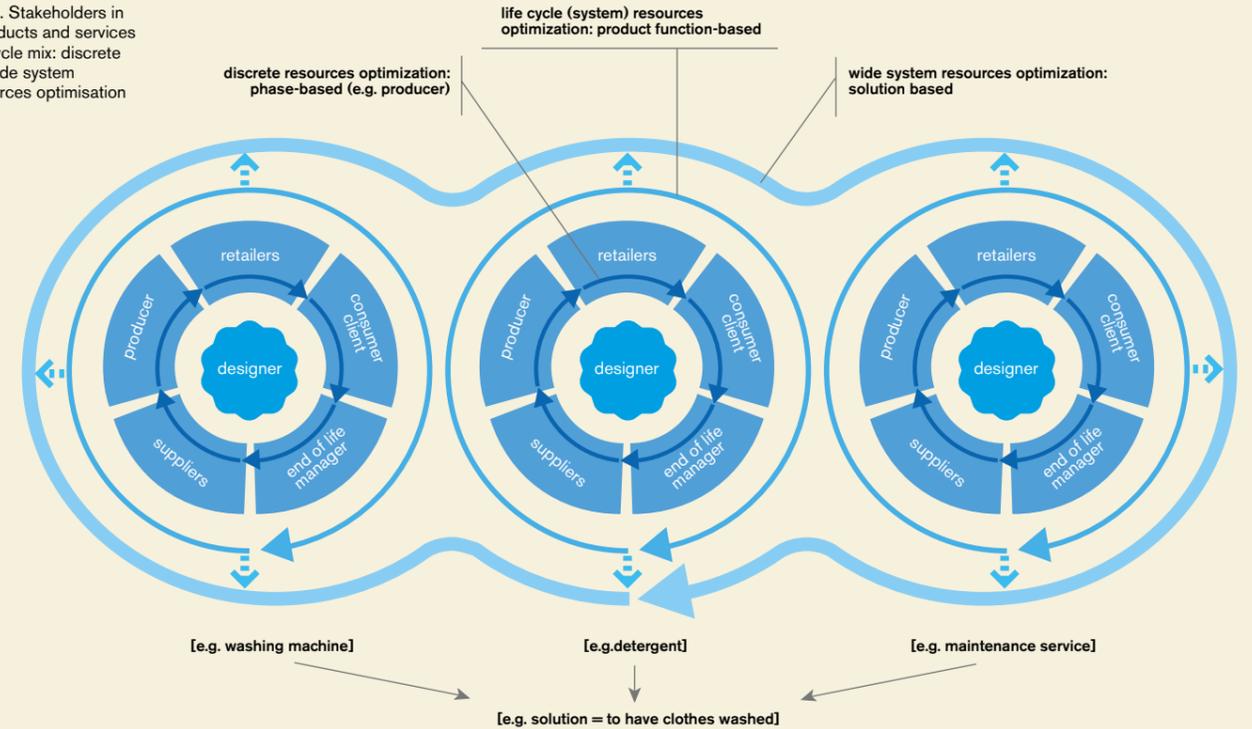
(see the outer arrows of figure 2). For example, if one considers cleaning services as the integrated functional solution (or final result) sought by the client, then profit is linked to the turnover on the sales of the use of the PSS, rather than on the number of washing machines sold. When the full system uses fewer resources, it has a lower overall cost and the gains can be, in different ways, shared among the various stakeholders (e.g. the cleaning service company and its client).

Fig. 2. Stakeholders in a product life cycle: discrete vs. system resources optimisation



Further, if we broaden this notion of whole system optimisation beyond a single product life cycle to an interconnected series of product and service life cycles, then the potential for eco-efficiency gains becomes even greater. In this case (as illustrated in figure 3) the stakeholders panorama is more complex, but offers greater potential for eco-efficiency system innovations.

Fig. 3. Stakeholders in a products and services life-cycle mix: discrete vs. wide system resources optimisation



3. What motivates a company to consider a Product-Service System?

PSS can be seen as strategic innovations which companies may choose in order to separate resource consumption from its traditional link to profit and standard of living improvements; to find new profit centres, to compete and generate value and social quality while decreasing (directly or indirectly) total resource consumption. In other words, PSS as win-win solutions: winning for the producers/providers, the users and the environment.

Three main business approaches to PSS can be seen as promising in terms of their win-win potential (systemic eco-efficiency) and will be explained below:

- Services providing added value to the product life cycle
- Services providing “final results” for customers
- Services providing “enabling platforms” for customers.

Services providing added value to the product life cycle

When applying this approach, a company is providing additional services to guarantee functionality and durability (i.e. product life extension) of the product, which is sold to the consumer or customer. A typical service contract would include maintenance, repair, up-grading and substitution services over a specified period of time. When the contract period is over, the PSS provider may take back the product, deciding about its possible sale or disposal.

An example of this is a service sold in conjunction with a product, such as a delivery service – characterised by an efficient system of transportation and packaging replacing individual inefficient acquisition (→ *Allegrini Casa Quick* case); or a maintenance and upgrading service sold with a product (→ *Klüber S.A.T.E. movable laboratory* case); or a service relieving the client of the product's end-of life treatment.

Win-Win solution

In this approach the win-win potential of a PSS is realised by:

- minimising costs for a long lasting serviceable product; hence the producer will seek to extend the life of the product through better reliability, maintenance, repair and upgrading; and
- designing and developing products which take into account the product's end-of-life (meaning that producers build into the product, parts and materials which can be easily re-used, replaced, recycled, composted or combusted).

Services providing final results to customers

This PSS strategy offers a customised mix of services (as a substitute for the purchase and use of products), in order to provide a specific final result (in other words, an integrated solution to meet the customer's satisfactions). The mix of services do not require the client to assume (full) responsibility for the acquisition of the product involved. Thus, the producer maintains the ownership of the products and is paid by the client just for providing the agreed results. The customer benefits by being freed from the problems and costs involved in the acquisition, use, and maintenance of equipment and products.

The best-known and most widespread application of this is found in the field of climate control and heating of buildings, where companies begin to sell thermal comfort or water heating (→ *AMG: solar heat service* case) instead of fuel and heating appliances: for those companies the less resources are consumed for heating, the higher the income. A similar approach has been followed in other fields, such as agriculture, industrial painting and engineered materials. In agriculture, a 'pest control service' can be offered (and not the supply of pesticides); when introduced, a decrease in the quantity and variety of sprays used has been

observed. The same attitude of selling results rather than products can be found in the field of durable goods (e.g. providing the copies, versus selling copying machines) and appliances. Other innovative examples include paying a fixed subscription in advance and receiving the best available food produce selected by the provider (→ *Odin: organic vegetables subscription system* case).

Win-Win solution

In this approach business is motivated to innovate a PSS in order to:

- Minimise the energy and materials consumed by optimising use. Payment is based on the unit of service and not on the unit of consumed resources.
- Extend product life through higher reliability, maintenance, repair and upgrading. This could postpone disposal costs and the costs of new product manufacture.
- Save on the costs of components by re-using or re-manufacturing those collected from the disposed products.
- Extend material life through recycling, combusting or composting, to reduce landfilling and limit new resource acquisition costs.

Furthermore:

- Specialisation, and the higher level of technological features a supplier may be able to economically afford, and the economies of scale which can optimise resource consumption and waste production, may, taken together, lead to greater eco-efficiencies for a company.

Services providing enabling platforms for customers

In this approach, a company offers access to products, tools, opportunities or capabilities that enable clients to get the results they want. The client obtains the desired utility, but does not own the product that provides it, and pays only for the time the product is actually used. Depending on the contract agreement, the user could have the right to hold the product/s for a given period of time (several continuous uses) or just for one use. Commercial structures for providing such services include leasing, pooling or sharing of certain goods for a specific use.

This is a strategy, which has been applied to traditionally individually owned goods which are used for short periods of time, such as tool rentals, laundry services or car sharing. For example, in developing countries an enabling platform can also provide access to scarce or previously unavailable goods.

Examples are the agricultural co-operatives which purchase tractors and tools and other staff through a consortium, and book out their use-time to associates; this gives systemic efficiencies through the more intense use of those products (→ *COVIAL: co-operative of 'Vinicola Aurora'* case). Car sharing initiatives work in a similar way, providing a fleet of vehicles to be booked and paid for by members (→ *AutoShare: car sharing service* case). Other examples are the so-called virtual offices (→ *Virtual Station: virtual office service system* case) in which the

companies supply, in a collective place, secretariat services, bookbinding, etc. and several other products such as telephone, fax, computers, printers etc. In developing countries this assists small entrepreneurs or professionals who do not want to invest in their own office; in developed countries this approach is taken up by large companies (e.g. consultancy) and public sector organisations. Other examples are seen in the field of new information technologies where access is gained to shared facilities (both in developing and developed countries), such as internet connections (→ *Greenstar: solar e-commerce and community centre* case). Finally, in the field of education and childhood, an example is given of how toys can be rented for a given period (→ *Eureka: toy library* case); thus, in developing countries, easier access is provided to these kind of products).

Win-Win solutions

In this approach business is motivated to innovate a PSS in order to:

- Maximise the use of a given product to meet needs/demands. Fewer products are needed, there is a lower service provider costs and a resultant reduction in the number of manufactured products needed for a community of people in a given time
- Extend both the life of the product and the materials used to produce it.

Furthermore

- The shared or collective use of the products leads towards a faster replacement (in terms of numbers of years) of worn out products with more eco-efficient designs, without an increase in the overall amount of goods manufactured; and
- The higher the level of specialisation, technological features and economies of scale of the service provider could result in eco-efficiencies.

4. Undertaking profitable and competitive business and reducing environmental impact

The PSS benefits for companies result from the potential of *higher operating efficiencies and improved strategic positioning*.

Higher operating efficiency

A shift to PSS can result in a situation where a company continues to make a profit and at the same time reduces the environmental impact of resources consumed. The bottom line is that, compared to a traditionally produced product, a company can make more money if it can meet the same demand by providing a less resource/service intensive product, and related service mix. Cost savings for the producer/service-provider result from reduced quantities of product materials, streamlined managerial costs, and reduced costs from prolonged responsibility for the product, throughout its use and disposal. Of course these potential reductions

have to be balanced against the possible increase in costs of servicing, transportation, disposal and recycling. In fact, today the cost of labour in industrialised countries may represent a barrier for a shift to PSS.

During the **use phase**, the producer has a potential economic interest to reduce the amount of resources consumed, because profit is dependent on the amount being paid per unit of service provided to the customer. Furthermore, since the producer remains the 'owner', or at least retains some responsibility for the product over its life-cycle, there is a further economic incentive to extend a product's lifetime. In this way the producer, in essence, postpones both the disposal costs and the costs of manufacturing a new product.

At the **end of a product's life**, the producer has a potential economic interest to re-use or re-manufacture components of disposed products to save on landfilling and new product manufacture. Furthermore, the producer will be motivated to look into other ways to extend material life, such as recycling, energy recovery or composting.

Improved strategic positioning

A PSS may improve a companies strategic positioning because of the potential added value perceived by clients, which comes from focusing on the utility delivered from a product service mix; the client is freed from the costs and problems associated in the acquisition, use, maintenance and disposal of equipment and products.

More specifically, an improved strategic positioning could be obtained as a result of:

- **New market development** a differentiated offer of a new product-service mix, typical of developed countries by giving an added value to consumers compared to a product only (most of the cases in Part 2 demonstrate this)
- **Increased flexibility** to respond more rapidly to the changing consumer market, due to new outsourcing relationships
- **Longer term client relationships** which lead to stronger company-customer relationships, so that the customer or client does not leave to find another producer (→ *Allegrini: Casa Quick*, → *Odin: organic vegetables subscription system* or → *Eureka: toy library*)
- **Improved corporate identity** to respond to the demands for a company to be 'responsible and transparent', by showing its environmental and social benefits (→ *Odin: Organic vegetables subscription system* or → *AMG: solar heat service*)
- **Improved market and strategic positioning** because of existing and future environmental legislative requirements/or restrictions, e.g. Extended Producer Responsibility, resources taxes, environmental performance labelling and standards and specific international agreements.

5. Product-Service Systems and the current economic transitions

Product-Service Systems can be relatively 'light' to introduce. In fact, PSS are design-based business strategies which rely on existing technologies and socio-cultural contexts.

An increasing number of people, in both rich and poor countries, are rethinking the definition of consumer desire as it relates to standard of living, and are moving away from the traditional concept of product ownership as a primary goal. Words such as: 'outsourcing', 'flexibility', and 'accessibility' are gaining greater currency especially with for companies (business to business PSS), but even with end-users (business to consumer PSS).

Businesses, on the other hand, are adopting PSS to respond to this new demand and to be more flexible in the rapidly changing consumer market, e.g. by outsourcing their activities. Because PSS are based on an articulated system of stakeholder relationships, within a service context, businesses are now relying more on Information and Communication Technologies (ICTs) to create the necessary 'metabolic system'. ICTs become an empowering tool and promote new ways of doing business. One good example which illustrates how short-term strategic innovations have resulted in new forms of organisation – is that of the growing number of companies which are now managed as flexible and distributed networks.

It needs to be stressed again that changes in the ways business is done (in this period of socio-economic transition) does not necessarily mean they are sustainable *per se* (e.g. ICT could be more resource and cost intensive than old solutions because of its rapid obsolescence), but it presents interesting opportunities for companies to produce eco-efficient PSS. We have seen for example:

- The dematerialization potential of new technologies: shifting the production of value from hardware to software
- The increased possibilities of managing more and more complex systems of interactions: allowing more eco-efficient flows of resources and information on a systemic level and
- The increase of outsourced activities: leading to better possibilities of efficient resource consumption, mainly due to economies of scale and specialisation.

6. Potential benefit for all: developed and developing countries

Developing countries need to go through a process of economic growth to reach a similar standard of living of developed countries. As a consequence, we have to expect an increase in natural resources demand. An important question is whether PSS could be a valid business strategy for both developed and developing countries.

Can PSS, as an approach, be applied to reach more sustainable production and consumption patterns in developing, newly industrialised and developed countries?

Furthermore, what lessons can we draw from the applications and experiences of PSS in different economic situations?

In answering this question it is useful to note that although perceived as an 'advanced concept,' PSSs do not require significant investments in specific technologies (except for ICTs, which, in comparison with earlier economic infrastructures, require a drastically lower investment cost). Additionally, PSSs take advantage of human capital resources so applications can vary depending on specific consumer needs.

- **In developed countries**, which consume more resources and produce more pollution, PSS can be an attractive way to make the transition towards a service economy. Proposed new mixes of products and services that are based on existing, though evolving, technological reality do require a cultural shift to redefine customer needs away from product ownership.
- **For developing countries**, a business application of PS systems may complement other political and economical interventions – and act as an opportunity to facilitate the process of industrialization, by jumping over or by passing the stage characterized by individual consumption/ownership of mass produced goods - towards the more advanced service-economy. In this case, a PS systems approach could reach and provide a widespread higher level of well being or utility at lower cost, because of the higher system efficiencies. In other words, it may represent a more promising and environmentally "lighter" path to contribute to industrial development.

Generally speaking, the economic opportunities for business would be in terms of market differentiation in developed countries and in terms of a market expansion in developing countries. In fact, for developing countries many PSS already exist as a consequence of economic and cultural conditions, such as scarcity of access to products and resources, large labour forces and locally focused culture and traditions.

Some of the most modern utilities have been offered and accessed by large numbers of people through service brokers. For example, the dissemination of Internet cafe sites in developing and newly industrialised countries is even more rapid than in the developed world. We also see in these countries, more shared use of products (in keeping with cultural norms) than in industrialised countries, and lower labour costs (PSS are generally more labour intensive) which may put developing countries at an advantage.

Finally, a PSS approach focuses more on specifying the context of use, and means greater company involvement at the user locations. In developing countries this may have positive implications, by enabling greater involvement and ownership of local economies by local rather than global stakeholders. There is also a potential for strategic partnerships between global and local stakeholders to benefit all.

A critical issue for developing countries now, is to examine ways of improving the range and environmental quality of existing systems, or, in other words, ways of improving the social and environmental quality of PSS business in those countries. To achieve this, it is essential that they gain access to information and knowledge from the best and most advanced technologies, which have the potential to make these businesses really economically and socially appealing.

7. The dilemma of the rebound effect

It has been said that not all shifts to PSS result in environmental benefits and/or economic advantages and that a PSS must be specifically designed, developed and delivered, to be highly eco-efficient. For example, schemes where products are borrowed and returned incur transportation costs (and the resultant use of fuel, and pollution emissions) over the life of the product. In some specific instances, the total fuel cost and environmental impact may make the system non-viable in the long-term.

Thus, even when well designed, it has been observed that some PSS changes could generate unwanted side effects, usually referred as **rebound effects**.

Society as a whole is a set of complex, inter-related systems that are not clearly understood. As a result, something may happen that turns *potential* environmentally friendly solutions, into *increases* in global consumption of environmental resources at the practical level. One example is the impact of PSS on consumer behaviour. For example, outsourcing, rather than ownership of products, could lead to careless (less ecological) behaviours.

Nevertheless, PSS development, seen as a whole, presents a potential for generating win-win solutions which promote profit, environmental and social benefits. They have the potential to provide the necessary, if not sufficient, conditions to enable communities to leap frog to less resource intensive (more dematerialised) systems of social and economical standards.

8. Barriers to adopting Product-Service Systems

The main barrier to adopting PSS in developed countries is the cultural shift necessary for the user to value 'having a need or want met in a sustainable way' as opposed to 'owning a product'. This cultural leap can be made, but is not straightforward for a consumer or intermediary retailer (as client) to understand. In a developing country, the main barrier may be the availability of advanced technological information and knowledge, to produce a socially and economically viable PSS.

Businesses face barriers in the design, development and delivery of PSS, in implementing the changes required in corporate culture and organisation, to support a more systemic innovation and service-oriented business. In this regard, it has been observed that some companies in mature industries see it as an opportunity to survive, whilst others see it as a way of gaining entry to a new sector.

A further obstacle for business is the difficulty of quantifying the savings arising from PSS in economic and environmental terms, in order to market the innovation to stakeholders both inside and outside the company, or to the company's strategic partners. Other barriers faced by business include lack of knowledge and experience in terms of:

- service design methods and tools
- new tools, which companies can use to assess and implement PSS
- service management systems
- entrepreneurial personnel who are skilled in service development and provision, and life-cycle costing methods.

Furthermore, businesses may perceive the risks of:

- conflict with existing internal procedures and tools, e.g. accounting and reporting methods
- service being easily replicated by a competitor (more easily than a physical product)
- partnerships and entrepreneurial interdependence leading to reduced control of core competencies and reducing the influence of business decisions.

Finally, barriers to be overcome may include a lack of external infrastructure and technologies, e.g. for product collection, re-manufacturing or recycling.

9. What are next steps for companies?

Given that a PSS approach changes the supply and demand relationship, a company must first break down the 'business-as-usual' attitude and recognise new opportunities. Accordingly, a company must generate a new corporate culture and organisation to support a more systemic innovation and service-oriented business.

More precisely a PSS approach requires:

- Managerial vision for innovation: the ability to recognise new opportunities, to recognise and design new product service mixes that provide added value to a product life cycle, final result or enabling platform.
- An innovative corporate culture capable of promoting new forms of internal organisation
- An innovative corporate culture capable of promoting new forms of external partnerships, and having the ability to interact on new levels with different stakeholders
- A knowledge of the opportunities offered by the new ICTs to empower the realisation and the application of a PSS (e.g. the maintenance, repair or other typical user services of a PSS can be monitored in eco-efficient ways with new ICTs devices).

Initially, companies can start acquiring more information or attending training courses (→ For more information) to work with different tools, e.g. in product design (Life Cycle Assessment and Life Cycle Design) or management (life cycle management approaches). Subsequently, a starting point can be identified about how to go about implementing or improving PSS. This will vary depending on whether a business is entering a new market sector, or shifting within its existing sector from simple product selling to a PSS.

In the first case, an analysis of the new sector needs to be made to identify the presence of already existing PSS, and of course, the opportunities to introduce a new one. A strategic analysis should be made, envisioning the whole system of products and services that fulfil a given 'demand' for 'result'. In other words, an analysis of the current market situation, the trends in frame conditions, the customer demands and the stakeholders who could be involved in the new PSS, should be made to highlight potential business advantages.

In the case of a company wanting to shift from product selling to a PSS in its own sector, a review should be made to identify within the company which activities are most suitable for piloting change. The process of building a new corporate culture could be then implemented by successive steps. Throughout this process, relationships with research institutions, such as Universities, could provide fruitful initial opportunities for company involvement in specifically funded Institutional research programmes. (→ For more information).

10. UNEP is taking action

Further research and development related to PSS and functionality is needed. UNEP initiates and facilitates research, training, awareness raising and policy development pertaining to PSS and other life cycle based tools such as Life Cycle Management (LCM), Life Cycle Assessment (LCA), eco-design, eco-labeling and supply-chain management. A key effort in this regard is the UNEP / SETAC (Society for Environmental Toxicology and Chemistry) Life Cycle Initiative.

The Product Service Systems (PSS) strategy is one of the approaches to promote sustainable consumption and production patterns. Life-cycle based tools provide the basic support for addressing change among consumers as well as producers. As demonstrated in this booklet, PSS has the potential of providing win-win solutions for society and for the environment. PSS require that a co-ordinated approach be taken by several groups of stakeholders. This is a response to the Malmö declaration signed by Ministers of Environment, May 2000, which stated that "Our efforts must be linked to the development of cleaner and more resource efficient technologies for a life-cycle economy".

11. A promise of sustainable innovative ideas

Product-Service Systems embody the potential for sustainable innovative ideas for companies in different socio-economical contexts, because they link sustainability with existing and emerging dynamics of economic and cultural change. For developed countries, PSS represent a potential trajectory, within the on-going economic transition towards the service economy. For developing countries it represents a promising path to contribute to industrial development, by avoiding (leap-frogging) some of the mistakes already made by developed countries. This booklet has tried to outline some of the potential of using PSS to shift current production and consumption patterns. Examples do exist, and can be used as models to learn from; others are in their inception. Further PSS applications will need to be developed and implemented. It is possible to foresee a generation of service-oriented solutions, based on company-led innovations, shifting a company's focus from *products* to *services*. PSS have the potential to open new markets. In fact, if, and when they are successful, it will be because the product service mix offered is recognised by the potential customers (be they companies or individual consumers), as better than existing solutions, or because they are meeting previously unanswered demands. In this context, a PSS approach, may be seen to offer real win-win solutions. Entrepreneurial initiatives in which *everybody wins*: the supplier, the clients and the environment.

Allegrini: Casa Quick



Company background

Allegrini S.p.A. is an Italian producer of detergents and cosmetics. Since its inception, Allegrini has always paid attention to respect for the environment. This was already evident at the end of the '60s, when Allegrini began producing biodegradable detergents. Allegrini's detergents, which are phosphorus-free and contain vegetal surfactants, are renewable, and obtained from palm and coconut oil, potatoes, corn, rice, vegetal glycerine.

Description of Product-Service System

Casa Quick is a service providing added value to the product life cycle, based on a home-delivery distribution of detergents. Casa Quick products are taken from mobile vans, which move from house to house, on a regular route. Each family draws down the detergents needed from the mobile van, in the quantity and quality preferred, using special containers and paying only for the quantity taken. Casa Quick consumers

receive a kit of plastic flasks which are easy to carry from the house to the van, and can be filled up even if not completely empty.

This system incorporates the product (the detergent) plus a service (home delivery), with a lower-level of client effort: there is no need for the client to travel to shops, rather, it is the 'shop' itself which moves to the client. Finally information is given to consumers on how to use the products to optimise the effect and minimise the amount used.

Product-Service System development

In 1998, Allegrini innovated a new way of supplying detergents for house-keeping. During its first year of activity, the effectiveness of the service led to widespread support. In fact, Casa Quick now attracts 25% of the potential clients in the geographical area it services. Seven different types of products are delivered each month by the Casa Quick mobile van, which regularly visits four municipalities, each of which has about 3.000 families.



Contacts Details

Ottaviano Allegrini
Allegrini S.p.A.
Via Salvo D'Acquisto, 2
24050 Grassobbio (BG)
Italy
Tel. +39 (0)35 4242111
o.allegrini@allegrini.com
www.allegrini.com

BENEFITS

Environmental

The environmental benefits are obtained by the optimisation of the distribution processes, in terms of both packaging and transportation. Previously clients used disposable flasks, but with the packaging re-use in the Allegrini system, there is a consequent reduction in raw material consumption and a minimisation of production processes. In fact, it has been observed that over a one year period, no container has been replaced. For the same reason, packaging landfill is reduced. Importantly, other problems related to waste treatments are also avoided: when recycled, traditional packaging causes

problems because of detergent residuals contamination; and improper disposal of packaging with possible dispersion of residual detergents is also minimised with the Allegrini system. It should be noted that this system is optimal in high density areas because of the transportation component.

Economic

The economic benefits are significant both for the producer and consumer. For the company, the major drive is to gain and keep the loyalty of customers over the long term, and the provision of a home delivered service deters customers from

seeking other producers. At the same time, the reduction in packaging costs lowers the price of detergent, and extending the life of the flasks helps in postponing the cost of new product manufacture. A clear added value for the consumers is the increase in comfort, with door to door delivery and reduced waste disposal. Allegrini also gains a competitive advantage in terms of diversification of the service provided. New market niches are opened to the company. In one year of activity, it has been estimated that Allegrini had a market share with a value of 50.000 €. Finally, disposal costs (generally paid by all) are reduced.

Klüber: S.A.T.E. movable laboratory

Company background

Klüber is one of the world's leading lubricant suppliers, backed by more than seventy years of research and development experience. Speciality lubricants from Klüber are used all over the world, for machines and components in various branches of industry.

Description of Product-Service System

Klüber has moved from selling to commercial customer just lubricants to a service providing added value to product use. Using a service called S.A.T.E.

it analyses the effectiveness of aerosol treatment plants and sewage treatment. For this purpose, Klüber has designed a movable chemical laboratory, a van, that is able to monitor a client's industrial machines directly, to determine the performance of lubricants used, and their environmental impact. It also controls noise, vibrations, smoke and many other undesirable industrial impacts. The additional service which Klüber offers clients, leads to plant improvement in term of efficiency, guarantees functionality and durability, and enhances environmental protection.



Contact Details

carlo.merli@it.kluber.com
Klüber Lubrication Munchen KG
Geisenhausenerstr. 7
81379 Munchen
Tel.: +49 089 78 76-0
Fax: +49 089 78 76-333
www.kluber.com

BENEFITS

Environmental

Klüber has broken away from the business-as-usual attitude. Its interests do not rely just on the amount of lubricant sold only, but also on service, and in fact there has been a reduction in the overall quantity of lubricant consumed per unit of service, and thus a reduction in polluting emissions. Other benefits arise from the improved monitoring of performance of various machines, so that any accidental pollution can be avoided. For example, a leading

Italian company of aluminium pressure castings, has reduced the consumption of chemical reagents in its purging systems by 20%. In another leading company involved in the mechanical machining of copper alloys, a lubricant containing chlorine, phosphor, boron, and formaldehyde has been substituted with another without these toxic compounds. Finally, the Klüber approach means operators are better safeguarded.

Economic

Clients perceive they derive added value from this service because it frees them from the costs and the problems associated in the monitoring and checking of their equipment. Achieving better efficiency from lubricants also provides many economic benefits both in production processes and in improving the life of machines, and plant costs are also reduced.

COVIAL: a co-operative of "Vinicola Aurora"

Company background

The COVIAL is a co-operative established within the Vinicola Aurora Ltda, the biggest wine-company in Brazil. It has 300 employees and sales of about \$ 50.000.000 per year. They produce 16% of the global wine production in Brazil, quantified as 34.000.000 litres every year. Vinicola Aurora Ltda's produces reds, whites, sparkling wine and grape juice. They also export to the United States. The COVIAL co-operative has 1300 associates and is the biggest wine market co-operative in Brazil. It is located in south Brazil, in Bento Gonçalves, in the state of Rio Grande do Sul. The co-operative makes use of 45.000.000 kg of grapes per year.

Description of Product-Service System

The COVIAL co-operative has ten members: the manager, three agronomists, two technicians, one accountant, one secretary and two social assistants. The associates take part in the COVIAL decision making process through thirteen elected representatives who attend regular meetings of the co-operative. The COVIAL provides enabling platforms and a final 'result' service to its associates. It supplies technical equipment to work on the vineyards (available to be booked by associates) and purchases seedlings from Italy, France and South Africa. It also bulk buys dung, herbicides and various

pesticides, barbed wire etc. and resells these to associates. In addition, four agronomists and two technicians are at the associates' disposal, and classes, and training courses on vineyard management, pruning and grape-harvesting are organised. Associates pay for services, equipment and materials when they deliver their produce; a part of their final fee (dependent on their size) is held back to cover the running costs of the co-operative.



Product-Service System development

The wine co-operative was initiated in 1931, nearly a century after Vinicola Aurora's commencement in 1875. It was created by a group of families of Bento Gonçalves. The idea of having a co-operative within a production company such as Vinicola Aurora, arose in order to; guarantee to associates the quality of grape seedlings coming from different

Contact details

Valdemir Bellé
Cooperativa Vinicola Aurora Ltda.
Ufficio Dipartimento Agricola
Rua Olavao Bilac n° 500
95700-000 Bento Goncalves (RS)
Brasil
Tel: +55 54 4552000
agricola@vinicolaaurora.com.br
www.vinicolaaurora.com.br



suppliers; guarantee to associates that all their produce would be acquired (by the COVIAL); and to guarantee harvest quality to Vinicola Aurora. The outcome is that different wine producers have established a network and a structured service centre, to create their own self sustaining Product-Service System. With its 1300 associates, the co-operative is no longer accepting new members as it has reached maximum viable participation.

BENEFITS

Environmental

The environmental benefits are generated by the sharing of technical equipment which leads to more intensive use, and access to more costly but efficient equipment than could be afforded by individual purchase. The assistance of agronomists and provision of training also leads to greater knowledge and consequent efficiencies.

Economic

There is an advantage for associates because, from seedling plant out, until harvest and collection, they can get ready access to technical and logistic support from Vinicola Aurora. They obtain professional equipment and personnel (agronomists) support, at less than market price, and make cost savings because of COVIALS bulk buying of sprouts and herbicide etc. Risk is minimised for associates because of

the guaranteed purchase of their harvest and for Vinicola Aurora because grape quality and quantity is assured.



AMG: solar heat service



Company background

AMG was initiated in 1906 as a municipal enterprise, providing the city of Palermo with gas and lighting. It is now involved not only in its institutional duties, but also in innovation and development directly linked to environmental issues. In fact, it distributes methane, it administrates public illumination and the traffic-light system, and it is actively promoting the use of renewable sources of energy and the implementation of experimental energy and environment projects.

Description of Product-Service System

The 'solar heat service' is a service providing a result, consisting in 'selling' heat as a finished product. Hot water is produced by new equipment that combines sun, energy and methane, with economic and energy savings. Solar plants are designed in order to maximise the contribution of solar energy. Hot water is measured by means of a specific heat meter and the whole system is monitored, in order both to control in real time how the system works, and also to apply the Guarantee of Solar Results, a specific contract through which the installer makes a commitment to get a pre-determined level of efficiency. AMG has already tested this service in a Tennis Club in Palermo city (Italy), providing hot water for the dressing-

rooms. The innovative feature of this Product-Service system is that AMG will not invoice the client for the methane consumed to obtain hot water, but rather, hot water is sold as an entire service. AMG sells heat, and calculates the thermal kilowatts consumed by its clients; for instance, in 2001 one litre of hot water costs 0,2 euro cents. With AMG the consumer pays for receiving a comprehensive service, from the installation, to the thermal-energy meters, and to the transportation of methane to the boilers. With equipment maintenance provided as well, the customer is overall buying a 'final result'.

Product-service system development

The 'solar heat service' is one of the biggest distributor to consumer initiatives which AMG has taken. The service took shape from the belief in the need to enhance the value of an important natural resource -solar energy. In the current climate, environmental problems have given rise to the need for a differentiation of one's business, and a search for new solutions, leading in this case to the constructive association of solar energy and methane. The Ministry of Environment has launched an important initiative based on the example of AMG, where it gives financial support (up to 30% of the cost of capital), for organisational, administrative and technical aspects of similar programs.

Contacts Details

Tullio Pagano
AMG Energia SpA
Via Amm. Gravina, 2/E
90139 Palermo
Italy
Tel. +39 0917435 207 – 272
azienda@amg.pa.it
www.amg.pa.it

BENEFITS

Environmental

This new product-service mix is sold as a complete service, which can significantly benefit the environment. The combination of methane and solar energy used to produce hot water supplies is 70% of what is needed. The company thus becomes motivated to innovate in order to minimise the energy consumed in use. Billing is by unit of service and not per unit of consumed resources. The less methane consumed (the higher the use of solar energy and the system efficiency) the

higher the income for AMG. AMG estimates this will lead to a decrease in emissions of 100 tons of carbon dioxide per year.

Economic

AMG derives economic benefits through diversification. It is improving its strategic position by giving added value to consumers, as well as the use of clean energy. From this perspective, it has achieved considerable value by tapping into local solar radiation as an economic

resource. Within the European context AMG has achieved considerable results and found real economic opportunities in terms of market differentiation.

The initial investment, used for the panels, is offset because half of the thermal energy needed is generated by solar energy, thus free. To give an example, an installation of 100 sqm. of panels costs about 50.000 €. The saving per year is about 6.000 €, compared to a traditional configuration. At this rate, eight years will be needed to recover the initial investment.

AutoShare: car sharing service

Company background

AutoShare, headquartered in Toronto, Canada, is a private corporation run by two primary shareholders. AutoShare's staff totals four people, and the organisation began operation at the end of 1998. AutoShare has a fleet of 19 cars and a membership of approximately 260 people. It is still very much in a 'growth' phase and as such, approximately half of the staff is focused on marketing and the other half on operations.

Description of Product-Service System

AutoShare, like many other car sharing systems, is a service providing an enabling platform. Cars are stationed near member's homes and accessible 24 hours a day via a telephone reservation system. Members can use the car for as little as one hour, or as long as they like. To obtain these benefits, members pay a small subscription fee to AutoShare to contribute to the fixed costs of the company, and are then charged only for the hours that they use the car. Essentially a member pays for the mobility they use (rather than needing to outlay a large amount of money for something that will spend most of its time immobile). All AutoShare cars are stationed at, or very near, a transit stop of the public transport system of Toronto, which consists of subway trains, streetcars and buses. This

also helps accommodate customers combining public transit and car trips. AutoShare currently has a partnership with a local car rental agency where it obtains nearly new cars from the agency for short-term leases, and in return, sends the agency the longer-term rental business which Autosshare cannot accommodate. Car sharing is targeted at people who will use it for major shopping expeditions, weekend trips to second homes or visits to friends / family who live at a distance.

Product-Service System development

Initially the motive for starting this service was as a means to alleviate the parking congestion in Toronto's 'downtown'. After researching the Quebec City car share

(and other successful European car sharing initiatives), it became apparent that large scale car sharing could also have a positive impact on traffic congestion and air quality in the city, and at the same time add a new component to the currently available transport options. The business is now attempting to establish a Canada-wide car sharing association with cross use agreements. For example, allowing a member to fly from Toronto to Montreal and use a car from another car-sharing business. AutoShare is also involved in a joint promotion scheme with the Transport Authority in Toronto, where people who buy annual metro-passes from the Transport Authority are given a substantial discount option on their subscription to AutoShare.



Contact details

Liz Reynolds, President
24 Mercer St.
Toronto
M5V 1H3 Canada
Tel: (416) 340-7888
Fax: (416) 340-0080
lizr@autoshare.com
www.autoshare.com

BENEFITS

Environmental

A car sharing system basically intensifies the use of cars, meaning a lower number of cars are needed in a given context for a given demand of mobility. AutoShare estimates that every 'shared' car on the road replaces 5 to 6 privately owned cars and this helps deter non-car owners from purchasing. A side effect is the reduction in car use per demand of mobility, in favour of public transport or other means, such as bicycles and walking. In fact, members belonging to

the car sharing organisation tend to drive much less than car owners, as it is in their interest to drive less in order to reduce the hourly costs associated with driving behaviour. This, in turn, reduces emissions which contribute to smog and climate change.

Economic

AutoShare has benefited by opening up a new market. Although environmental consciousness is attractive to members and helps 'sell'

the service, the economic benefit is, for them, the primary attraction. For car users, a subscription to AutoShare provides convenient access to car mobility at lower costs than a traditional car rental agency. For those who travel less than 12,000 km per year by car, subscribing to, and using the AutoShare service, is cheaper than purchasing a private car, and the company manages the associated issues of owning (regular maintenance and repairs, cleaning, insurance, etc.).

Odin: organic vegetables subscription system

Company background

Odin Holland was set up in 1983 and has an annual turnover of around £12 million. It has a staff of 80 people, of which 65 are full time employees. The business has 3 main activities. It imports and exports fruit and vegetables around Europe, distributes organic vegetarian food to specialist organic shops and provides an organic food subscription directly to consumers.

Product-Service System description

Odin Holland supplies an additional service of organically grown fruit and vegetables to consumers. The consumer receives the produce by paying a fixed subscription fee. Once a week the consumer is sent a paper bag with assorted fruit and vegetables and accompanying recipes from an (often) organic store in the neighbourhood. One Odin bag provides fruit and vegetable needs for consumers for around four days. The selection of best available produce is

made by Odin. Customers do not pre-specify the mix of produce. Where possible Odin supplies regionally grown food which minimises transport over larger distances. Some food is however imported, especially in the wintertime, for the purposes of variation. All produce is supplied to Odin by growers on a fixed price contract, without going to third parties such as wholesalers or auctions. Odin works directly with the growers to plan cultivation, and effectively work as a supply manager of the growers' produce, based on the forecasts of consumer demand for particular vegetable needs. In fact, information is given to the consumers, which directly enable these farmers to grow organic produce in demand. In return, the consumers share the harvest and participate in the system. As part of the supply relationship Odin also offers its growers advice on agricultural and horticultural matters by experts. Around 100 growers are

cultivating approximately 500 hectares of land. All organically produced vegetables and fruit supplied are certified by the Dutch organisation responsible for all organic certification.

Product-Service System development

Odin Holland started as a small group of motivated people trying to improve the market acceptance of more environmentally friendly food. The subscription service itself, was set up by Odin as a means of direct supply to the consumer from the producer, rather than using other partners in the supply chain. Whilst this has economic benefits for Odin, one of the key motivations was to provide a closer link between the consumer and the producer with benefits for all stakeholders. At the moment 28.000 households/families participate weekly. It is a very effective system because of the security it provides to growers (crop-planning and harvest guarantees)



Contact details
Koos Bakker
Director
Postbus 225
4190 CE Geldermalsen
The Netherlands
Tel: +31 345 57 51 54
info@odin.nl
www.odin.nl



BENEFITS

Environmental

Most of the produce is grown regionally and therefore the transport costs to deliver the goods to Odin are reduced. Packaging waste is also minimised, both in the transport stage and end product packaging. Even produce waste is minimised because Odin is managing the selection, for best optimisation, in regard to production trends. It has been estimated that, with about 10.000 families joining the Odin subscription system, the likely (and significant) energy and resources saving equates to: 350 Kg pesticides and herbicides; 2.652 billion kilojoules energy, 23.000 Kg packing materials, 546.000 t/kilometres transport.

Finally, as all of the produce is grown organically there are no pesticides used and no artificial fertilisers, and hence the impact on soil quality (degradation) is lessened. This means too, that the biodiversity of local animal populations suffer less because of the absence of pesticides.

Economic

Since the introduction of Odin's service, the organic food stores have experienced 15% additional growth because of market differentiation, mainly by new customers. Odin also achieved a revenue growth of 50% in 1998. Odin have an effective supply control (over the grower business, from supply to delivery), thus keeping

losses to a minimum. The growers are offered a fixed price to grow certain produce, which allows them some form of financial security. Furthermore, their margins are higher than with supply to either organic food stores or supermarkets. Odin also takes responsibility for any financial consequences due to losses that occur from the supply of produce. Consumers benefit from lower vegetable costs than they would incur from an organic store, as well as an assurance of freshly produced goods; this in turn leads to a stronger customer loyalty to the company.

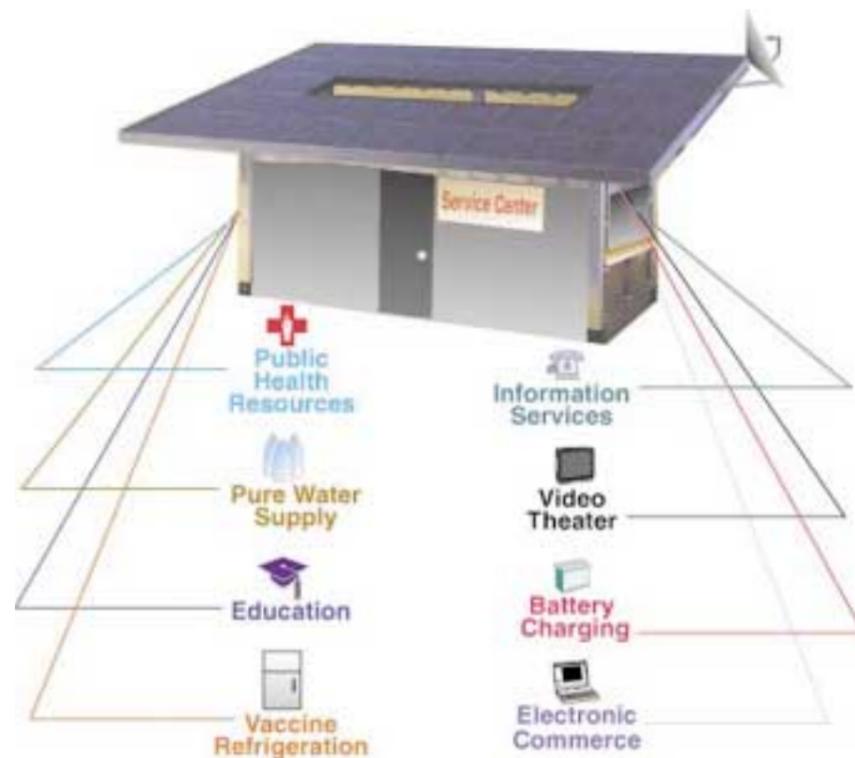
Greenstar: solar e-commerce and community centre

Company background

Greenstar was founded in 1998 by a small group of people with varying backgrounds, including a high tech executive, the head of the US Department of Energy's National Renewable Energy Lab, and a member of the White House Office of Media Affairs. The company presently has a de-centralised network of offices in Los Angeles, Boston, Washington DC, Cairo and Hyderabad, India. Greenstar is a profit-making business. The first priority is to meet basic needs of communities in rural areas without access to electricity and modern communications, then to initiate a source of income to village partners by establishing an e-commerce internet link to worldwide markets and to repay the investors who provide the start-up capital necessary to launch Greenstar's Community Center.

Product-Service System description

Greenstar provides an enabling platform service, delivering a solar powered, wireless connection for villages in the developing world, as e-commerce centres, so residents of remote rural communities can sell their wares world-wide. They record traditional art, music, photography, legends and storytelling in small villages, and bring these products to global markets through the Internet. Products offered on the Web can also include coffee, dried fruits, and spices, as well as handicrafts, art and cultural works like ceramics, brassware, musical instruments, tapestries, etc. Greenstar packages digital culture materials for various markets, both directly to the consumer, and through licensing to businesses. Villagers own the Greenstar Village Centre themselves, and become shareholders in Greenstar.



The centre provides electricity and drives a water purifier, a small clinic, a vaccine cooler and a classroom. The centre is a modular, scalable, unified hardware system, which is highly portable. Each location includes an e-commerce and computer workstation, as well as a medical clinic with basic equipment and tele-medicine connections and a classroom. It is all powered by a commercial-grade photo-voltaic solar power array, and connected to the Web through a satellite dish or digital cellular modem for high-speed telecommunications. Greenstar conducts all business transactions on the Web on behalf of the community through a secure US-based server. The accounting systems transfers a portion of each dollar of revenue directly from Greenstar's holding account into a local bank account for the village, using a

Visa-denominated transfer, that includes conversion into local currency at the best possible exchange rate each day. Authorised representatives of the village can then access these funds by cheque, cash withdrawal, or by credit-card-supported debit card, where available.

Product-Service System development

To date, pilot installations have been completed in a remote Bedouin settlement on the West Bank in the Middle East; in a small community in the Blue Mountains of Jamaica, and in the central India village of Parvatapur, and in a traditional Ashanti community in Ghana. Greenstar plans launches soon in Brazil and Tibet and in over 60 other communities on all continents of the world, building a network of people, skills, ideas, tools and cultural voices.

Contact details

Dr. Charles F. Gay
 Founder Greenstar
 1399 Southwind Circle
 Westlake Village,
 CA 91361-3426
 USA
 Tel: +1 805-370-8530
 Fax: +1 805-370-8141
 cgay@greenstar.org
 www.greenstar.org

Rajeswai Rao Pingali
 Director Greenstar India
 Tel: +91 40 3310560
 +91 3316083
 +91 3397279
 rajeswari@e-greenstar.com



BENEFITS

Environmental

Because the centre is self sufficient in producing its own energy, it requires no development of further infrastructure in order to carry out its purpose. Furthermore, the centre is completely solar powered through a photo-voltaic array, thus using a clean and renewable resource. The solar power can also be used to provide water purification capabilities via solar thermal distillation or pasteurization.

Economic

The facilities acting as e-commerce centres generate income benefits for rural people who own and create the products and provide a return to Greenstar shareholders, in order to cover the cost of capital, provide marketing, logistics and distribution services, and to fund further Greenstar installations world-wide. The centre requires minimum supervision and management and there is always a connection to a global support network via e-mail. One person can manage the

system and provide all support. A one-week intensive training course is provided to select individuals from the local community in order to maintain the centre. Revenues earned from digital culture sales are used to fund an ongoing, community-driven process of literacy, local business, education and training, public health, and environmental programs. This formula provides new jobs and skills, strengthens local culture and language, and affirms people's ability to be self-reliant.

Virtual Station: virtual office service system



Company background

Virtual Station is affiliated to the 'Associação Nacional dos Centros de Negócios – ANCN'. The administrative headquarters is in Londrina-Paraná, Brazil. The virtual station service facilities are located in Fortaleza in an area of high economical and commercial development, with stores, restaurants and supermarkets and is close to the University of Fortaleza (UNIFOR). The company services are targeted to independent professionals, commercial representatives, autonomous and companies working with services.

Description of Product-Service System

Virtual Station is a service providing an enabling platform because they supply a full range of services and infrastructure for a complete office. Clients only pay for the periods in which they use the service. Like other 'Virtual Offices', they are spaces planned to provide efficiency and comfort, at a low cost. They are equipped with computers, printers, scanners, access to internet, TV, video recorders, air conditioning, copiers and bookbinding services. Secretarial services such as reception, personalised phone answer, phone calls, answering and remittance of fax reception and transmission of

messages, transmission of e-mails with personal address, creation and impression of business stationery (cards, envelopes, pamphlets, etc.), typing services, photocopies and translations are generally available. More specialised services are also accessible such as support for advertising campaigns, administrative assistance and bank services. Logistic solutions include lease of rooms for meetings, consultations or interviews with candidates, mini-auditorium lease and coffee-break service.

Product-Service System development

The idea of a virtual space where facilities for all kinds of office work are present, is not new. In fact it is already in use in Europe and the United States of America and it is estimated this trend is increasing world wide by 15% per annum. At present there are around three and a half million such companies offering Business Centres. In Brazil, growth in virtual offices is running at around 25% per annum and is most consolidated in the regions of Rio de Janeiro and São Paulo. Virtual Station has established similar facilities in Ceará (Fortaleza), Brazil.

Contact details

Aldeir Chaves
Av. Washington Soares
1400 - Sala 206,
Edf. Juridical centre
Edson Queiroz. : 60811-341 –
Fortaleza-CE
Brazil
Tel: +55 (85) 278.7274
Fax: +55 (85) 278.6563
virtualstation@secrel.com.br
www.virtualstation.com.br

BENEFITS

Environmental

Environmental benefits include a decrease in consumption of products and energy savings, because of the collective use of equipment and physical space. At every stage in the consumption process there is resource optimisation. The intensive use of infrastructure, machines and tools reduces the amount of manufactured products needed at any given point. IT equipment such as computers can be better utilised before it becomes obsolescent, and needs to be supplanted. Lessening resource

costs of disposal also leads to reductions in resource consumption and emissions.

Economic

Service providers gain customers from start-up companies reluctant to sink too many funds into infrastructure. Utilising Virtual Station clients can save 70% on administrative and routine functions compared to conventional offices. In a given year, Virtual Station estimates that the total cost for a conventional office of 32 sqm. in Brasil, is around 9.388 US\$

per year; compared to a Virtual Station office cost, of between 384 US\$ and 2.784 US\$.

At a system level there are economic benefits because Virtual Station effectively has no down time compared to conventional offices. The regular (albeit temporary) use, generates predictable monthly operational costs and resource demands. Important socio-economical benefits also flow with the concomitant employment generation and requirement for specialist service staff.

Eureka: toy library

Company background

Euréka Toy Library is located in Alberton, a neighbouring city south of Johannesburg. Euréka Toy Library is a small-size family running enterprise, where the owner, Mrs. Jansen, manages everything from the educational aspects to the contractual/administrative requirements. Her background as an Information Technology specialist has enabled her to write computer systems for the stock list and accounting needs as well as to set up the web-site.

Description of Product-Service System

Toy Libraries are PSS, that lend educational items and toys. A variety of toys, games, puzzles and educational aids can be borrowed in a way that is very similar to a public library. Members have access to the stock list, sorted by age or development areas. Free advice is also supplied by toy library's personnel, during the selection of items and with other child related issues.

Families who want to borrow toys from Euréka Toy Library have to become members. The membership fees are of R50 (US\$4.07) per year plus a fee of R20 (US\$1.63) per month. Members can get a discount if the entire year's monthly fees are paid at the time of joining. Items can also be purchased after a "test drive" to guarantee that the child indeed find the item useful. After choosing items, they can



Contact details

Mrs. Euréka Jansen
10 Bowkeria Street
Brackendowns, Alberton
1448 South Africa
Tel.: +27 (11) 867-1195
Mobile: +27(82) 805-7205
zirkj@mweb.co.za
eureka.jansen@mweb.co.za
home.mweb.co.za/zi/zirkj

keep them for two weeks, then return and exchange them for two more toys. When the item is returned, it is checked to see whether everything is in order. The members are asked to clean the items before return them, but the toy library also takes care of cleaning them whenever necessary.

Toys are selected by Mrs. Jansen herself. They need to be durable, interesting, low maintenance and not likely to have many lost or broken parts. Toys without batteries and with not too many small parts are preferred. A web-site explains how items have been organised according to skills and ages, accompanied by photos of toys from the different categories. If the toy breaks, the action taken by the toy library depends on the importance of the damage. If a toy is completely broken or totally lost, the member has to pay the

replacement cost. If, however it is possible to fix the toy to be fully functional again, the toy library repairs it and just charges the member a penalty that will cover costs.

Product-Service System development

Euréka Toy Library started in 1999, as a community library, basically as a hobby, since Mrs. Jansen was interested in pre-school education. But she continued her involvement because she understood the effectiveness of the service as a complete system, satisfying socio-economic and environmental criteria. Euréka Toy Library started with about 100 items, and now has 400. Originally, toys were considered for children from 3 to 5, but the requests were for children of other ages, too. At the moment, there are toys for children from about 1 year old to about 9 years old.

BENEFITS

Environmental

Items are used to their maximum potential and they are no longer bought by one family, used and then discarded when not needed anymore. In this way, they are used many times. In other words, the use of toys and educational items is maximised to meet given demands: fewer products are needed, since this service makes the same product available for a higher number of people. As a consequence, there is a resultant reduction in the number of manufactured products needed for a community of people in a given time and a reduction in disposal. With this perspective, the life of the product is

extended. Finally, the shared or collective use of toys leads towards a faster replacement (in terms of numbers of years) of worn out products with more eco-efficient designs, without an increase in the overall amount of goods manufactured.

Economic

All across the world, even in developing countries, this system can be implemented successfully. This concept is already well known in countries as USA, Australia, Japan, and India, where 190 of them have been set up by the Children Toy Foundation and new ones are to commence in Bangladesh and the Middle East. In South

Africa this sort of activity has not yet spread widely and to date there are just 38 toy libraries, but there is potential for great development in the same way as other countries.

From the consumer point of view, the economic benefit is evident since families do not need to spend a lot of money in buying toys that are to be changed within a short period. Considering that toys typically cost between R60 – R150 (US\$4.89 - US\$12.21), with the more expensive toys costing over R200 (\$16.29), if you are a toy library member, you can get 48 toys just paying R290 (US\$23.62), i.e. an average of about R6 (US\$0.49) per toy.

About the UNEP Division of Technology, Industry and Economics

The mission of the UNEP Division of Technology, Industry and Economics is to help decision-makers in government, local authorities, and industry develop and adopt policies and practices that:

- are cleaner and safer;
- make efficient use of natural resources;
- ensure adequate management of chemicals;
- incorporate environmental costs;
- reduce pollution and risks for humans and the environment.

The UNEP Division of Technology, Industry and Economics (UNEP DTIE), with the Division Office in Paris, is composed of one centre and five branches:

The International Environmental Technology Centre (Osaka), which promotes the adoption and use of environmentally sound technologies with a focus on the environmental management of cities and freshwater basins, in developing countries and countries in transition.

Production and Consumption (Paris), which fosters the development of cleaner and safer production and consumption patterns that lead to increased efficiency in the use of natural resources and reductions in pollution.

Chemicals (Geneva), which promotes sustainable development by catalysing global actions and building national capacities for the sound management of chemicals and the improvement of chemical safety world-wide, with a priority on Persistent Organic Pollutants (POPs) and Prior Informed Consent (PIC, jointly with FAO).

Energy and OzonAction (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition, and promotes good management practices and use of energy, with a focus on atmospheric impacts. The UNEP/RIS Collaborating

Centre on Energy and Environment supports the work of the Unit.

Economics and Trade (Geneva), which promotes the use and application of assessment and incentive tools for environmental policy and helps improve the understanding of linkages between trade and environment and the role of financial institutions in promoting sustainable development.

Coordination of Regional Activities Branch, which coordinates regional delivery of UNEP DTIE's activities and ensures coordination of DTIE's activities funded by the Global Environment Facility (GEF).

UNEP DTIE activities focus on raising awareness, improving the transfer of information, building capacity, fostering technology cooperation, partnerships and transfer, improving understanding of environmental impacts of trade issues, promoting integration of environmental considerations into economic policies, and catalysing global chemical safety.

For more information contact: United Nations Environment Programme
Division of Technology Industry and Economics
Production and Consumption Branch
39-43 Quai André Citroën
75739 Paris, France
Tel: +33 1 44 37 14 50
Fax: +33 1 44 37 14 74
www.uneptie.org/sustain
Contact person:
Bas de Leeuw: sc@unep.fr

Institutions

Interdepartmental Research Centre Innovation for the Environmental Sustainability (CIR.IS)

Politecnico of Milan University
c/o Faculty of Design
via Durando 38/A
20158 Milan, Italy
Tel: +39 2 2399 5983/5967
Fax: +39 2 2399 7203/5967
www.polimi.it/CIR.IS

Contact persons:
Ezio Manzini:
ezio.manzini@polimi.it
Carlo Vezzoli:
carlo.vezzoli@polimi.it

International Institute for Industrial Environmental Economics

Lund University
P.O.Box 196, Tegnersplatsen 4
221 00 Lund, Sweden
Tel: +46 46 222 02 00
Fax: + 46 46 222 02 10
www.lu.se/IIIEE/
Contact persons:
Chris Ryan:
chris.ryan@iiiee.lu.se
Oksana Mont:
oksana.mont@iiiee.lu.se

Faculty of Design Engineering

Delft University of Technology
Jaffalaan 9
2628 BX Delft, The Netherlands
Tel: +31 15 278 2738
info@io.tudelft.nl
www.tudelft.nl
Contact persons:
Han Brezet: j.c.brezet@io.tudelft.nl
Sacha Silvester:
s.silvester@io.tudelft.nl

PREPARE – Thematic Group Sustainable Services and Systems

c/o Econcept
Redwitzstr. 7
D-50937 Cologne, Germany
Tel: +49(0)21/420 26 –76
Fax: +49(0)21/420 26 –74
www.prepare-net.org
Contact person:
Ursula Tischner:
u.tischner@econcept.org

Centre for Sustainable Design

The Surrey Institute of Art & Design
University College, Faculty of Design
Falkner Road
Farnham, Surrey GU9 7DS
United Kingdom
Tel: +44 1252 892772
Fax: +44 1252 892747
mcharter@surrart.ac.uk
www.cfsd.org.uk
Contact person:
Martin Charter:
mcharter@surrart.ac.uk

IOEW

Potsdamer Str., 105
D-10785 Berlin
Germany
Tel: +49 30 8845940
Fax: +49 30 8825439
Contact person:
Gerd Scholl: gerd.scholl@ioew.de

Sheffield Hallam University

Lund University
City Campus Howard Street
UK-S11WB Sheffield
United Kingdom
Tel.: +44 114 2253405
Fax: Tel.: +44 114 2253433
Contact person:
Tim Cooper: T.H.Cooper@shu.ac.uk

GrAT

Wiedner Hauptstr, 8-10
A-1040 Wien, Austria
Tel.: +43 1 58801 49523
Fax: +43 1 786 4205
Contact person:
Robert Wimmer:
r.wimmer@grat.tuwien.ac.at

INSEAD

Boulevard de Constance
F-77305 Fointainebleau, Cedex
France
Contact person:
Kai Hockerts:
Kai.Hockerts@insead.fr

The Product-Life Institute

P.O. Box 3632, 1211
Geneva 3
Switzerland
Tel: +41 22 3463504
Fax: +41 22 3472078
Contact person:
Walter R. Stahel: wrstahel@vtx.ch

GRI

Oevre Fogelbergsg 3
S-41128 Goeteborg
Sweden
Tel: +46 31 7740937
Fax: +46 31 7740684
Contact person:
Olof Zaring:
olof.zaring@esa.chalmers.se

CEED

UK centre for Environment
and Economic Development
3 East King's Parade
CB2 1SJ, 1 Cambridge
United Kingdom
Tel: +44 1260 274418
Fax: +44 1260 298653
Contact person:
Peter James:
peterjames2000@cs.com

FUA

Vakgroep Algemene Vorming,
Faculteit Natuurkunde en
Sterrenkunde
De Boelelaan 1081
1081 HV Amsterdam
The Netherlands
Tel: +31 20 4447979
Fax: +31 20 4447988
Contact person:
Peter Groenewegen:
pgroen@nat.vu.nl

IPTS

IPTS Joint Research centre
W.T.C. Isla de la Cartuja
E-41092 Sevilla
Spain
Tel: +34 5 4488320
Fax: +34 5 4488325
Contact person:
Per Soerup: per.sorup@jrc.se

RMIT

Centre for Design
RMIT University
P.O.Box 2476V
Melbourne
Australia 3001
Tel: +61 418374332
Fax: +61 3 96393412
Contact person:
Chris Ryan: chris.j.ryan@rmit.edu.au

NTNU

The Norwegian University
of Science and Technology
Fakultet for maskinteknikk,
Institutt for produktdesign
NO-7491 Trondhjem
Norway
Tel: +47 73 59 01 00
Fax: +47 73 59 01 10
http://design.ntnu.no
Contact person:
Kari: kari@design.ntnu.no

Bibliography

UNEP, *Towards the Global use of Life Cycle Assessment*, 1999.
To easily get a copy:
www.earthprint.com/

UNEP, *Life Cycle Assessment: What it is and How to do it*, 1996.
To easily get a copy:
www.earthprint.com/

UNEP, *The role of product service systems in a sustainable society*, 2001.
To easily get a copy:
www.earthprint.com/

Bijma A., Stuts M., Silvester S., *Developing Eco-efficient Product-Service Combinations in Proceedings of the 6th International Conference 'Sustainable Services and Systems. Transition towards Sustainability?'*, The Surrey Institute of Art and Design, University College, Amsterdam, Netherlands, pp. 239-245, October 2001.
To easily get a copy:
arianne@arcanaconsultancy.nl

Cooper T., Sian E., *Products to Services*, report for the friends of the earth, Centre for Sustainable Consumption, Sheffield Hallam University, June 2000.
To easily get a copy:
T.H.Cooper@shu.ac.uk

Goedkoop, M., van Halen C, te Riele, H, Rommes P., *Product Services Systems, Ecological and Economic Basics, report 1999/36*, VROM, the Hague, 1999.
To easily get a copy:
goedkoop@pre.nl

Groenewegen P., De Jong P., Nijhuis L., Scholl G., *Creating Eco-efficient Producer Services in Proceedings of the 6th International Conference 'Sustainable Services and Systems. Transition towards Sustainability?'*, The Surrey Institute of Art and Design, University College, Amsterdam, Netherlands, pp. 301-302, October 2001.
To easily get a copy:
gerd.scholl@ioew.de

Hockerts, K. *Eco-Efficient Service Innovation: Increasing Business-Ecological Efficiency of Products and Services*, in: Greener Marketing: A Global Perspective on

Greener Marketing Practice, Ed. M. Charter, Sheffield, UK: Greenleaf publishing, pp. 95-108; 1998.
To easily get a copy:
Kai.Hockerts@insead.fr

Jacobsen M.M., Wigum K. S., *Sustainable Services & Systems – 3S and the Impact on Eco-design Education in Proceedings of the 6th International Conference 'Sustainable Services and Systems. Transition towards Sustainability?'*, The Surrey Institute of Art and Design, University College, Amsterdam, Netherlands, pp. 147-154, October 2001.
To easily get a copy:
mcharter@surrart.ac.uk

Krutwagen B., Lindeijer E., *LCA Services. An adapted approach including consumer based rebound effects in Proceedings of the 6th International Conference 'Sustainable Services and Systems. Transition towards Sustainability?'*, The Surrey Institute of Art and Design, University College, Amsterdam, Netherlands, pp. 233-238, October 2001.
To easily get a copy:
mcharter@surrart.ac.uk

Manzini E., Vezzoli C., Clark G. *Product-service Systems: Using an Existing Concept as a New Approach to Sustainability*, The Journal of Design Research, 2001.
To easily get a copy:
carlo.vezzoli@polimi.it

Mejcamp, R., *Changing consumer behaviour through eco-efficient services*, Delft University of Technology, Delft, 2000.

Mont, O. *Introducing and Developing a Product – Service System (PSS) concept in Sweden*, IIIIEE Reports 2001:6., NUTEK and IIIIEE, Sweden, 2001.
To easily get a copy:
Oksana.Mont@iiiee.lu.se

Péro H., *Industrial research in the European Research Area and in the Framework Programme, In the Field of Product-Service in Proceedings of the 6th International Conference 'Sustainable Services and Systems. Transition towards Sustainability?'*, The Surrey Institute of Art and Design, University College, Amsterdam, Netherlands, pp. 67-

75, October 2001.
To easily get a copy:
mcharter@surrart.ac.uk

PREPARE, *Minutes of the PREPARE – Thematic Group, Sustainable Services and Systems Workshop*, compiled by Tischner U., Lund, Sweden, 2001.
To easily get a copy:
www.prepare-net.org/topics_projects/index.html

Sonnemann G.W, Solgaard A., Saur K., Udo de Haes H.A., Christiansen K., Jensen A.A.: *Life Cycle Management workshop - Sharing experiences on LCM. International Journal of LCA* 6 (6) 325-333, 2002
To easily get a copy:
sc@unep.fr

Stahel, W., *Sustainability and Services*, in *Sustainable Solutions – Developing products and services for the future*, eds. Martin Charter and Ursula Tischner, Sheffield, UK: Greenleaf publishing, pp. 151-164; 2001.
To easily get a copy:
wrstahel@vtx.ch

Tischner U., Brezet H., Grablowitz A., *Sustainable Services and Systems (3S) – Sustainability in Practice? in Proceedings of the 6th International Conference 'Sustainable Services and Systems. Transition towards Sustainability?'*, The Surrey Institute of Art and Design, University College, Amsterdam, Netherlands, pp. 53-58, October 2001.
To easily get a copy:
u.tischner@econcept.org

WBCSD, *Sustainability through the market, 7 principles for sustainability*, on the WEB, 2001
To easily get a copy:
www.wbcd.org/projects/pr_market_sust.htm

Zaring O., *Creating Eco-Efficient Producer Services*, Goteborg Research Institute, Goteborg, 2001
To easily get a copy:
olof.zaring@esa.chalmers.se

design and layout:
bianca graphic design
Milano
www.biancagraphicsdesign.it

print:
La Fenice Grafica
via Roma 71
26812 Borghetto Lodigiano

ISBN:92-807-2206-9