

## Session-1

# Product Service Systems and “Servicizing” in the US: B to B evolution and prospects

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Mark Stoughton

Good morning. As Professor Gunjima introduced me, my topic today is product service systems in the United States with a focus on the business to business context.

**Orientation: What is a PSS?**

- As you will hear today, there is no single definition of a PSS.
- In this presentation, a PSS is:
  - “a marketable set of products and services capable of jointly fulfilling a user’s need” \**

The definition requires. . .

- a combination of products and services AND
- That this combination can be offered for sale

**BUT**

*The definition does not assume or require that PSSs are environmentally superior or that they result from a particular innovation process*

\*Policy Document on Environment and Economy, Government of the Netherlands

In common with all of the other presentations today, this presentation uses a particular definition of product service system (PSS). There is no single, accepted definition. So, I'll give you mine, and I'm sure that the other speakers will give you theirs. In this presentation, a PSS is a marketable set of product and services that together fulfill a user's need. So this definition has two important requirements. There must be a combination of product and service, and that combination can be offered for sale. This definition does not assume or require that PSSs are environmentally superior or that they result from a particular innovation process or a particular course.

In this presentation, I'm trying to give some idea about the evolution and prospects of

product service systems in the U.S. context. So I think a very useful way to start is to look back and see where they have come from.

**Where we were. . .**

- The US situation 5 years ago. . .
  - Tellus Institute assessed emergent trends in B2B PSSs. . .
  - Our focus was “servicizing,” which we defined as:
    - The emergence of a class of product-based services; manufacturers who traditionally delivered “products in a box” are increasingly viewing products as a vehicle or platform to deliver service or function.
    - Today, we recognize “servicizing” as an important class of PSSs.

Five years ago, Tellus Institute assessed emergent trends in business to business product service systems in research commissioned by the U.S. Environmental Protection Agency. This was before the term “product service system” entered the common usage. The term we used was “servicizing”. We defined servicizing as; the emergence of a class of product-based services offered by traditional product manufacturers who were now viewing products as a vehicle or platform to deliver service or function.

Today, I would classify servicizing as one important class of product service systems. It's not the whole product service systems, but, it's one important piece. We undertook this research 5 years ago for the same reasons that

product service systems are important now.

**Why we cared then... And now.**

- Fundamental structural change in wealthy economies is underway.

Services continue to grow in importance. This structural transformation **will not** automatically result in a green economy. Why?

The service economy depends on the industrial economy.

Many of the fastest-growing, services sectors require corresponding growth in the most environmentally problematic products

e.g. IT hardware, vehicles, fuels

Environmental regulatory systems are strongly oriented towards products and manufacturing processes

Services are a "blind spot"

There is a fundamental structural change underway in all the wealthy industrial economies. Services continue to grow in importance. They are the economic lead sectors. However, this structural transformation will not automatically result in a "green" economy.

There are two broad reasons for this. The first is on the left hand side of the screen. If you look at a service economy, you see that the service economy relies on an extensive manufacturing sector and other services such as transport. The example of medical services is given on the slide; the services that a dentist delivers require a very large amount of manufacturing and transportation. Many of the fastest-growing service sectors require growth in the most environmentally problematic products, for example, information technology. The growth in trade services requires the growth in transport, vehicles, fuel. In general,

**The challenge of services**

- A clear conclusion: We must find a way to make a service- and information-led economy a green economy.

↓

**And more specifically:**  
how can services change the ways that products are made, used & disposed of?

The appeal of PSSs:  
In principle, they can do exactly this.

environmentally problematic products underlie the growth in services.

The second reason is that environmental regulatory systems are strongly oriented towards the regulation of products and manufacturing processes. Services tend not to be well-regulated. They are blind spot in the regulatory system.

So, if you look at the structural transformation, and you look at the environmental challenges it poses, there is a clear conclusion:

*We must find a way to make a service- and information-led economy a "green" economy. And more specifically, we must figure out some way that services can change the way that products are made, used, and disposed of.*

In short, if services continue to require more utilization of traditional products, we've got a problem.

The appeal of product service systems is that in principle, they can change the way that products are made, used & disposed of.

**Where we looked...**

- Case studies of 7 "early movers,"
- focused on the servicing business case: motivation, challenges & implementation

	White goods (Appliances)	→	Functional appliance sales
	Lubricants; metal-working fluids	→	Chemical management services
	Chemicals & chemical products	→	Chemical management services
	Chemicals & chemical products	→	Car-painting & carpet services
	(Coro, Inc.) Office furniture	→	Post-occupancy services
	Computer hardware & software	→	"Information solutions"
	Document storage & reproduction	→	"Document services"

So, in our study five years ago, we looked at case studies of seven early mover companies that were deploying pioneering servicing business models. We focused on the servicing business case. We wanted to know what motivated the companies, what challenges they faced, and how they implemented these models.

I won't go into detail in this presentation,

regarding the seven cases. As you can see from the company names, these were on the whole large companies with the well-known products. They were all traditional manufacturers and were experimenting with making profit from product-based services.

**And where we worked. . .**

- Since 1998, engaged in applied research and piloting of a B2B PSS: performance-based Chemical Management Services.

Goal: create incentives for chemical suppliers to help customers reduce chemical use & risk

Via: the non-profit **Chemical Strategies Partnership** ([www.chemicalstrategies.org](http://www.chemicalstrategies.org))

- More than 15 hands-on, in-depth collaborations with private sector and institutional partners
  - Business case assessment, RFP development, program assessment
- Case Studies
  - Motorola, Chrysler, General Motors, Ford, Raytheon, Nortel...

Our research was not limited to passive or desk-based study. Since 1998 we've been actively engaged in an applied research and piloting of a business to business PSS model. This is performance-based Chemical Management Services. The goal of this PSS is to create financial incentives for chemical suppliers to help customers reduce their chemical use and their chemical risk. We carried out this work via a non-profit organization called the Chemical Strategies Partnership (CSP). The work has been very hands-on. We have more than 15 collaborations with private sector and institutional partners. We've assessed the business case with them for this

**What we found. . .**

- Business goals were the major driver to PSS development—not environmental or regulatory considerations

PSS concepts had more promise in B2B markets than B2C markets

- Business attaches less value to "ownership," more likely to make rational economic choices (selling a PSS is less complicated)
- PSSs/Serviceizing are compatible with and reflect some key management trends that are particularly strong in the US:
  - Outsourcing; core competency; strategic partnership; supply chain management

PSS, helped them develop requests for proposals, and assessed Chemical Management Programs already in progress.

So, what have we found via this hands-on research and what did we find from the more traditional research?

First, we found that business goals in the U.S. context were the major driver to PSS development, not environmental values and not regulatory requirements.

Second, we found that the PSS concepts had more promise in business to business markets than business to consumer markets.

This was for two reasons. The first is that business attaches less value to ownership. Business tends not to care if it owns a car or rents a car. It's concerned with the cost and availability of the service or function that the car provides. So, selling a PSS to business is often easier. The second is that PSSs and serviceizing are compatible with and reflect some key management trends that are particularly strong in the U.S. context. These are trends like outsourcing, a focus on core competency, a focus on strategic partnerships, and supply chain management.

**What we found. . .**

- Products that demand specialized knowledge were good candidates for serviceizing
- Products that demanded a specialized "core competency" in their use were strong candidates for PSSs. (e.g., chemicals, IT)

Serviceizing presents challenges to traditional manufacturers

Environmental benefits were NOT automatic

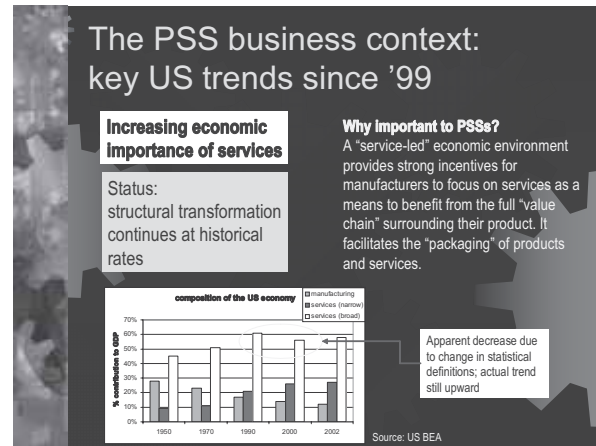
- Environmental benefits were most certain when the business model broke the linkage between profit and volume consumed
- Environmental benefits in PSSs involving durable goods are difficult to quantify → depends very much on the individual characteristics of the PSS.

Third, we found that products that demand specialized knowledge were good candidates for serviceizing. Examples are chemicals and information technology. Many people use information technology without really understanding it. Many people have a need to use

chemicals, but are not experts in the environmental aspects of chemical use and in the handling and in the disposal.

Fourth, we found that servicizing presents challenges to traditional manufacturers, mostly because servicizing can separate profit from the amount of product you sell.

Finally, we found that environmental benefits were not automatic. Environmental benefits in PSS were most certain when the business model broke the link between profits and the volume of products consumed. Many businesses and researchers have focused on PSSs as applied to so-called durable goods. (That is, goods like refrigerators, televisions, and automobiles). We found that the environmental benefits of PSSs applied to these products are very difficult to quantify and it depends very much on the individual characteristics of the PSS, and the speed of technological change in the product.



transformation of the US economy continues more or less at its historic rate. This is important because the service-led economic environment does provide strong incentives to business as a whole to focus on services as a means to benefit from the full "value chain" or the full amount of profit that is generated in the economy due to their product. It facilitates the the joint marketing of products and services.



So, these were our findings five years ago. Now, how have things evolved since then? The way to answer that question is to look at the factors that influence the business case or the market for product service systems. I'm going to particularly focus on factors that may influence the market for environmentally beneficial product service systems.

The first point to note is that the US trend towards the economic dominance of services continues. The structural



Another key trend is that the globalization of supply chains and markets (a trend that includes outsourcing) has continued strongly. This is relevant to PSSs for a few reasons.

First, there is a huge and growing demand for logistics services vis a vis the management of supply chains and the movements of parts and products across national borders.

Second, many businesses see services as a way to defend home markets from new outside competitors.

Third, outsourcing generally increases the market for business to business PSSs. You're willing to go outside your company for services that previously you accommodated inside your company.

However, close interaction between suppliers and customers becomes more difficult when the supply chain is global. And exactly this type of close interaction is required for many business to business PSSs.

**The PSS business context: key US trends '99**

**Speed of change in information technology**

Status: **RAPID CHANGE CONTINUES**

**Why important to PSSs?**  
IT is one of the earliest and strongest sectors for B2B PSSs. Continued rapid change creates a strong market for services related to:

**End-of-Life management**-- particularly as local and state regulations increase the cost of disposal

**Installation, maintenance, and training.**

**Rental/leasing.** Investment in rapidly obsolete capital is often not attractive to business

average lifespan of a personal computer

Year	Lifespan (Years)
1980	~3.5
1985	~3.0
1990	~2.5
1995	~2.0
2000	~1.5
2005	~1.0

Another key trend is the speed of change in information technology. The trend here is that rapid change continues. This is important for PSSs, because rapid change creates a strong market for services related to end-of-life management of computer equipment, and for services related to installation, maintenance, and training of information technologies. It creates incentives for customers to seek alternatives to owning short-lived equipment and software. Businesses are not happy if they

**The PSS business context: key US trends '99**

**Environmental Regulation**

Status: **Highly mixed**

**Why important to PSSs?**  
EPR requirements can create markets for PSSs that solve end-of-life management problems for customers.

Regulation can create markets for PSSs in environmentally critical areas such as energy-efficiency services, chemical services, waste management services

**state and local level:**  
increasing EOL requirements (e-waste). CO2 restrictions in some states?

**Europe:**  
international firms must respond to EOL requirements and substance bans

**US Federal level:**  
no action on extended product responsibility—even in traditional EPR areas like fuel efficiency.

must make capital investments in equipment that is rapidly obsolete. So, the IT sector is likely to continue to be a very strong sector for business to business PSS.

Another important factor regarding the business environment for PSS is environmental regulation. Here we have a very mixed story. Regulation is important to PSSs because regulatory requirements-particularly for extended product responsibility-can create markets for PSSs that address end-of-life management problems. Regulation can create markets for PSSs in environmentally critical areas such as energy efficiency, chemical management, and waste management. However, as we look at the U.S., there is no strong EPR policy or regulation at the national level and under the current administration, it most certainly will not happen. At the state and local level, we see significant activity regarding end-of-life management for electronic waste (e-waste). Some states and regions are discussing CO2 emissions restrictions. Meanwhile, international firms based in the U.S. must comply with European end-of-life requirements and restrictions on the use of certain toxic substances.

**The PSS business context: key US trends since '99**

**Consumer demand for green products**

Status: **HIGHLY MIXED**

**Why important to PSSs?**  
"green demand" can create markets for B2C PSSs explicitly focused on providing "greener solutions" (e.g., EOL management, car-sharing, etc.)

Green consumer preferences likely to translate into demand for corporate social responsibility (CSR)

**Organic foods industry records 20% sales growth in 2003; forecasts 18% growth over 2004-2008\***

**"green-e certified renewable electricity sales up 86% in 2003\*\*"**

**car-sharing organizations experience exponential membership growth.\*\*\***

**SRI portfolios grow 50% faster than conventional portfolios over 1995 to 2003\*\*\*\***

**BUT...**

- Dominance of SUV sales
- lowest cost basis for retail competition
- focus on financial corporate responsibility, not CSR
- low-density suburban development

The final trend or issue of interest for PSS business is consumer demand for "green" products. This is important because "green demand" can create markets for B to C PSSs that are focused on providing "greener solutions" like

car-sharing. Green consumer preferences are also likely to translate into demand for corporate social responsibility.

As we look at "green" demand in the US, we do not see any single clear trend. It's extremely easy to find headlines and news stories that point to growing consumer demand for "green products". However, if you look at other indicators of consumer preferences, the story becomes more complicated. US consumers as a whole continue to show a preference for large cars and to demand lowest-cost retail goods, not environmentally preferable ones.. The financial scandals in the U.S. have put corporate, government and civil society focus on *financial* corporate responsibility, not corporate *social* responsibility.

**Has five years made a difference?**

- **CONCLUSION:**  
In the US, no radical changes in the PSS business environment
- The management approaches and structural economic trends that support PSSs development and success on the demand and supply side continue to exert strong influence.
- PSS development continues to be driven from the business case, not CSR or regulation

However. . .

So, where are we today? The clear conclusion for me is that there are really no radical changes in the US PSS business environment now as compared to five years ago. The management approaches and structural economic trends that support PSS development and success continue. PSS development continues to be driven from the business case, not from corporate social responsibility or regulation.

However, there are certain regulatory trends that favor or require end-of-life management services for certain products. The most prominent example is information technologies; however, automobiles and appliances also are

**Has five years made a difference?**

- However, regulatory trends—largely international and local—favor end-of-life management services for certain products (e.g., IT)
  - In IT, the need for support services during the product lifetime, high turnover, and end-of-life requirements indicate that IT will continue to be one of the strongest PSS sectors.
  - In general, proper management (and minimization) of e-waste should have environmental benefits.

experiencing these requirements to a lesser extent. In these sectors, we see regulatory incentives for end-of-life oriented product service systems.

**Has five years made a difference?**

- **B2C PSS applications remain limited**
  - Expect that a combination of factors common to the US will continue to limit B2C PSS applications that involve "common goods and infrastructure." Key factors are:
    - low-density development,
    - large living spaces &
    - an "ownership" culture
  - However, niche geographical markets do exist for certain green "green PSSs" (e.g., car-sharing). These may be high-growth.

In general, however, business to consumer PSS applications remain limited. I would expect that a combination of factors typical of the U.S. will continue to limit B to C applications that involve common goods and infrastructure. (For example, car-sharing.) Those factors are the low-density development & large individual living spaces typical of the U.S., and a culture that values the ownership of products. However, certain niche or local geographic markets do exist for "green PSS businesses". Again, car-sharing is the most common example. And these green PSS businesses have experienced high growth in these particular markets.

What we've seen over the last five years leads me to continue to believe that the PSSs

### B2B PSSs with the greatest promise

- Continue to believe that the PSSs with the greatest potential are those that:
  - Separate profit from volume consumed in the procurement of essential, environmentally problematic goods and services
    - E.g. chemical management services
    - Performance-based energy contracting
    - Performance-based waste management

May not involve a purchased product, but all these business models are closely related: The source of profit is *efficiency services*. And they involve the supplier in the customer's operations.

with the greatest potential are those that separate profit from volume in the procurement of essential and environmentally problematic goods and services. Examples are chemicals, energy and waste. All such PSSs create a market for efficiency services and involve the supplier in the customers' operations.

### The source of reliable environmental benefits. . .

- Supply contracts are restructured to change the basis of profit & thus the behavior of the supplier. . .

These PSSs all are characterized by the transformation of the basic contract or basic relationship between the supplier and the customer:

In traditional procurement, the supplier makes profit by selling more; more of the product, more chemicals, more energy, and more waste removed. In function or performance-based procurement, the incentive to the supplier changes. For example, the customers are not paying the supplier the liter of cleaning solvent, but per circuit board cleaned. They are not paying per unit of electricity, but they are paying for lighting services. In this arrangement, the

supplier has incentive to reduce the use of the environmentally problematic product or service.

### The source of reliable environmental benefits. . .

Achieving this transition requires the customer to understand their **total costs**. . . Supported by the adoption of environmental management accounting (EMA)-based approaches and metrics

Achieving this transformation of the basic contract or source of profit almost always requires that the customers understand their *total costs*. This means that the movement to performance-based procurement is supported by—and almost *requires*—the adoption of *environmental management accounting approaches*.

### Why total costs?

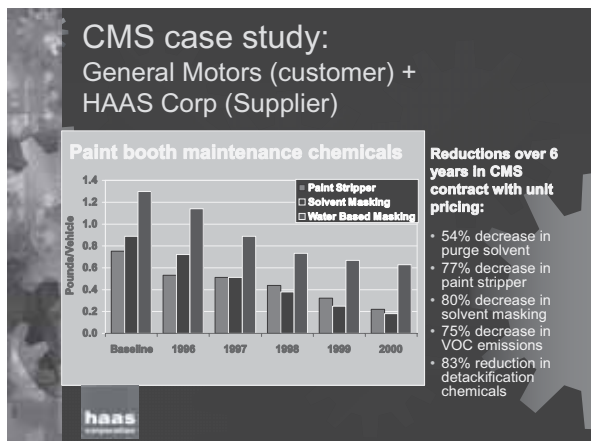
- E.g. CMS contracts are based on **TOTAL COST of CHEMICALS**

Costs > \$1 to manage every \$1 of purchased chemical. May cost \$10!

- Why? CMS supplier takes over key internal chemical management functions. Customer must understand total chemical costs to evaluate the business case.

If you look at the example of chemical management services (CMS), you can see this. The chemical customer of course incurs the cost of purchasing the chemicals. But the customer also incurs the cost of delivery, inventory, internal distribution, collection, treatment, and disposal, and environmental compliance. If you add up all of these costs, it always costs more than one dollar to manage every dollar of chemical purchased. If the customer doesn't understand that, they will never believe that

purchasing chemical management services makes economic sense.



Where the customer does understand the total cost argument, you can get very dramatic improvements. This is a graph of a chemical and paint use in a General Motors assembly plant in the painting operation. And it depicts decreases on a per vehicle basis that are the direct result of the CMS program



I think the prospects for performance-based procurement are more generally good. CMS continues to increase its market penetration. Current high energy prices or state-based CO2 restrictions, if they are enacted and sustained, are likely to increase the market for energy services. Municipalities and major institutions are experimenting with performance-based waste contracting. However, not all factors in the market encourage the growth of performance-based procurement: global supply chains do pose barriers, as does poor cost awareness

among customers.

**In conclusion. . .**

- B2B PSSs in the US will continue to expand, but. . .
  - Except for
    - performance-based procurement and
    - PSSs that focus on e-waste/end-of-life management
- See no *overall* trend that will lead to environmental benefit from PSSs in the US B2B context.
- The "challenge of services" largely remains before us. How do we assure that a service- and information-led economy is a green economy?

So, in final conclusion, business to business PSSs in the U.S., I believe, will continue to expand, but, I see no *overall* trend that will lead to environmental benefit from PSSs in the U.S. business to business context. There are two important exceptions; the performance-based procurement examples that I named just now, and PSSs that are focused on end-of-life management for e-waste, vehicles, appliances. For the US economy, the challenge of services remains: How do we assure that a service- and information-led economy is a "green economy"?

In my personal opinion, achieving a green service-led economy will require more substantial public policy involvement and regulatory drivers than there have been up to now. However, performance-based procurement is at least an important first step towards greening the service economy.

**For more information: CMS**

- [www.chemicalstrategies.org](http://www.chemicalstrategies.org)
- [www.cmsforum.org](http://www.cmsforum.org)
  - CMS Forum: A coalition of CMS providers, their customers, Tier II chemical suppliers, and other stakeholders interested in promoting chemical management services.
  - Mission: grow the awareness and practice of economically and environmentally beneficial chemical management services
- Mark Stoughton, Ph.D.  
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Thank you for your attention.



**Session-1**

# PSS Applications in the Consumer Goods Industry: Lessons Learned in the UK

University of Cambridge (UK)  
**Marcus Wong**

Good morning and welcome to my talk. Hopefully, I can provide a counterpoint to Stoughton-san's work which focused on B to B work in the U.S. My research concentrates mostly on the consumer goods sector and Business to Consumer in the UK and in the EU.

**1. Introduction**

- **Background to Industrial Sustainability**
  - The scale of improvement necessary (Factor 4+)
  - The need for demand-side management
- **What are consumer goods and why are they of interest?**
  - Mass-produced items with consumer choice and contact
  - Environmental impacts
  - Financial impacts
  - Social impacts

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 PSS Applications in the Consumer Goods Industry: Lessons learned from the UK  
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IGES-KRC PSS Workshop  
 Kobe, 16<sup>th</sup> November 2004  
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The environmental and social pressures driving Industrial Sustainability are well known; I propose to mention just two specific points, as they have a bearing on the concept of PSS solutions. The first is that the issues of cleaner or greener products are only likely to produce 10%, 20%, may be 15% improvements and most commentators suggest that we require improvements of Factor 4, Factor 10, or even greater Factor 50 or 100. The second point is that there is a great need for demand management - Factor 4 improvements in eco-efficiency are of little use if demand also increases fourfold. PSS solutions are perhaps to only means so-far proposed that can directly

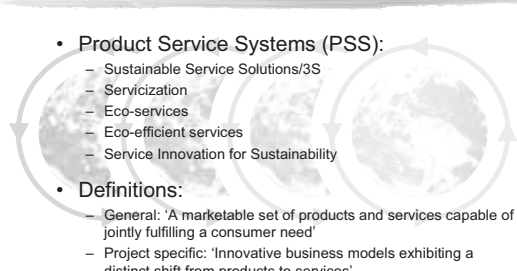
tackle these two issues.

The research looks specifically at the consumer goods industry. Consumer goods have been defined as mass-produced items, where the consumer has a level of choice and a level of control over the use of these particular goods. This excludes such things as pharmaceuticals and also housing and foods, but explicitly includes such sectors as the automobile sector, consumer electronics, household goods and clothing.

Why are consumer goods of particular interest to us? Firstly, consumer goods have significant direct environmental impacts, in terms of energy consumption and waste generated per household. Consumer goods are also financially significant, in terms of the proportion of GDP and the proportion of exports. However, it is for social reasons that consumer goods are of particular interest. There is Western saying: 'you are what you eat.' In this particular context, perhaps it is better to say: 'we are what we consume.' Consumer goods seem to embody and reinforce the values of the society that created those goods and thus there is a great promise that by changing consumer goods so may in turn start to effect a change in societal values, towards a less resource intensive and more fulfilling model.

There are many definitions of PSS and also many different names for PSS solutions. The most common definition is: 'a marketable set of products and services capable of jointly

**1. Introduction (cont.)**

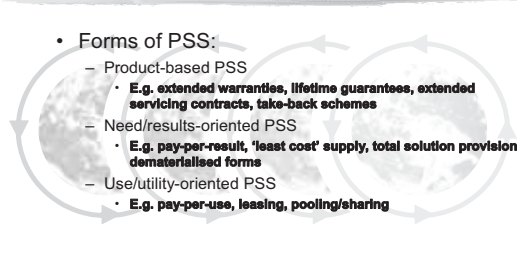


- **Product Service Systems (PSS):**
  - Sustainable Service Solutions/3S
  - Servicization
  - Eco-services
  - Eco-efficient services
  - Service Innovation for Sustainability
- **Definitions:**
  - General: 'A marketable set of products and services capable of jointly fulfilling a consumer need'
  - Project specific: 'Innovative business models exhibiting a distinct shift from products to services'

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fulfilling a consumer needs.’ This is obviously a very broad and very wide definition, and potentially includes such things as a standard one-year guarantee that one may obtain with a standard TV set or wash machine. This research has focused specifically on more innovative and novel models, and so the research definition of PSS is: ‘an innovative business model that exhibit a distinct shift from products towards greater services.’

**2. PSS Background**



- **Forms of PSS:**
  - Product-based PSS
    - E.g. extended warranties, lifetime guarantees, extended servicing contracts, take-back schemes
  - Need/results-oriented PSS
    - E.g. pay-per-result, 'least cost' supply, total solution provision, dematerialised forms
  - Use/utility-oriented PSS
    - E.g. pay-per-use, leasing, pooling/sharing

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There are many different forms of PSS: The first is warranties, guarantees, and servicing contracts. These were accepted as being innovative if they were applied in new ways and/or in new industries e.g. the Nike Air to Earth take-back scheme, which uses novel collection and recycling techniques. Also, there are outdoor clothing and equipment manufacturers that not merely offer one year or two-year guarantees but lifetime guarantees. These things are particular of interest, because they

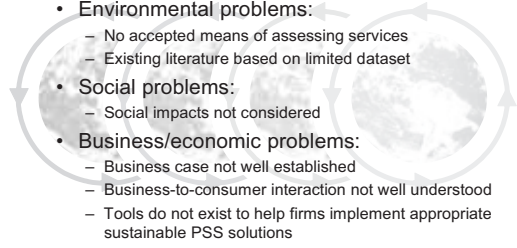
increase the functionality and life cycle of the products. However they are essentially still product-based -they take the existing products and add a service to them.

The second class is a needs/results-oriented PSS i.e. pay-per-results. This is akin to the idea of functional sales. If you see that the functional sale is achieved without any physical products, we may say that the function has become dematerialised. Within this research, there are a number of case studies which deal with this form of PSS, including the on-line, the on-demand provision of software, and also the peer-to-peer downloading of software-both these replace the physical CDs and CD-ROMs that would otherwise have to be produced and bought.

The concepts of ‘least cost supply’ and ‘total solution provision’ take a broader view of the needs which require fulfilment. A good example of this (already covered by Stoughton-san in a previous lecture) is Chemical Management Services, whereby instead of just the functional fulfillment associated with chemicals, associated services to do with providing advice/consultancy, transportation and even storage facilities are also included.

The last class of PSS solutions, ‘use and utility-oriented PSS,’ include leasing and renting schemes. Both leasing and renting schemes are very common but may be regarded as innovative and creative if they are applied in new ways and/or to different industries. An example covered in the research involves the quite well known example of Interface, whereby they have leased carpet tiles instead of selling carpet tiles. Also included is a case on Ford, which involves an innovative business to consumer leasing models for their electricity cars. Under renting schemes, the research also covers a case study involving Phillips, which involves a pilot study for the

**2. PSS Background (cont.)**



- Environmental problems:
  - No accepted means of assessing services
  - Existing literature based on limited dataset
- Social problems:
  - Social impacts not considered
- Business/economic problems:
  - Business case not well established
  - Business-to-consumer interaction not well understood
  - Tools do not exist to help firms implement appropriate sustainable PSS solutions

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renting of digital camcorders and PDA (Personal Digital Assistant)-style city guides.

Sharing schemes involve the group ownership of a single product, whereas pooling schemes involve a single owner allowing a wide group of people to use those products. The research includes car-pooling and ride-sharing case studies.

Other papers have discussed the great potential for PSS. However, there are number of gaps in the existing knowledge base. The first and perhaps the most significant of those gaps involves the lack of an accepted means of assessing services from environmental standpoint. This is a significant problem, and concerns the definition of the system and how widely to take the system boundaries. It also concerns the problems of rebound and re-spending effects. This is not something which is directly addressed by the research; instead, a rough-cut estimation method has been used to assess environmental effects. The existing literature is also based on the somewhat limited dataset - the same case studies appear again and again.

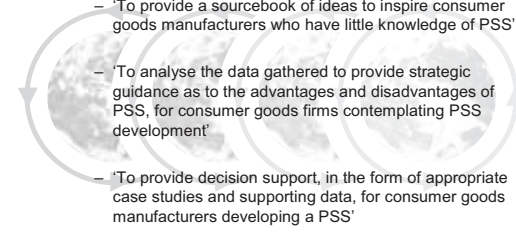
If you look at the existing literature with respect to social problems, most case studies barely mention the social impacts of PSS solutions. Looking at the business and economic case for PSS implementation within the existing literature, the business case is not at all established. Manufacturers and academics know a great deal about the development of services.

However, the development of sustainable PSS services, services that perhaps move from products towards greater service intensity, is not at all well established. Also, the research which is being carried out is not very accessible and easily-understandable for firms.

Finally, the business-to-business interaction is somewhat better characterized than the business-to-consumer interaction.

This research has looked specifically to address these issues on three distinct levels.

**3. Aims of the research**



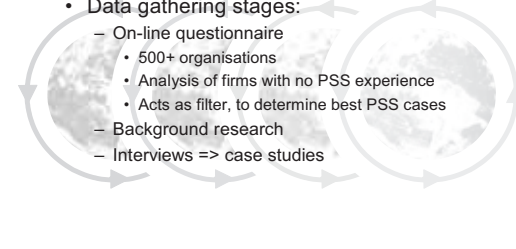
- 'To provide a sourcebook of ideas to inspire consumer goods manufacturers who have little knowledge of PSS'
- 'To analyse the data gathered to provide strategic guidance as to the advantages and disadvantages of PSS, for consumer goods firms contemplating PSS development'
- 'To provide decision support, in the form of appropriate case studies and supporting data, for consumer goods manufacturers developing a PSS'

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The first level is to act as a source of inspiration, creating a database that can easily and quickly tell interested-parties what is already available. It also involves gathering new case studies, rather than simply using the existing data. The next level is to analyse the data and draw out trends and conclusions. And the third level is to pull all that information together in a way which is easily understandable and accessible to companies.

**4. Methodology**



- Data gathering stages:
  - On-line questionnaire
    - 500+ organisations
    - Analysis of firms with no PSS experience
    - Acts as filter, to determine best PSS cases
  - Background research
  - Interviews => case studies

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### 4. Methodology (cont.)

- Case studies:
  - Characteristics
  - Drivers
  - Barriers
  - Impacts
  - Future developments

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### 6. Analysis

- The consumer goods sector:
  - Understanding the consumer goods sector may provide a key towards sustainable societies
  - Use existing trends towards 'personalisation/total solution provision of goods
  - Little acceptance of compromise solution - there is no premium purely for 'green'
  - PSS: no need for compromise

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### 4. Methodology (cont.)

- Case-based reasoning and case study fragments:
  - Fragment 1  
- Datadatadata
  - Fragment 2...  
- Datadatadata
  - ... Fragment n  
- Datadatadata
  - Synthesise conclusions

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### 5. The case studies

- **Automotive:**
  - Ford THINK: Consumer vehicle leasing
  - GM/Haas Chemicals: Chemicals Management Services
  - LifShare.com: Lift-sharing
  - Smart!Move!s: Car-sharing
- **Clothing:**
  - Gentle Touch: Integrated laundry services
  - HP Bulmers: Leasing of sports clothing
- **Computing:**
  - Email vs. regular mail
  - Multimedia Computer Systems Ltd: MicroPro upgradeable systems
  - Anort: P2P downloading services
  - Anort: On-line computer gaming services
- **Consumer electronics:**
  - Philips: Vision of the Future project (rentable electronics)
  - Philips: Upgradeable TV contract
  - Philips: Take-back of TLD Earthlight lighting range
- **White goods:**
  - Box Clever: White goods leasing
- **Misc.:**
  - BG MicroGen: Leasing of consumer MicroCHP units
  - Interface: Evergreen leasing system
  - Unilever: MyHome cleaning service

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appear to be a good place to begin i.e. the correlation between consumer goods and consumer behavior is quite close - consumer goods often have a very personal interaction with the consumer. They are bought for very emotional and often non-rational reasons. And thus, the idea that potentially we can change consumer behavior through consumer goods, has some support.

The second point is that the shift towards services is already happening in the consumer goods sector. We see that customers are increasingly looking for personalized goods and the issue of mass-customisation is increasingly becoming important for consumer goods firms. Consumers in many sectors often do not want physical goods but instead are actively seeking functional fulfillment. These are already trends that are well established in the consumer goods industry. By greening these trends, by making them sustainable and integrating PSS into these solutions, PSS may piggy-back on these existing developments.

There is little evidence for the acceptance of a compromise-solution - consumers are unlikely to pay extra simply for a greener product. However, PSS does not necessarily entail the compromise. PSS solutions can be better in terms of value for money as they can offer greater functionality and greater perceived quality. PSS should be marketed not so much as a greener solution but simply as a better solution, that also happens to be a greener.

The methodology used for data-gathering involved on-line questionnaires, talking to the companies that had carried out PSS solutions which fulfilled the criteria and also carrying out a great deal of background research. This data produced a series of case studies, covering the typical areas covered in a case study. The case studies were structured using the methodology called 'case-based reasoning.' The following are the critical conclusions drawn from across the case studies.

The first conclusion is that consumer goods

**6. Analysis (cont.)**

- Product Service Systems implementation:
  - Primary drivers:
    - Legislation
    - Economics
  - Critical facilitating factors:
    - Senior management support
    - Working in partnership
  - Primary barriers:
    - Not always appropriate – complex, dependent
    - Lack of understanding of sustainable PSS concept
    - Lack of strong macro-economic drivers

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Legislation is the key driver that have pushed PSS implementation in the consumer goods industry in the EU. While there is little legislation which mandates for the development of PSS solutions, legislation is increasingly being framed with extended producer responsibilities at its core within the EU e.g. the Waste of Electronic and Electrical Equipment (WEEE) and End-of-Life Vehicle (EoLV) Directives. PSS and service-based solutions are increasingly attractive means of dealing with end-of-life issues and take-back issues.

Economics is also a key driver. None of the cases covered in the research were driven simply for altruistic reasons - they were all driven because the companies noted particular market needs that they felt that PSS could best exploit. For example, companies like Phillips look specifically at environmental issues to gain competitive advantage over other firms.

There are number of other factors that, while they may not drive implementation of PSS, nevertheless had to be in place for successful PSS implementation. The first of these is senior management support - having a credible and highly visible champion for the PSS project at a high management level appears to be very important. The example of Interface Carpets shows much difference such a champion can make. The issue of working partnerships is also very important. It is often the case that a single firm cannot deliver the

entirety of the PSS - it needs to be done in collaboration with suppliers, retailers etc. A good example is again Chemical Management Services, whereby it took a collaboration with suppliers, transportation, unions, shop workers and of course general workers and management themselves to bring about PSS implementation.

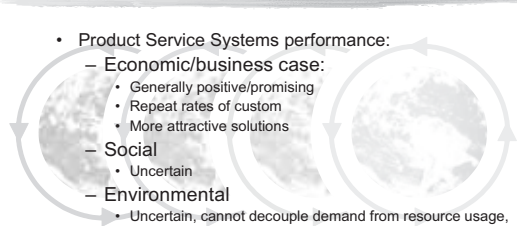
However, there are of course significant barriers to PSS implementation as well. Firstly, it is not always the most appropriate means of going forward. It must be employed with a great deal of sensitivity to the context. PSS solutions are also often more complex to develop, involving more elements to design and to develop than a typical product-based system.

There is also a lack of understanding of the PSS concept. Many manufacturing firms, when looking to generate greater profit, look primarily to squeeze the production cost and perhaps the cost associated with supply, together with looking to sell greater volumes of physical products. PSS fundamentally addresses this mindset. It suggests that instead of squeezing production and supply, it may be possible to extend the value-chain and derive profitability from use, from post-use and even perhaps from recycling and re-use. Instead of greater profitability only being associated with greater volume of sales, it may be possible to generate greater profitability with less physical sales. This idea is often a very difficult one for management to accept, shown again through the example of Interface, whereby an employee re-education system had to be introduced to help employees change their particular mindset.

Finally, there is a lack of a strong macroeconomic driver. PSS would be easier to implement if there were strong systems of eco-taxation but unfortunately these things do not currently exist.

The economic and business case for the case studies in the research is generally very good. However, it must be pointed out that

### 6. Analysis (cont.)



- Product Service Systems performance:
  - Economic/business case:
    - Generally positive/promising
    - Repeat rates of custom
    - More attractive solutions
  - Social
    - Uncertain
  - Environmental
    - Uncertain, cannot decouple demand from resource usage, rebound effects
    - No guarantees but always the potential for improvements through system optimisation

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within the research, most of the cases involved only early implementation of the PSS concept. Thus, the situation at the moment is promising rather than proven. The potential is great due a number of reasons:

The focus on ICT/de-materialization often leads to reduced production cost. Also higher profit margin are often possible through offering greater functionality and marketing the idea that PSS may be a better solution, not just a greener one.

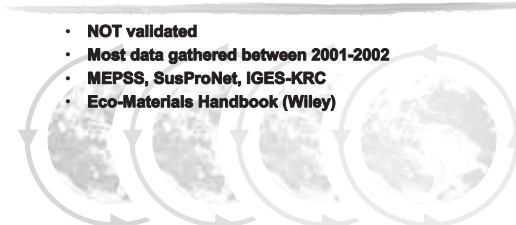
The PSS concept typically ties the consumer more closely to the manufacturer, making repeat-rate custom more likely. This obviously also has implications for customer protection.

However, the social performance of PSS solutions is somewhat uncertain and it is also very much tied up with environmental performance. In terms of the environmental performance, firstly one can say that service cannot entirely decouple demand from resource usage. Services at some point still consume energies and still consume materials. Furthermore, rebound effects are extremely significant in the consumer goods industry. For example, giving a non-PSS example, if one has a more efficient car engine, this may save the consumer a sizable amount of money. However, as the cost per mile drops, it may encourage the consumer to drive more and so the efficiency gain is lost. In consumer goods, the 're-spending' rebound effects is particularly important. If the PSS

leads to a cost saving to the consumer, the consumer then may spend it on other, non-associated services and goods. One means of minimizing this re-spending rebound effect would be to keep the price of the PSS at a comparable level to an existing product-based solution, so that there is no re-spending effect. However, by keeping this price high, there are implications for social inclusion. Thus, in consumer goods and for PSS, there is often a balance to be traded off between social performance and environmental performance.

However, through all of this, the focus on systemic innovation and system optimization shows that there is always greater potential for superior environmental performance, even if that potential is not at the moment always realized.

### 7. Current status of the research



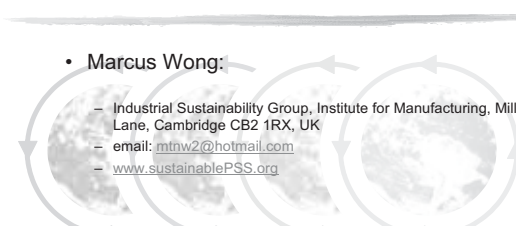
- **NOT validated**
- **Most data gathered between 2001-2002**
- **MEPSS, SusProNet, IGES-KRC**
- **Eco-Materials Handbook (Wiley)**

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The tool developed as an outcome of this research has not been validated i.e. it has not been tested in a company. Most of the data was gathered between 2001 and 2002 for my

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PhD research. The data and the associated analysis is also being used by research organizations as MEPSS, SusProNet in the EU and also IGES and also for my thesis and an article in a forthcoming book.

\* \* \* \* \* Q & A \* \* \* \* \*

**Prof. Yoshida:**

I have a question regarding "6. Analysis." You mentioned one of the primary drivers for implementing PSS is "legislation." I won-

der if you are referring to legislation from UK or the one from EU as a whole?

**Wong:**

In terms of the research that I have carried out, most of the legislation is primarily, originally, from the EU. But the way that works in Europe is that directives are sent out at EU level, but actual implementation of those particular directives are then up to the nations within the EU to implement. So the original drivers are definitely from the EU.





## Session-1

# Trends in PSS Field in European Union

International Institute for Industrial Environmental Economics  
at Lund University (Sweden)

Oksana Mont

Good morning, everyone. I am very pleased to be here. It is a great honor and I am sure we have a lot to learn from each other.

Now, I would like to share some experiences from a decade-long research in the area of product service systems in Europe. It's exactly ten years ago when the first workshop on "eco-efficient services" took place in 1994, at which some thirty of researchers from Europe presented initial results on eco-efficient services.

However, the idea has a much longer history. One of the prominent researchers in this field was Walter Stahel. His original idea on the product service systems came from the idea of servicizing products, meaning not exactly selling function, but trying to extend the life cycle of products by re-manufacturing products and recycling materials. So, that was the original idea.

Later the research focused primarily on moving from material product to immaterial services. At some point of time, researchers believed that it was possible to move from selling material products to providing immaterial services. However, then it was realized that any service is supported or delivered with help of material products and any product in its turn is supported by material systems of production, consumption, transportation, and infrastructure.

As the previous lecturer said, there is a

## PSS development

- PSS lacks common definition
- PSS vocabulary: limited understanding
- PSS methodology
- PSS classification
- Numerous examples, but much fewer solid case studies
- Uncertain potential to emulate B2B examples
- B2B  $\neq$  B2C

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lack of common definition and in Lund we define product service systems as a system of products, services, infrastructures, and networks of actors that are brought together to develop a system that is competitive, satisfies customers and that has lower environmental impact than traditional business models. I think it is very important to add the environmental sustainability or soundness of product service systems to the definition. Many researchers define product service systems very broadly as a marketable set of products and services, which leads to a large number of examples and projects that have very little systems approach and at best can illustrate services added to services. However, since the shift to delivering services is not more environmentally sound, adding services to products does not lead to reduced environmental impact.

This confusion was clearly demonstrated at the last conference in Brussels when

companies presented traditional products with added warranties or with IT software added to products with no record of reduced environmental impact and any suggestions for improvement. So, for this research area to develop as a strategy towards sustainable development, it is very important to have a clear definition and in Lund we are placing much more focus on systems thinking and that is why we say that it is important to define PSS as a system as consisting of elements of products, services, infrastructures and networks to help companies define elements on which they should work on. Also because any offers the company sells on the market consists of material products and immaterial services in whatever form even retailing is a service which is added onto any products.

When it comes to vocabulary of product service systems, it is a strongly restricted to a very limited research community. Therefore, when one visits or works with companies it is important not to impose own terms, but instead learn the terms and strategies that companies are using.

In Scandinavia, companies operate with the term "functional sales", implying that profit is linked to selling function instead of selling a number of products. At such companies we emphasize that functional sales is a financial mechanism, one element of a product service system. We stress that in order for a company to create a more systematic way of developing product-services in a more environmentally sound way, one needs to look at how services are designed, how products are designed, how networks with actors who deliver products and services to the final consumer are created.

In recent years, European Union funded many projects on developing methodology how to develop product service systems in companies. The results of these projects were

reported at the last conference on product service systems in Brussels held in October 2004. The current concern is that first of all methodologies are too many. They differ quite a lot from one another, depending on companies, sectors and agencies that developed these methodologies. So methods developed by energy-efficiency companies might not be useful for companies that provide car-sharing services or chemical management services. The general conclusion is that there is a clear need for a simplified and commonly accepted general methodology, which identifies the main PSS elements, but leaves the details of PSS development and implementation to companies, since each company works in its own settings and its own context.

When it comes to product service systems classification, also previous speaker mentioned traditional classification that is used widely which is the result-oriented services, product-oriented services, and need-oriented services. In my opinion, this is not a classification that divides services into separate categories. These are also rather elements of product service systems, because different systems can have specifically designed products for specific use, or additional services or can provide products through sharing or leasing arrangements. So, they are not exclusive categories, but rather you can look at the elements as ideas for what types of elements could be added to create a total system.

Now there is a quite a broad range of examples of product service systems towards different sectors. However, concern is also that we lack really deep case studies which would investigate each particular case in details and provide the historical data developed of context-related data and so on. And another concern is that these cases which we have available in the PSS field, they are often not written in business language. So if you want

these cases to be disseminated to many or to larger population of companies, we need to write them in business management language to speak to managers of companies and not to may be only environmental managers.

Also cases differ in their dissemination extent. Some cases, like car-sharing, are restricted to niches. Some cases like chemical management systems are used quite broadly in automotive industry, 80 percent of companies use chemical management services.

Looking at individual company, famous Interface case actually only creates five percent of profit from leasing carpets, the rest comes from producing carpets and selling them. And if you are looking at the company like Schindler Hose Lease, Elevator Power, they create 75 percent of their profit from leasing services. So we should also be aware that there are not many companies who are completely working on PSS models. Often new companies are created for delivering systems solutions. Very seldom producers would shift 100 percent of the operations to the new models.

It is also quite unclear from the cases we have how well companies can use existing knowledge and create their own PSS. The famous Xerox company leases copy machines, takes care of maintenance and services, and takes back copiers for re-manufacturing and recycling. The company has been developing the idea for more than a decade starting with simple increasing efficiency of production processes, moving towards product design and finally towards service and system-based solution. It took the company more than ten years to create system that it has now. And the question is: can other companies permit themselves to spend decades on developing these new business models and whether it is possible to learn from existing systems and develop model which would help other companies

leapfrog and create system solutions in much shorter time. This is still an open question.

Researchers in Europe primarily investigated business to business cases. Lately we saw that a focus is shifting toward consumer goods and to business to consumer cases. It is in this area that totally new challenges arise, because in business to business, there are direct relations between business providers of PSS solutions and business customers. There is often no direct relation between producer of consumer goods and final consumers. Not to mention that there are millions of final consumers. So providing customized solutions is very expensive or in principle impossible in private market.

An additional problem is that there are often additional actors between producers and final consumers. These might be service organizations who provide services to households or community-based companies including housing companies who have direct link to consumers and who might take the role of providing services.

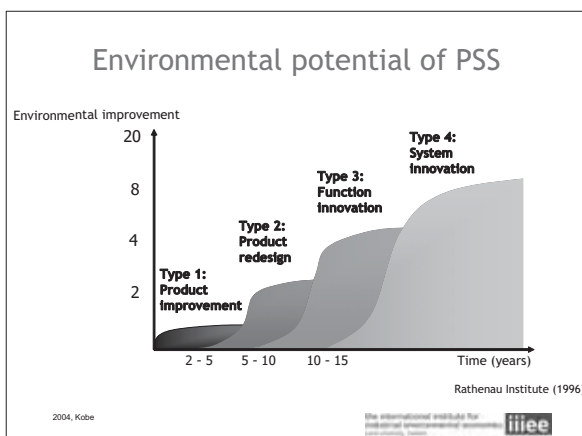
Good development is also that PSS are being found and developed in many sectors. We started with very few cases in a couple of sectors; chemicals, energy-efficiency sectors. Now we have examples from a much broader range of sectors; car-sharing and washing services from private households, leasing of sport goods, and do-it-yourself tools and gardening equipment. These are examples in a business to consumer case and market.

The problem here is that often these services are not supported by changes or adoption of product design. In business to business cases, we see much more concurrent development of products and services. However, on total, we do lack cases where product design would go hand in hand with service design and each of these elements is adopting for development in the other one.

Speaking about policy, at the European level, we do see some shift in policy development. There are no direct policies towards product service systems, primarily because the area is too young. Secondly, we lack clear answer regarding circumstances under which do reduce environmental impact. It is too early for direct policy intervention. However, strict legislation in general in environmental area and especially in extended producer responsibility does trigger companies to explore innovative solutions and more system-oriented solutions.

Our experience is that in chemical sector, legislation or cost of compliance are very high. This triggers companies to look for outsourcing and for sharing responsibilities with professionals that handle chemicals for them. In energy sector, in many European countries we see market deregulation which leads to increasing competition and then companies simply cannot survive on the low-profits from selling energy. The trigger here is purely economic; they need to survive on the new deregulated market.

The PSS concept advocates the idea that by improving one element of the system will not allow us reaching the target which is accepted by many environmental experts - Factor 20 and higher (see picture below).



This graph shows that together with product improvement, we need to develop services;

we need to think about functional innovation and foremost we need to think in terms of systems. Good example in this respect is car-sharing. It is the most successful example in niche market in business to consumer cases, but the problem is to optimize the use-phase. However, there are no major changes in product design to adapt to new ways of delivering mobility. And this is not to say that our cars are very efficient: from the 100 percent of the fuel with which we fuel our cars, only two percent goes to the actual mobility.

So together with improving the use-phase through sharing or leasing of cars we need to work on efficiency of cars as products. Additionally a question is about infrastructure, because if the country's infrastructure is built around cars and there is no public transportation, then it is difficult to promote car-sharing and more efficient or less environmental damaging systems of mobility. So, together with developing more efficient cars and introducing services which would allow people using cars but not owning them, we need to think in terms of different infrastructure which would help customers to also adopt the new system.

Another example from Sweden is washing machine: not every household has a washing machine. When I moved to my flat, I did not have washing machine. There is a space in my bathroom and a socket for me to plug in washing machine if I would like to have my own washing machine. There is instead a common washing center, where there are three rooms with three washing machines in each room. There is a drier and various other machines to cloth care, which I would not have at home. By providing this type of infrastructure, I have still a choice or possibility to buy my own washing machine, if I really need to own it and put it in my flat. But the whole setting helps customer at least to think if you really need to own a washing machine or you

can satisfy your washing needs with the common infrastructure.

### Lessons learned (1)

- New skills are needed for PSS development in companies
- Importance of developing and evaluating scenarios before actually implementing product-service systems
- The role of actors outside traditional supply chain: from B2B to B2C through new actors that are best suited to providing solutions to households

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I will now move towards lessons of the decade of the PSS research in European Union. First I would like just to repeat that it is important to agree on the definition which is not all inclusive because this creates problems and confusion in companies and in research as well. So it is important to have as precise definition as possible. But it is also important to have a definition, which would trigger continuous improvement process by companies.

What we learned is that in order to develop product service systems, new skills are often needed in companies, which use to produce products, they suddenly find themselves in a situation where they need to organize the service element and for many companies this is a big challenge. It is a challenge also for researchers because service design research is much less mature than product design and we know even less about concurrent design of products and services that fulfill the same or similar functions or together present a package that fulfills a certain function.

One of the important emerging ways of thinking of product service systems is to develop scenarios. The starting point for developing products and services is to try to imagine the future starting from function that customers require. For many companies, this is a big

challenge, because they restrict themselves in terms of their technological capacity or their traditional way of thinking is to develop a technical device and then find possible applications.

In product service systems, companies start from customer needs, think in terms of products and services that can satisfy the need of customers, not in terms of technical solutions they have at hand. Additionally it is important to think about the role of new actors who are traditionally not considered of a part of supply chain, especially in business to consumer market. This has implications also for promotion of local economies, because local companies know their customers better than big multinationals, which have probably problems with knowing what different customers in different countries want and can accept.

### Lessons learned (2)

- Success and failure factors for PSS development are similar for companies, but their combination and context (institutions+culture) are unique for each company
- Regulatory and normative frameworks should be set to promote systems with lower environmental impact (efficiency+sufficiency)

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When we looked at success and failure factors for product service systems, there are emerging number of factors which are similar to many companies. However, their combination is different. The combination of these factors depends on institutional setting in each company and also on the cultural context the company is working in. Taking an example of the top management support which Interface has, the CEO is very engaged in the idea and was very active in promoting the idea within the company and outside. However, even a CEO does not change the institutional setting.

As a consequence, the company is struggling with being economically profitable in carpet leasing business. In other cases when institutional settings are favorable for PSS; it might be hard for PSS promoter in the company to obtain top management commitment. So we know what kind of barriers or what kind of factors, a company or a PSS developer should think about, but whether this factor will be positive or negative, will be a benefit or a barrier in this specific depends on the context. Additional "context" factor is the ideology of economic growth, which is unfortunately defined only in materials terms. The main premise of the product service systems is to unlink economic growth from material consumption and instead link the profit to services delivered.

### Lessons learned (3)

- Need to incorporate business and management knowledge
- Methodologies: each company or a network works in its own way - general steps but not the detailed prescriptions
- Environmental impacts can be reduced by systematic and targeted strategies

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For many companies, this represents a very big challenge. Energy-producing companies, which are shifting towards selling energy-efficiency services, are basically undermining their business case, because one department is getting premiums on selling more and more kilo watt hours, while another department within the same company is getting premium on selling as less energy as possible by selling energy-efficiency services. So for many companies, this is a very challenging situation and it creates internal conflicts.

Thus it is a challenging task to introduce an idea based on sufficiency, if the entire society is based on the idea of increasing material

consumption. What we also saw is that environmental impacts will not be reduced automatically in PSS. Unless companies develop systematic strategies to reduce environmental impacts, we will not see that product service system will lead to environmental improvement. So, environmental goal should be set from the beginning.

### Future research directions (1)

- Development of new product-service systems
  - Illustrate possibilities and alternatives
  - Show higher level of integration along the value chain
  - Identify leverage points within networks
  - Balance environmental superiority and customer satisfaction with business viability and social soundness

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When we look into the future, what European researchers will be researching? The development of new product service systems is still an open question. And here we would like to see more research on supply chain and we need to see more integration in value chain. We will also need to identify the strong actors in networks who should be the leader in the network which delivers product service systems. It will always be a question about finding balance between economic viability and environmental superiority of product service systems.

### Future research directions (2)

- Translation of scenarios into practice
- Probing PSS potential in many sectors
- How to build strategic alliances and resolve conflicts?
- Methods for evaluating new PSS
- Multi-disciplinary area - concerted effort and cross-fertilisation

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We started with developing scenarios, but now we need to move towards implementing scenarios in practice and studying what product service systems potential exist in different sectors. As was mentioned before, we do lack methodologies for evaluating environmental features of new product service systems. Again, we have a good starting point with life-cycle analysis of products, but it is a matter of setting boundaries and finding the right units for comparison. What is important and is starting to happen in Europe is collaboration with researchers not only in environmental field but with sociologists and psychologists, who help develop ways of evaluating customer satisfaction and acceptance of new and existing PSS.

### Future research directions (3)

- Research on customer satisfaction and social value systems
- Measure customer satisfaction with alternative solutions supported by cost-benefit evaluation
- Information dissemination about PSS
- Policy measures to promote PSS

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To understand how customer acceptance can be created and where the limits and flexibility of customers are, we need these new scholars to take part in the PSS research. Therefore the research on social value systems is needed as well as the research on a customer satisfaction that is combined with evaluation of costs and benefits for each customer.

\* \* \* \* \* Q & A \* \* \* \* \*

#### Floor:

You mentioned car-sharing has become one of the common B to C examples in EU and it is the users of cars who need to

develop infrastructures - not the owners of cars. For Japanese people, it is hard to understand the concept of "building infrastructure of car-sharing". I wonder if you could give us some examples.

#### Mont:

Thank you. That's a very good question. In Europe, there are municipalities that support, for example, car-sharing by allocating special parking spaces. And European cities are very crowded. So, for many people, that is very difficult to spend very lot of time trying to find a parking place. By allocating specifically designated place for parking, municipalities help people at least consider car-sharing as an option. Additional consideration is information provided by municipalities on car use. On average in Europe a car is used for 30 minutes a day. The rest of the time the car is just standing on the parking lot and people are just paying for it. Moreover, many cities are not built for the number of cars that currently drive in the cities, which leads to traffic jams and increasing pollution. Since there is a good public transportation system in many European cities, for many cities the combination of these considerations shifts the preference towards car sharing.

#### Bleischwitz:

It's Raimund Bleischwitz of Wuppertal Institute. I would like perhaps to briefly comment on the question too. Because what we seen in car-sharing is not only a demand for physical infrastructure, but also for organizational or social infrastructure which means essentially that somebody has to run it, since customers need to be organized and the question is who should bear the additional cost for that kind of social infrastructure. Should it be the customer? Or it is difficult to organize. Should it be the car leasing companies? Or

they may say, "Why should we do it?" So, most of the experiences I know from Europe is that the local authorities have delivered some public space and have hired some kind of service assistant to run such an offer. Of course, one needs additional financial means to organize such services.

**Wong:**

I am just quickly adding on the U.K. situation. I covered car-sharing studies in my

research. And one of the things which currently is pushing implementation of car-sharing, ride-sharing services in London, is what is called "congestion charge". Basically if you want to drive a car into the Central London, you need to pay unless it's something associated with things like car-sharing or it's an electric car. So these things are increasingly becoming common in a number of cities in the U.K. This is one of the issues related to institutions around car-sharing.