

## Gruppo di quesiti n. 1

Gli accordi tra pubbliche amministrazioni

Le clausole sociali negli appalti pubblici

Le Scuole Superiori ad Ordinamento Speciale nel sistema universitario: definizione e peculiarità.

Fonti fatto e fonti atto

Il candidato crei una tabella excel ed inserisca nella colonna A, da A1 ad A8, i seguenti numeri "16, 5, 8, 3, 4, 10, 15, 17" ed ordini i numeri dal più piccolo al più grande con l'apposita funzione.



## **A Case Study Analysis of the Furniture System From Sustainable Product-Service System Design Perspective**

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### **Abstract**

Studies on design for sustainability indicate that the concept of Sustainable Product-Service System (S.PSS) is a promising approach to bring radical changes in the production and consumption system with environmental, socio-ethical and economic benefits. The furniture system has been recently identified as one of the key sectors that should be addressed and improved for environmental sustainability and economic prosperity in the Circular Economy Action Plan (European Commission, 2020). In this respect, this paper presents a case study research aiming to explore and characterise the offer model of S.PSS when applied to the furniture sector as a promising win-win approach towards sustainability. The result indicates that applying S.PSS in the furniture sector can bring win-win benefits for a low environmental impact and a high economic value, even though with some peculiarities compared to the known general win-win S.PSS economic and environmental benefits. Some reflections are given concerning this approach in the socio-economic crisis taken by the Covid-19, which is made around the opportunities that S.PSS applied to furniture can extend the access to high quality and well-designed furniture to even low-income individuals and entrepreneurs.

**Keywords:** Sustainable Product-Service System, furniture system, Design for Sustainability, system innovation, Life Cycle Design

### **1. Introduction of the furniture sector's environmental impacts and possible solutions**

The furniture production and consumption system is a resources intensive sector with high input and output related environmental impacts. Each year, around 42 million tons of furniture are produced, of which 57% are wood made furniture, 20% are upholstered furniture, 12% are metal made furniture, etc. (Tomaselli *et al.*, 2014; Forrest *et al.*, 2017). This means vast environmental impacts caused by the furniture sector in resources input and waste emission. As

a result, furniture has been recently identified as one of the key sectors that should be addressed and improved for more sustainable development (European Commission, 2020).

These negative environmental impacts of the production and consumption system accelerated research on the causes and solutions to these problems. Moreover, it has become a necessity to take radical steps towards sustainability in a systematic way. Former proposed method for product innovation, specifically environmental sustainability products design (even known as Life Cycle Design, LCD), is crucial to improve products' environmental performance concerning the life cycle processes (Vezzoli, 2018; Ceschin and Gaziulusoy, 2019). However, based on the production and sale of products in traditional business logic, manufacturers are usually not economically interested in optimising the sustainability along the product's life cycle, for example, extending product lifespan (Manzini *et al.*, 2003). From these aspects, it is necessary to move from product innovation to a more systematic approach. Researchers underline system innovations, which mean production processes and artefacts, patterns of consumption and access to goods and services are all under discussion (Brezet, 1997; Adams *et al.*, 2015; Manzini, 2002). In this aspect, Sustainable Product-Service System (S.PSS) is a promising one (Manzini, 2002; Tukker, 2004; Vezzoli *et al.*, 2014; Vezzoli *et al.*, 2021; European Commission, 2020). The definition of a S.PSS is “an offer model providing an integrated mix of products and services that are together able to fulfil a particular customer/user demand (to deliver a “unit of satisfaction”), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the product/s and/or the life cycle services costs/responsibilities remain with the provider/s, so that the same provider/s continuously seek/s environmentally and/or socio-ethically beneficial new solutions, with economic benefits” (Vezzoli *et al.*, 2021).

The research hypothesis of this paper, described in chapter 1, is that S.PSS for the furniture system could bring win-win benefits for environmental sustainability, economic prosperity and social cohesion with its own peculiarities.

The paper describes the S.PSS's general win-win benefits in chapter 2. Chapter 3 states the method for the case study; Chapter 4 describes the detailed information of a representative furniture S.PSS case and a cross-case analysis of 8 furniture S.PSS cases. In Chapter 5, the

### Gruppo quesiti n. 3

Il silenzio assenso tra le pubbliche amministrazioni.

Le modifiche dei contratti durante il periodo di efficacia.

Il Nucleo di Valutazione: costituzione, compiti e funzioni.

Costituzione e leggi costituzionali

Il candidato crei un documento excel inserendo nella cella B1 il numero 5, nella cella C2 il numero 3, nella cella D3 il numero 8, nella cella E4 il numero 11 ed effettui la media mediante l'apposita funzione.



After analysing each case, cross cases analysis is conducted. The aim is to compare the S.PSS for furniture configuration, satisfaction unit, offered products & ownership, offered service & provider, payment method and sustainable win-win benefits.

#### 4. The outcome of case study analysis

Eight cases are analysed according to the case study format. All cases' information has been recorded in LeNS network<sup>4</sup>. The following part recorded one representative S.PSS for furniture case to show how cases are analysed.

##### 4.1 An example of furniture S.PSS cases - Furniture as a Service (GISPEN, the Netherland)

###### 4.1.1 General information

<b>Brand name</b>	-Gispen
<b>Producer/provider /alliance of providers</b>	-Gispen
<b>Company location</b>	-The Netherland
<b>E-mail</b>	- info@gispen.nl
<b>Website</b>	- <a href="https://www.gispen.com/en/">https://www.gispen.com/en/</a>
<b>Start (year)</b>	-1916
<b>State</b>	-ongoing
<b>Link to video</b>	- <a href="https://www.youtube.com/watch?v=XxQwZtVGu-k">https://www.youtube.com/watch?v=XxQwZtVGu-k</a>
<b>Source of information</b>	- KATCHE project, (Bosch et al., 2017), (Pergande et al., 2012), (Zancul et al., 2011)

###### 4.1.2 Furniture products analysis

###### i) Furniture characteristic

<b>Furniture series (name):</b>	Triennial seats
<b>category</b>	- chair
<b>Main materials</b>	-steel, textile, wood, foam
<b>LCD strategies:</b>	
<b>Furniture use extension/ intensification</b>	-use standard components and modular structure; design for easy disassembly;
<b>Material consumption reduction</b>	-none
<b>Material Life Extension for furniture</b>	-mono-material strategy; design for easy disassembly
<b>Toxicity reduction for furniture</b>	-none
<b>Energy Consumption Reduction for furniture</b>	-none
<b>Resources conservation/biocompatibility</b>	-none

###### ii) Short description of furniture products

- General information of the project including brand, location, contacts, start year, project state, video (interview or introduction), source of case's information;
- Furniture analysis: (i) furniture characteristics including category, main materials and life cycle design strategies (i.e. furniture use extension/intensification, material consumption reduction for furniture, material life extension for furniture, toxicity reduction for furniture, energy consumption reduction for furniture, resources conservation/biocompatibility for furniture). (ii) furniture description. (iii) sustainable benefits;
- Furniture PSS analysis: (i) System characteristics including providers, customer, S.PSS type, satisfaction unit, offered products, offered services; ownership of products and payment methods. (ii) System description. (iii) Sustainable benefits of the system, including environmental benefits, socio-ethical benefits and economic benefits. (iv) stakeholders interaction showed with system map (developed by the LeNs network<sup>4</sup>, see figure 2);
- Limits and barriers of the system (if there are);
- Pictures to show products and systems.



Figure 1. Case study format

### 3.4 Cross-case analysis

<sup>4</sup> <http://www.lens-international.org/>



## GRUPPO QUESITI N. 7

Gli incarichi esterni a dipendenti pubblici

Il Collegio Consultivo Tecnico

Il Consiglio di Amministrazione: modalita' di nomina, compiti e funzioni;

Le leggi regionali

Il candidato crei un documento word digitando il seguente testo in maiuscolo: "NUOVE NORME IN MATERIA DI PROCEDIMENTO AMMINISTRATIVO E DI DIRITTO DI ACCESSO AI DOCUMENTI AMMINISTRATIVI"; trasformare tutte le parole in minuscolo e sottolineare il testo; salvare il file sul desktop denominandolo documento \_uno.



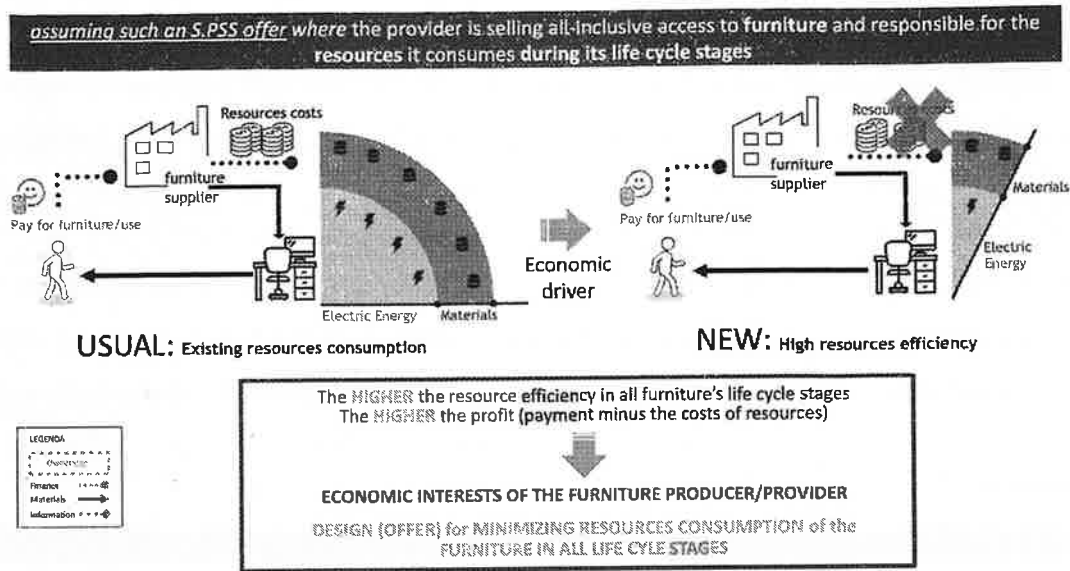


Figure 8. the win-win benefits of S.PSS for furniture (Resources consumption minimisation)

### 5.3.5 S.PSS for furniture facilitates resources renewability/biocompatibility

When we enlarge the furniture system to include some type of energy/materials consuming furniture in use, such as a workstation, and the S.PSS for furniture provider has an all-inclusive offer of furniture and resources during use, with pay per period/time/satisfaction (e.g. furniture and energy production unit), the higher the proportion of passive/renewable sources (environmental benefits), the higher the profit, i.e. the payment minus (among others) the costs of sources (economic benefits). Hence, the furniture producer/provider is driven by economic interests to design (offer) for resources renewability. See figure 9.

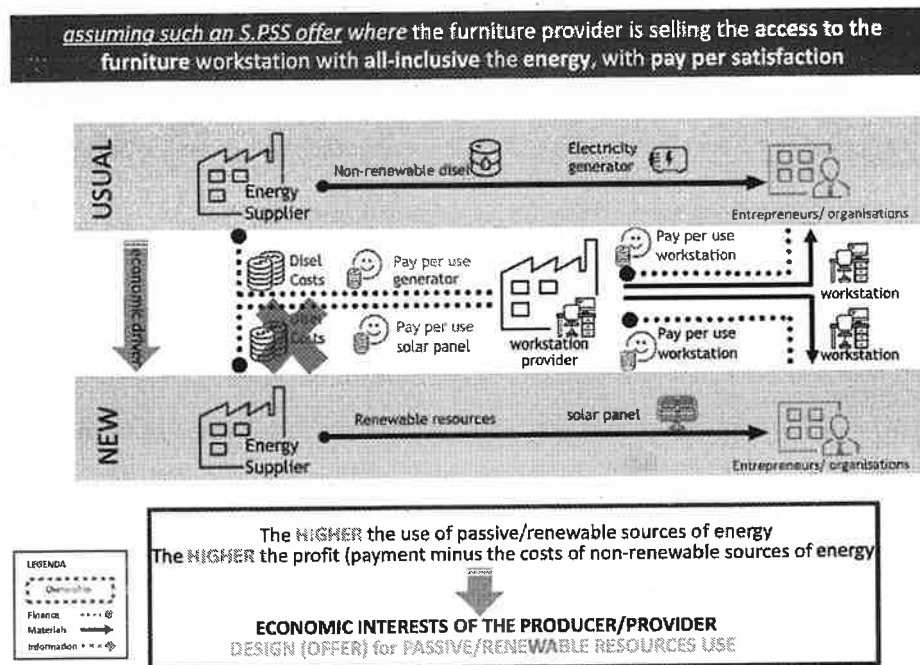


Figure 9. the win-win benefits of S.PSS for furniture (Resources renewability/biocompatibility)

### 5.3.3 S.PSS for furniture facilitates material life extension (recycling, energy recovery)

As far as the S.PSS for furniture provider is selling all-inclusive furniture with its end-of-life treatment, the more the materials are either recycled or incinerated with energy recovery (environmental benefits), the more costs are avoided of landfilling, the purchasing of new primary materials or energy (economic benefits), see figure 7. Hence, the furniture producer/provider is driven by economic interests to design for material life extension (recycling, energy recovery etc.), by applying furniture LCD strategies, including adopting the cascade approach for furniture; selecting materials with the most efficient recycling technologies; facilitating collection and transportation of disposed furniture; identifying furniture materials; minimising the number of non-compatible furniture materials and/or facilitating their separation.

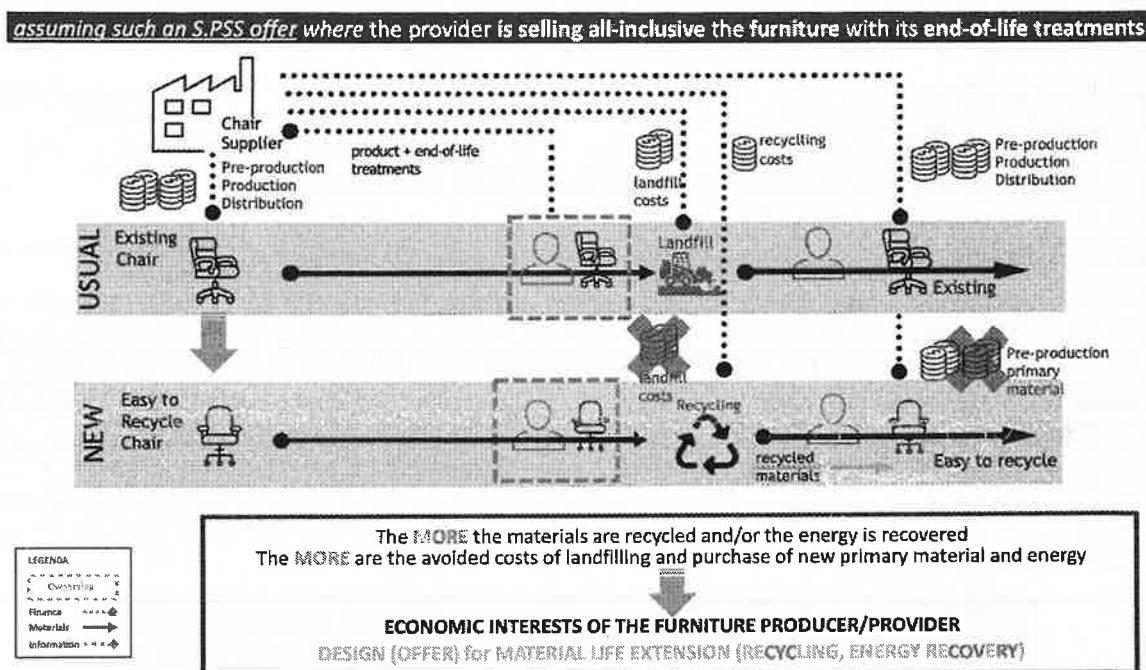


Figure 7. the win-win benefits of S.PSS for furniture (material life extension)

### 5.3.4 S.PSS for furniture facilitates resources consumption minimisation

As far as the S.PSS for furniture provider is selling all-inclusive access to furniture and responsible for the resources (i.e. materials and energies) it consumes during its life cycle stages, the higher the resources efficiency in all furniture life cycle stages (environmental benefits), the higher the profit (economic benefits), see figure 8. Hence, the furniture producer/provider is driven by economic interests to design/offer furniture and/or services that minimise resources consumption by applying furniture LCD strategies, including minimising the material content of furniture, minimising scraps and waste, minimising or avoid packaging, minimising material consumption during use and minimising energy consumption along the furniture life cycle.