Configuring new business models for circular economy through product-service systems

Marina P. P. Pieroni 1*, Tim C. McAloone 1 and Daniela C. A. Pigosso 1

Supplementary Materials A

Table S1: cases for the Furniture sector embedded in the CE-Driven Business Model Configurator. Legend for sources: 1- Ellen Macarthur Foundation [1]; 2 – Knowledge Hub [2]; 3 - Official reports funded by the Nordic Council of Ministers; 4 – Academic works [3,4]; 5 - Snowballing and companies websites

Code	Case company	Sources
CF01	Auping	1
CF02	Biofurniture	1
CF03	Brabantia	1
CF04	Casamania	1
CF05	Cirkel	1
CF06	COCO-MAT	1
CF07	Data city	5
CF08	Desko	1
CF09	Desso	1
CF10	DSM Niaga® Technology	1
CF11	Emblem furniture	5
CF12	Emeco	1
CF13	Furnishare	2
CF14	GH Form	3
CF15	Gispen	1; 4
CF16	IKEA	5
CF17	Interface - Fishing nets	1
CF18	Interface - Evergreen lease (discontinued)	1
CF19	Kaiyo	5
CF20	Lithuanian designer Mindaugas Zillions	2
CF21	Martela	3
CF22	Opendesk	1

CF23	Orangebox and Premier Sustiain (joint venture)	1
CF24	Re-Worked by Adam Fairweather	1
CF25	Rype office	2
CF26	ShareDesk	1
CF27	Steelcase 1	2
CF28	Steelcase 2	2
CF29	Steelcase 3	2
CF30	Steelcase 4	2
CF31	Studio Bernardita Marambio	1
CF32	Studio Tjeerd Veenhoven	1
CF33	Valpas	5
CF34	Vitsøe	4
CF35	Zuo	5

Supplementary Materials B

SEIZE **Business Model Framework for Circular Economy** Configuration: Digital platform to enable access to/ or use of modular furniture systems through short term contracts **Activity 06 Outcomes** Offering **Network** Target customers **Traded** (products and services) Resource secondary resources Economic Modular furniture systems (idle/ Partner for delivery and Decoupling · Companies: •Recurring income • Reduced waste service provision - in need of flexible refurbished) from circular supplies MDF panels •Long-term/closer • Relation to Add-ons workspaces · Local recycling facilities for Ocean plastics customer Reduced virgin wanting to modernize Free delivery and assembly MDF and 'ocean plastics' relationship materials Configuration/design of spaces with circular economy 'Ocean plastics' collectors New market •Restore ocean Spare parts and repair (e.g. connectors) values segments qualities Reconfiguration (e.g. moving) · Venue owners or property Disassembly and take-back Society developers **Value delivery** • Project-based organizations processes (channels & relationship) Marketing: campaigns for awareness in how to take care of modules **Value creation** Sales: digital platform (marketplace); processes configurator software; service contracts **Value Proposition** · Increased revenues Simplicity of concept (activities and resources) Service Delivery: delivery/assembly (key actors get...) • Flexibility to renew furniture Brand enforcement with CE Sourcing: personnel; inventory truck ("stocks on · Lower investment costs initiatives - Develop and apply recycled materials the move"); packaging for moving Circular modular furniture (e.g. ocean plastics) (delivery/reconfiguration) systems to create flexible and Operations/Logistics: Revenue mechanism functional workspaces per Demand management and tracking subscription/temporary contract 1) Pay-per-use, rental or leasing contracts Transportation for taking back Storage and reprocessing facilities 2) Subscription packages Refurbishing and remanufacturing processes (dismantle, sort parts, clean) **Value Shared** Value Delivered Recycle processes · Refurbishment facilities • Initial stocks and inventory/ 'on the move' (truck) Cost structure · Digital platform development · Logistics operations (operational and financial) Financing options Partner with existing customers who own idle modular systems and propose renting those (cash flow condition restrictions & out in the digital platform in exchange for shared revenues external financing options)

Figure S1: CE-oriented PSS BM concept for Ope (adapted from Biloslavo et al. [5], Kraaijenhagen et al. [6] and Osterwalder and Pigneur [7]).

SEIZE **Business Model Framework for Circular Economy** Configuration: sales of long-life products with through-life care services and buy back schemes **Activity 06 Outcomes** Offering **Traded** Network Target customers (products and services) Resource secondary resources Economic Assembly/ Disassembly/ Decoupling B2G or B2B New or refurbished outdoor furniture Potential • Potential for Wood Building contractors - help Free delivery and installation increase/new Longevity removing/preparing revenue lines Warranty for materials (15-80 years) Triple lifetime Potential 85% production furniture for pick-up Manuals/pro-active contact for occurrence of new energy reduction maintenance • 80% materials saving Transport companies (takemarket segment Long-life care package (time-based and Improvement in · Enhancement of back) resource control brand value scheduled maintenance) Local refurbishment/ Renovation or refurbishment services Society remanufacturing centers • Pick-up or buy-back at the end-of-use Local repurpose partners **Value delivery** for wood processes (channels & relationship) · Sales pitch and process Proactive marketing/ communication **Value creation** for customers processes Environmental conscious/ Additional revenues/ **Value Proposition** Take back logistics (activities and resources) compliant option for end-ofaccess to new customers Sustainability reporting for customers (key actors get...) Management system for returned use o Tool/ methodology furniture: · Convenience – 'get rid of 'old' Brand enforcement and 'Furniture for social meeting places o Team/ staff o New software for inventory managt. furniture at the end of use' publicity to last a lifetime with services for o Governance Customization for the new **Revenue mechanism** Physical inventory life-extension ...trade in or we pick-• Fee for removal/ pick-up purchase up your used furniture for free' Refurbishing/remanufacturing preparation Facilities Lower controlled Methodology for inspection/ maintenance costs terminology Affordable option/lower · Service agreement packages · Maintenance investment - buy refurbished Upgrade/Refurbishment services o Team and training Durable and long-life products Management system (CRM) **Value Shared Value Delivered** Service level agreement/packages Physical storage for returned products **Cost structure** Marketing/communication (operational and financial) • CRM/ Inventory management system · Maintenance team training **Financing options** · Pilot - self financed (cash flow condition restrictions & external financing options)

Figure S2: CE-oriented PSS BM concept for Vestre, configuration 1 (adapted from Biloslavo et al. [5], Kraaijenhagen et al. [37] and Osterwalder and Pigneur [38]).

Business Model Framework for Circular Economy Configuration: access to outdoor furniture based on temporary service contracts **Activity 06 Outcomes** Offering **Network** Target customers **Traded** Resource (products and services) secondary resources Economic Decoupling B2G customers with • Upgradable & timeless long-lasting Installation/ Potential increase/ Wood Enhanced furniture for urban spaces restrictions in investment decommissioning partners new revenue lines resource security · Consultancy for configuration or Potential new and control of budget (local) market seament product life cycle specification of spaces Customers with short- Transport companies (take-Enhancement of • Free delivery and installation brand value term projects or • Maintenance and repairs (time-based and back) · Enhancement of temporary spaces - e.g. scheduled) customer relationship Local refurbishment/ Pick-up at the end-of-use/ renovations seasonal parties remanufacturing centers Society • Upgrade: extra units or changes in current product configuration Local repurpose partners for **Value delivery** wood processes (channels & relationship) • Sales pitch and process Proactive marketing/ **Value creation** communication processes Service contract management Additional revenues/ **Value Proposition** Lower upfront investment (activities and resources) Insights analytics on how places access to new customers (key actors get...) More value received to Management system for retuned work furniture: money Take back logistics: transport/ Brand enforcement and Software for inventory 'Best fit/configuration furniture Convenience packaging publicity management for social meeting spaces at a Environmental conscious/ Revenue mechanism o Governance 'monthly maintenance budget' ' compliant option for end-of- Refurbishing/remanufacturing · Renting fee o Facilities and methodology for Shorter or longer time packages inspection/terminology Maintenance Subscription to premium o Team and training upgrades to top of line collections Management system (CRM) or wood **Value Shared Value Delivered** Service level agreement/packages • Pick-up and transfer of returned furniture to refurbishing facilities • Physical storage for returned products **Cost structure** • Maintenance team/ inventory mngt. Marketing/communication (operational and financial) • CRM/ Inventory management system Maintenance team training

SEIZE

Financing options

(cash flow condition restrictions & external financing options)

Figure S3: CE-oriented PSS BM concept for Vestre, configuration 2 (adapted from Biloslavo et al. [5], Kraaijenhagen et al. [37] and Osterwalder and Pigneur [38]).

· To be investigated

References

- 1. EMF *Circular Economy Case Studies*.; https://www.ellenmacarthurfoundation.org/case-studies (accessed 23 September 2018), 2018;
- 2. Knowledge Hub Case studies and articles. [online] Available online: https://circle-lab.com/knowledge-hub/all-content (accessed on Sep 23, 2018).
- 3. Bocken, N.M.P.; Short, S.W. Towards a sufficiency-driven business model: Experiences and opportunities. *Environ. Innov. Soc. Transitions* **2016**, *18*, 41–61.
- 4. Bosch, T.; Verploegen, K.; Grösser, S.N.; van Rhijn, G. Sustainable Furniture that Grows with End-Users. In *Dynamics of Long-Life Assets*; Springer International Publishing: Cham, 2017; pp. 303–326 ISBN 9783319454382.
- 5. Biloslavo, R.; Bagnoli, C.; Edgar, D. An eco-critical perspective on business models: The value triangle as an approach to closing the sustainability gap. *J. Clean. Prod.* **2018**, *174*, 746–762.
- 6. Kraaijenhagen, C.; Van Open, C.; Bocken, N. *Circular Business Collaborate and Circulate*; Circular Collaboration: The Netherlands, 2016; ISBN 9789082490206.
- 7. Osterwalder, A.; Pigneur, Y. *Business Model Generation*; Self Published, Amsterdam, 2010; ISBN 9780470876411.