Routledge addition: Practical ideas for introducing design ecologies

Design Ecologies Exercise:
The Innovation Landscape Matrix

This exercise positions an ecosystem perspective as central to design learning. In considering a particular design focus, students are invited to explore the ecological and social consequences of design practice. The exercise uses probing questions to better understand the context of a designed outcome and then uses the 'Innovation Landscape Matrix' [ILM] to explore new design opportunities. This activity builds a design ecology and makes visible the systemic interactions that connect across multiple scales. The ILM's rich picture helps students consider new spaces for design outcomes and the potential unintended consequences of different design activities. This process opens possibilities for transformative practice – while being mindful of creating new problems.

1. Step One: Contextualising Questions

Students are asked to choose a designed outcome**: a product, a piece of clothing, a building, a billboard, an app, a service, etc. –** and to consider the following questions:

- what it looks like;
- how it functions;
- how it is used, and who uses it;
  - what it is made of;
  - how it is manufactured;
- how people misuse it;
- what its environmental impacts might be;
- how it might need to be powered –and by what;
- what resource/s it might consume in use;
- how often it will need maintenance;
- how to care for it – to reduce need for maintenance;
- can it be shared – and how it might be shared?;
- is it owned or leased – how does this impact durability? …

The intention of this exercise is to encourage questions that move beyond the usual considerations of form, function, user-centeredness, and feasibility. Instead students are asked to explore the wider relationships and connections between products, people, services, and systems.

2. Step Two: Innovation Landscape Matrix

The 'Innovation Landscape Matrix' [ILM] helps students think about where they should focus their design endeavours. Here, numerous ecological systems boundaries influence the questions being asked. The ILM maps product, service, and system against materials, people, and structures. Each box of the matrix poses different questions to consider, helping

students to see current dominant areas of design focus – often in the area of products and materials. This work helps reveal gaps in the landscape when thinking about relationships between products, services, and systems and the contexts in which they operate.

The matrix prompts learners to explore these multi-level relationships and to initiate discussions that open up different design spaces. For example, the 'product ecology' of a washing machine might illustrate current design and innovation solutions focused primarily on products and materials in the bottom left box of the matrix. The typical dominant themes of design and innovation of the typical washing machine today focus on transforming products. Questions concerning energy efficiency, durability, maintenance, ergonomics, digital interfaces, usability, reusability might surface in this space. Tracking diagonally upwards across the matrix, the middle box prompts exploration of interactions between people and product-services, from exploring new needs and stakeholders to questions addressing cultures of use. Landing in the top right box students are asked to consider infrastructural trends and challenges and new technologies for example that impact on the system in which the products and cultures of clothes washing sit. Here an example could be in foresighting the vulnerability of domestic water supply where innovation responses might include no water washing technologies, or washing machines fed from domestic grey water, or washing services that promote the resource efficacies of washing at a community scale. Although innovation in the system/infrastructure space may appear far removed from the actual scope of design today, it is in making these connections across the systems that stimulates discussion of new innovation opportunities. Such a landscape helps show the difference between asking students to consider the design of a washing machine compared to asking different questions to draw out debate around other washing system boundaries. As part of the assessment for this course, students are asked to select a product of their choice as a starting point and map out its ecology, using the ILM as an approach to delve into questions rarely asked of a product.

History and Inspiration

The Innovation Landscape Matrix was initially created at the Open University in the early 2010s for a 3rd year undergraduate design course to support ecosystem thinking in design. It was further developed for an early Transition Design Symposium in 2016 (Dewberry 2018) . The version Innovation Landscape Matrix presented here has been updated to integrate more recent knowledge in design for sustainability. This work builds on ecological theory and sustainable design theory such as the systemic design principles presented by Peter Jones (2014, 8) , the Design for Sustainability Innovation Framework by Fabrizio Ceschin and Idil Gaziulusoy (2020, 144) , and Four Design Domains by Peter Jones and Kristel Van Ael (2022, 8) . It offers a practical example of thinking more holistically in design teaching. We invite you to use the ILM to explore different design ecologies with undergraduate and postgraduate students when framing and developing solutions to problems.

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	Materials	Society / People	Structures
System Level **Spatio-social-socio-technical system** • Infrastructures • Resources • Governance • Ethics • Culture	• What resources and infrastructures does the system rely on (e.g. renewable/non-renewable energy, shipping, etc.) • What are the key environmental impacts of this system? • What are the ethical issues of the system? Consider the ethics of resource extraction/production; displacement of communities; trade-offs in intensive production processes; etc. • How adaptable is the system or its component parts? Can it work with less energy and few resources? What are the trade offs? (e.g. using less/different energy or resources)? • What are the likely long-term impacts on resources and pollution? • Are there regulations and guidelines that determine how resources are used within this system? • Is this system a site of political contestation? • Are there alternative, less resource intensive options? • Why are these options not implemented?	• How do technology, culture and infrastructure influence the expectations people have about their needs /wants? • What needs (now and in the future) are satisfied within this innovation system? • What are the social norms associated with material consumption in the system? • What key things influence system-level issues, e.g. media, markets, technology, consumption, climate change? • Which actors have opportunities to influence decisions in this system? (e.g. policy makers, manufacturers, consumers, society) • Who benefits as a result of the innovation system • Who is disadvantaged as part of the innovation system? • What ethical considerations are visible at the system level? • Are there communities groups or other citizen groups with social, sustainability concerns? What are their arguments?	• How is the innovation system influenced by different geographical/ technological, cultural and infrastructure contexts? • What geographical or time scale(s) does the system rely on or affect? • What are the key trends at a system level that influence the effectiveness of innovation functions or outcomes? (e.g. increased interconnectedness through smart technology • What opportunities are there for interventions at the system level to influence changes in the context of innovation? (e.g. technological, regulatory, cultural) • What political factors are relevant to the innovation system?
Service Level **Product - service system** • Needs • Functions • Outcomes • Resources • Infrastructure	• What function(s) does the service provide? • What needs are met through the service? • What materials are required for the service to function effectively? • Which part of the service life cycle has the most environmental impact? • What technologies are required for the service to function effectively • Can the service evolve to meet new needs? • Would the service require additional functionality/material things in order to make it adaptable and to meet other types of need? • Do users own the product components or are they leased? What are the implications of various ownership models?	• Who uses this service? How and where do people access the service? Does this involve travel or technologies? • What needs are met by the service? How are these needs met (innovation functions and outcomes)? • What other needs could be met by the service(s)? • Do needs differ in different contexts (geographical/cultural/market)? • How is the service used or interacted with? • Is this interaction influenced by cultural or behavioural contexts? • What is the main interface(s) between provider and customer? • Who are the primary stakeholders in the service provision? • Who manages the service?	• What physical infrastructures (e.g. materials, energy, water, communications) are required to ensure an effective service? • Where is the service located? • What infrastructure supports the delivery of the service? • What challenges does the service present to local economic and social context? • Which cultural systems support the service concept? • What external pressures impact on service functions? • Does context determine the nature of the service functionality and outcomes?
Product Level material component • Materials • Energy • Technologies • Interface • Functions • Durability • Adaptability	• What resources does the product contain or use during its lifespan? • Are these resources renewable or non-renewable; rare or easily accessible and replenished? • Could the product use less resources, and if so, how? • What technologies are utilised in the product or in its production, distribution, use or disposal? • Is the product technologically vulnerable in a fast-changing technology sector? Does its reliance on technology affect its durability? • How durable is the product? Can it be maintained /repaired / serviced / reused / adapted? • Where is the product manufactured? Is it mass manufactured? • Where are the key markets for the product?	• What basic human needs does the product meet? • What functions of the product meet this need(s)? • What is the interface(s) between product and user? Is this effective? • Who uses the product? How is the product used – can it be misused? How does culture(s) influence practices of use? • Does the way in which the product is used greatly influence its environmental impact? • Who are the main stakeholders and who are the decision-makers in the product system? • Who makes the product? Are the employees fairly paid and treated? Who benefits from the existence of this product? Who doesn't (e.g. human/other species)?	• What are the geographical location(s) of production and use? • How is the product/sector affected by regulation, legislation or markets? • Which systems, such as ecosystems or infrastructure, support the delivery of product functionality (e.g. power,water, etc.)? • What are the cultural and technological contexts of the product and how do these influence interactions with the product throughout its lifespan? • What context(s) is the product designed to be used in?
	Materials ***Materials Analysis Context*** • Ecosystem impacts • Materials used, Materials in 'use' • Production, Technologies • Resource flows	**Society / People** ***Socio-Cultural-Personal Analysis Context*** • What and whose needs are met (or not met)? • Who are the stakeholders? • Cultures of use (e.g. behaviors, habits) • Key interactions with product, service or system	**Structures** ***Socio-Technological Context*** • Policy and regulation • Physical infrastructures • Social / economic structures • Whose interests are served – and not served

ILM is open source and exists in a variety of versions created by Emma Dewberry.

References

Ceschin, F.; Gaziulusoy, İ. (2019) *Design for Sustainability: A Multi-level Framework from Products to Socio-technical Systems.* London: Routledge.

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