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Integrating Design Strategies and Tools for Sustainable Production and Consumption of ICT and Electronics Products: An Implementation for Academia and Industry

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Abstract

The study aims to indicate the challenges of design strategies and tools currently applied in academia and industry, investigate the contribution of circular design toward sustainability, and propose a design framework to enhance social sustainability. Action research, expert interview, systematic literature review, and design thinking research, were executed to summarize the findings. The result shows that major challenges are a demand for multi-disciplinary setting, a time constrain in training tools and data collection, and an uncertainty in incorporating the tools into day-to-day design tasks. Moreover, service-led approach in business model innovation, societal and emotional aspects in product design, service design during use, and collaborative distribution and logistics in supply chain management, must be considered more to achieve a high level of circularity. The integration of life cycle thinking, design thinking, and business model tools, coupling with essential emerging technologies can be applied during product development process to solve social problems.

Keywords: design for sustainability, life cycle thinking, sustainable production and consumption, system innovation, ICT and electronics industry

Research Focus

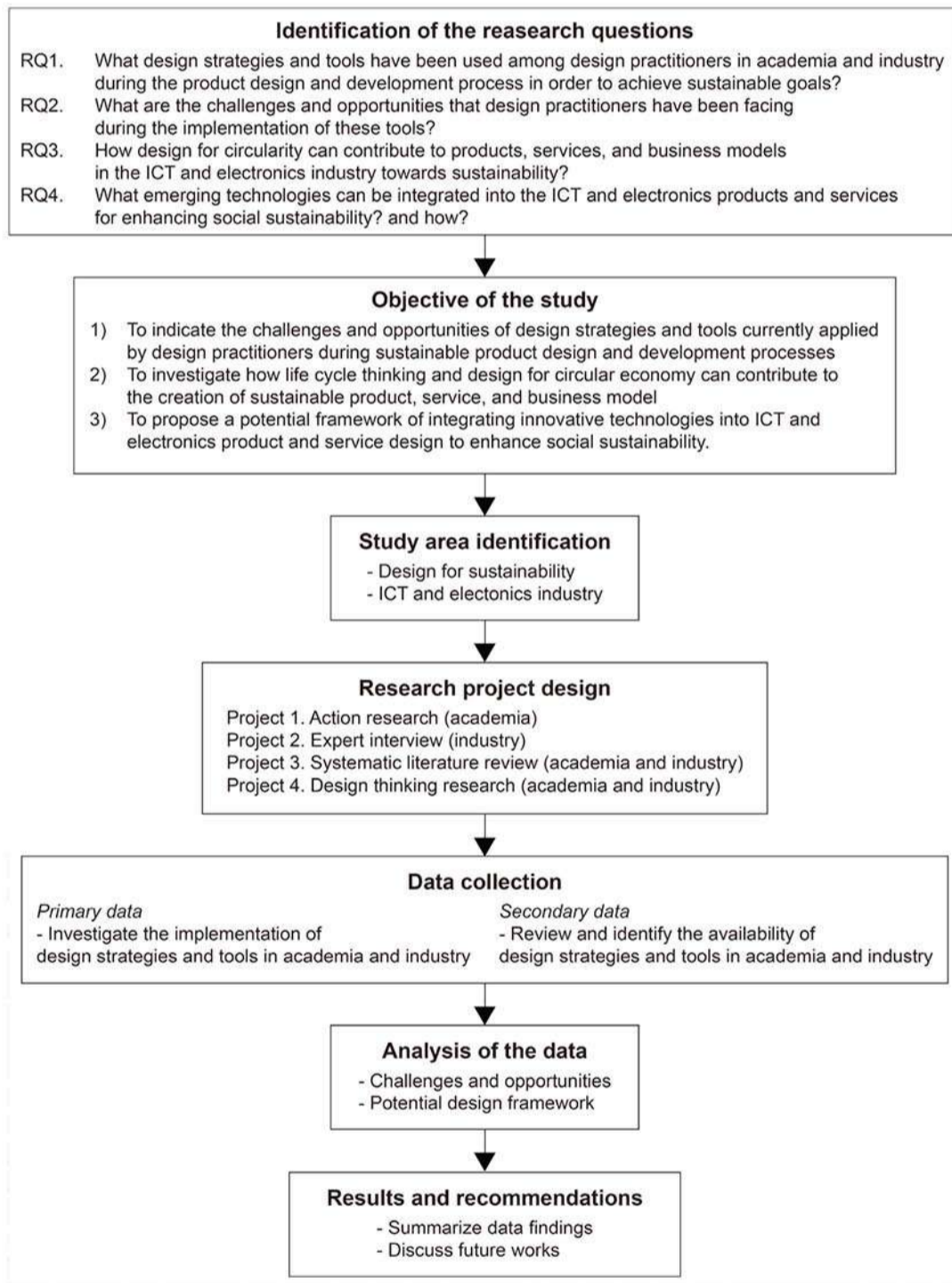


Fig 1. Seven-step research framework

Selected Journal Publications

- Suppipat, S., & Hu, A. H. (2022). Achieving sustainable industrial ecosystems by design : A study of the ICT and electronics industry in Taiwan. *Journal of Cleaner Production*, 369(July), 133393. <https://doi.org/10.1016/j.jclepro.2022.133393>
- Suppipat, S., & Hu, A. H. (2022). A scoping review of design for circularity in the electrical and electronics industry. *Resources, Conservation & Recycling Advances*, 200064. <https://doi.org/10.1016/j.rcradv.2022.200064>
- Suppipat, S., Teachavorasinskun, K., & Hu, A. H. (2021). Challenges of Applying Simplified LCA Tools in Sustainable Design Pedagogy. *Sustainability*, 13(4), 2406. <https://doi.org/10.3390/su13042406>

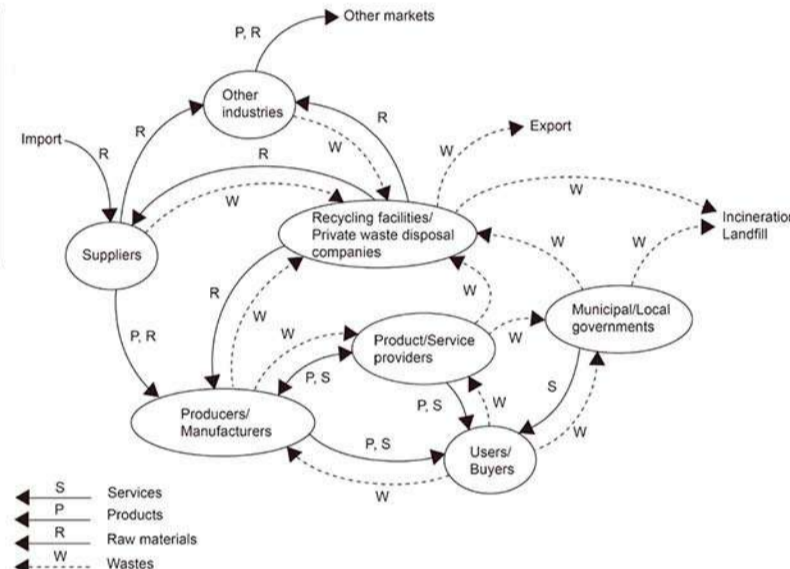


Fig 2. Service, product, raw material, and waste flows within the ecosystem of the ICT and electronics industry in Taiwan

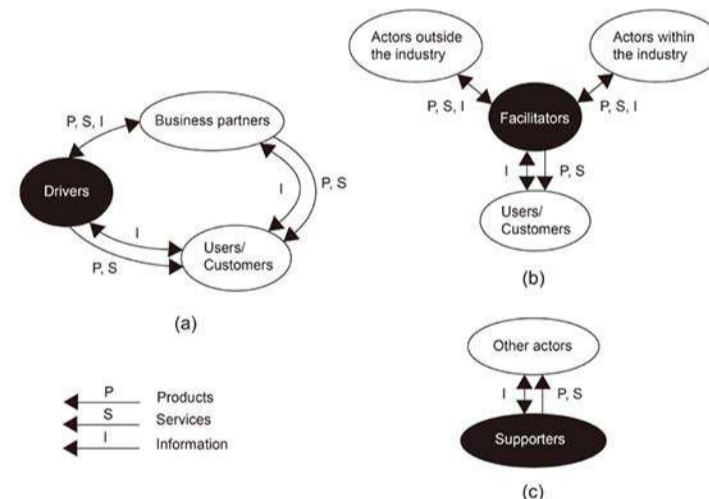


Fig 3. Three major actors in the ICT and electronic industry in Taiwan: (a) a driver, (b) a facilitator, and (c) a supporter

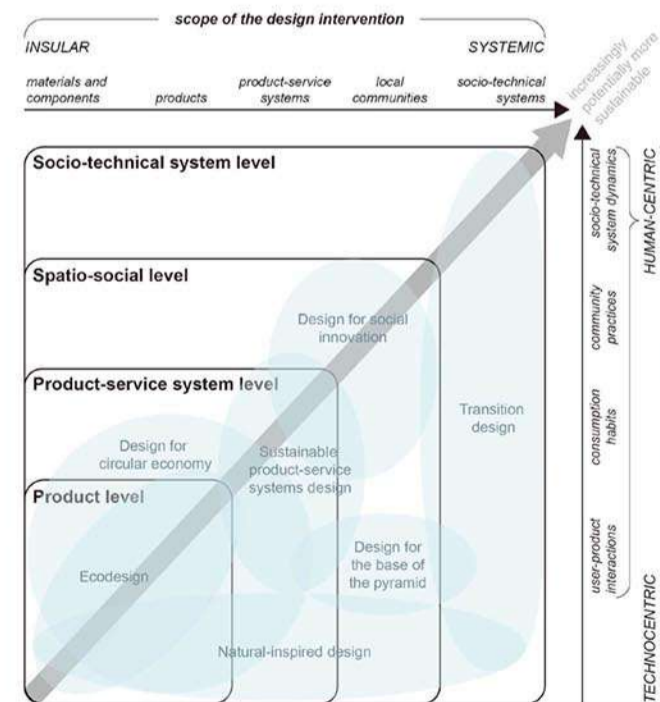


Fig 4. Mapping seven design approaches onto the design for sustainability innovation framework (adopted from Ceschin and Gaziulusoy [2020])

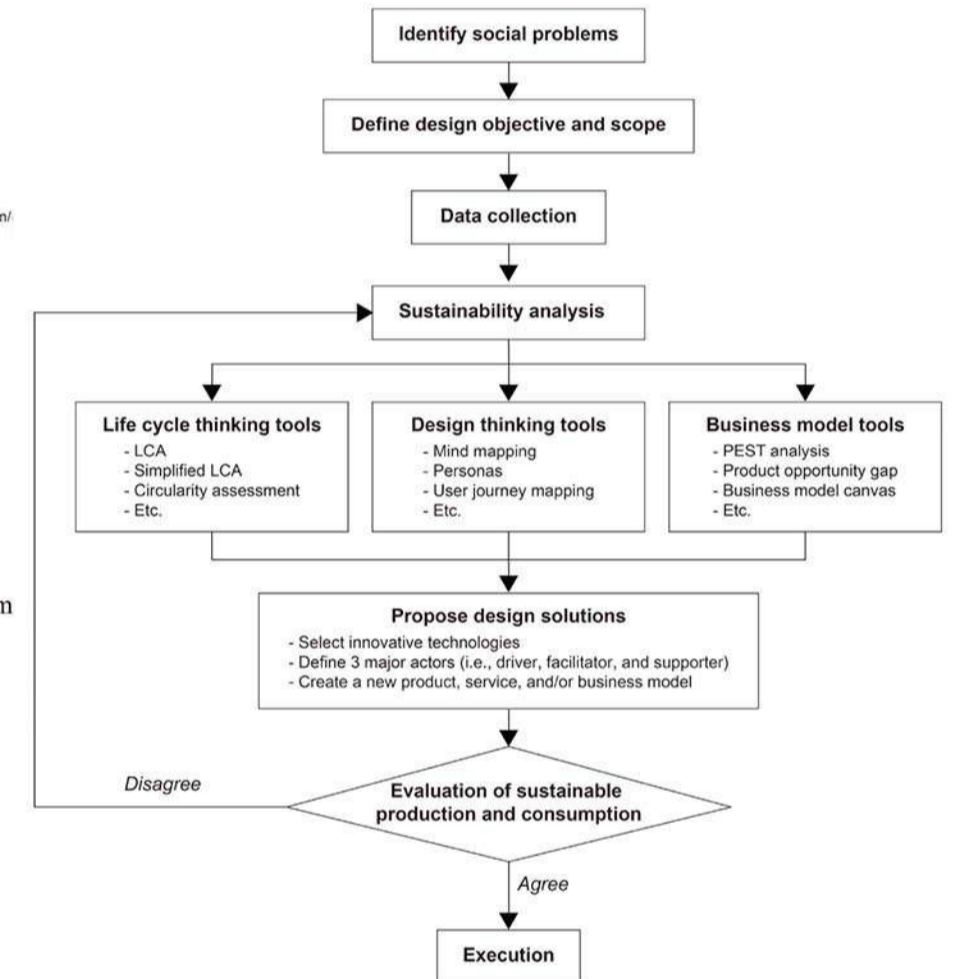


Fig 5. Framework of integrating innovative technologies in product-service systems design to enhance social sustainability

For achieving SCP of ICT and electronics products, an intensive implementation of three major approaches of design for sustainability (i.e., ecodesign, design for circular economy, and sustainable product-service systems design) is currently applied in academia and industry. These design approaches are somehow categorized into an area of product-service system level of the design for sustainable innovation framework. To increase more sustainable potential, the design strategies that can encompass spatio-social and socio-technical system levels, including design for social innovation, design for the base of the pyramid, holistic biomimicry, and transition design, should be promoted exclusively to design practitioners in academia and industry.

Three types of tools, namely, life cycle thinking, design thinking, and business model tools, are integrated into the product design and development processes by design practitioners in order to come up with a new product, service, and business model for sustainability. By integrating these tools into the product design and development processes, design practitioners have been facing various challenges and opportunities. On the one hand, the challenges such as 1) a demand for a multi-disciplinary setting, 2) a time-consuming activity in tool training and required data collection, and 3) uncertainty of integrating the tools in the day-to-day design activity and culture of the organization, need to be overcome. On the other hand, the opportunities of applying these tools to enhance sustainability include 1) supporting managerial and communication tools, 2) Allowing a new combination of tools that match design objective and context, and 3) facilitating a holistic viewpoint and system innovation for designers.

In order to obtain a better understanding of the framework proposed in this study, further research on how effective of applying this framework by design practitioners should be executed both in academic and industrial contexts. Moreover, various tools related to life cycle thinking, design thinking, and business model have been introduced and available in the market over the last decades. It is suggested to increase the number of participating companies and educational institutions in different countries to compare the differences and similarities of the tool application. Also, the best practices of a new combination of the tools should be investigated. Thus, design practitioners need a guidance on which tool they should select during the sustainable product and service design process.