

Tuotearkkitehtuuri

...ja tuotekehitys

17.11.2021

Design-termin määrittely (toimintana)

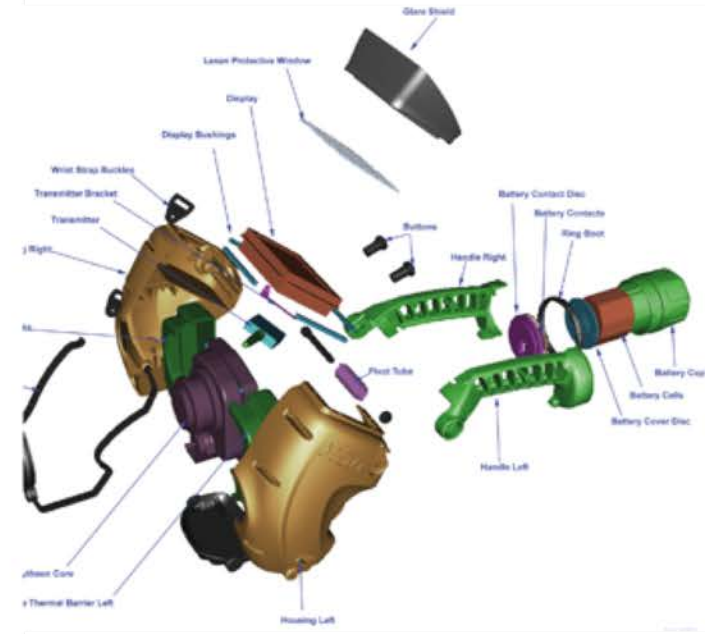
Design-toiminta on **prosessi**, jonka suorittaa joku **agentti** (toimija), muodostaakseen **objektista** (kohteesta) **spesifikaation** (kuvauksen, määritelmän), joka perustuu:

- **Ympäristöön**, jossa objekti esiintyy.
- **Tavoitteisiin**, joita tuotteelle asetetaan.
- **Objektin rakenteellisiin ja toiminnallisiin ominaisuuksiin** (**vaatimukset**).
- **Primitiiveihin** (alakomponentit), joista objekti koostuu.
- **Rajoitteisiin**, jotka rajaavat hyväksyttävät ratkaisut.



Image by Scott Health & Safety

Project: Eagle Imager 160, Scott Health & Safety
Created: 2001-2003 NC, USA
Role or relevance: Industrial designer
Project description: Thermal Imaging device for firefighters.

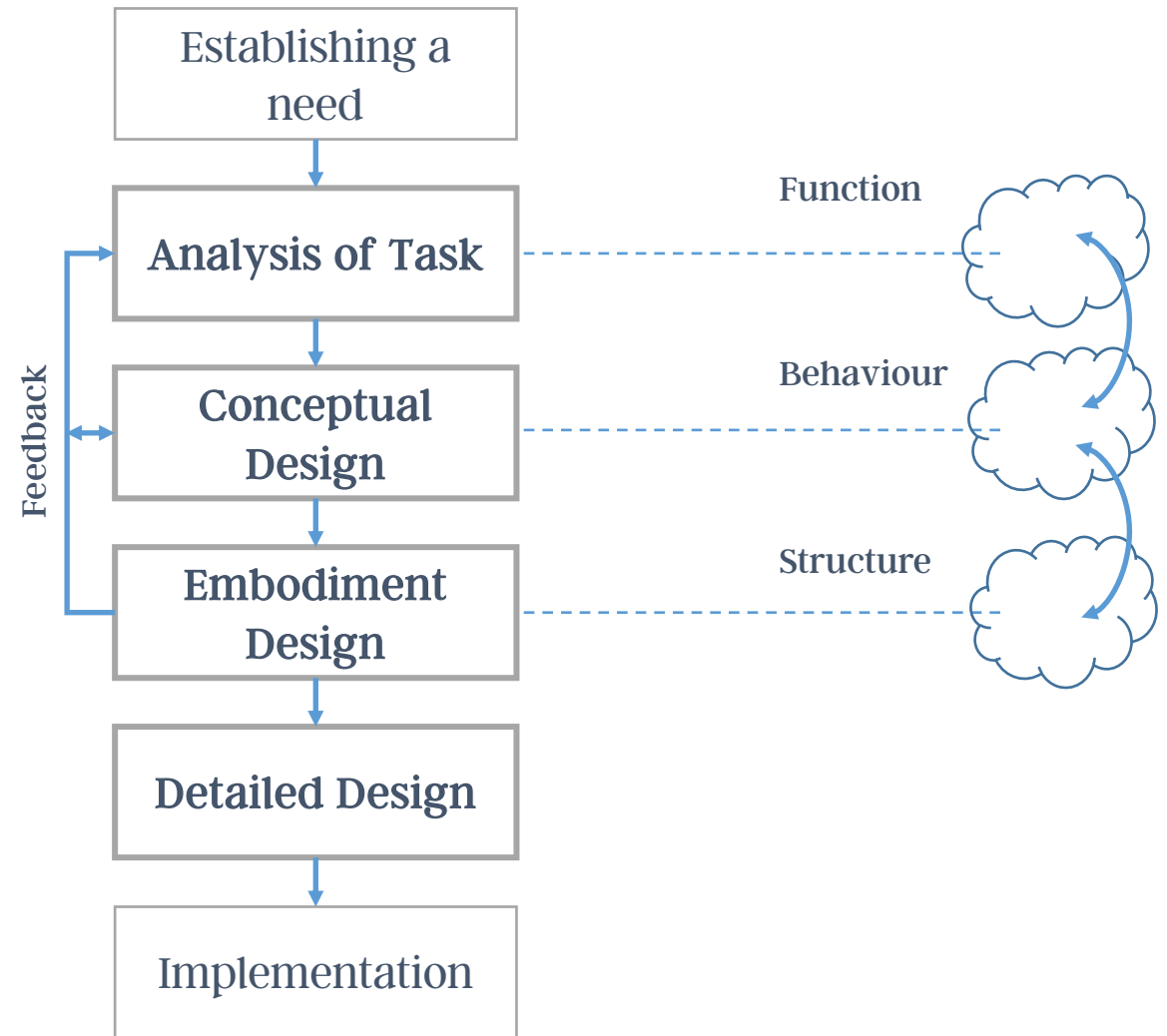


The task included packaging concept design, embodiment design, detail design including testing and iterations, mechanical design and production ramp up. The assembly of the device happened at the same plant I was working at, so design for assembly became important and familiar. The design of the device was done in collaboration with firemen. The unconventional hinged design of the handle enables using the device in a search and rescue situation in different postures, including crouching.



Design prosessi

- Design voidaan nähdä koevolutiivisena
- Tuotekehityksen kuusi vaihetta, joista keskimmaisissä neljässä (selkeimmin) luova komponentti






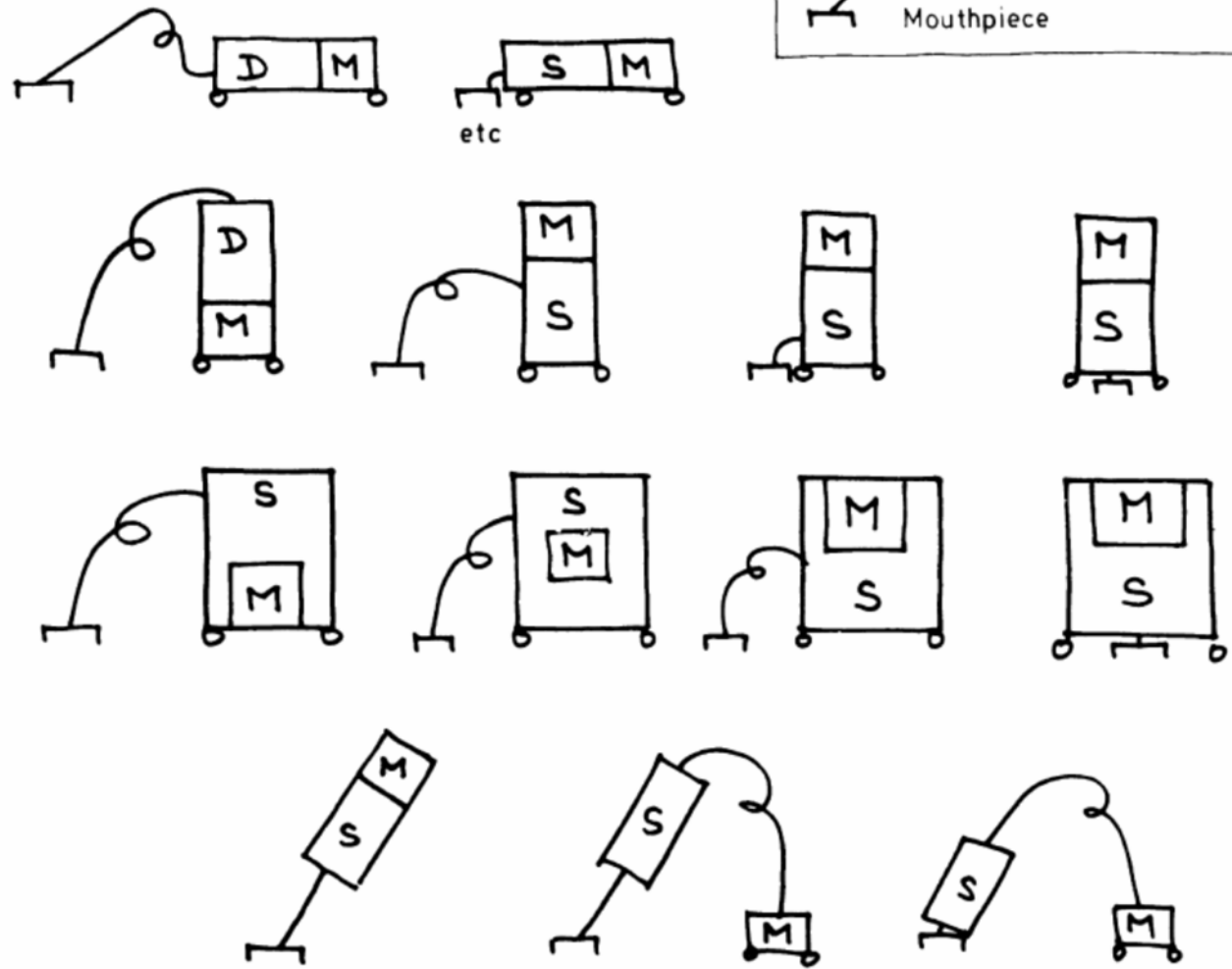
Ulrich: tuotearkkitehtuuri

- Toiminnallisten elementtien järjestely
- Toiminnallisten elementtien määppäys fyysisiin komponentteihin
- Keskenään vuorovaikutuksellisessa tekemisessä olevien fyysisten komponenttien välisten rajapintojen määrittely

QUANTIFIED STRUCTURES

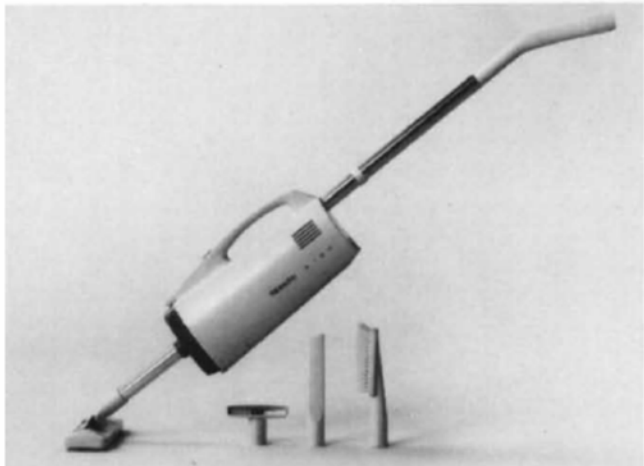
Variation of relative arrangement

SYMBOLS	
	Motor
	Dust container
	Mouthpiece



Tjalve, E. (1979). *A short course in industrial design*.
London: Newnes-Butterworths.

Figure 21 Quantified structures for vacuum cleaners



Tjalve, E. (1979). *A short course in industrial design*.
London: Newnes-Butterworths.

Figure 22 Vacuum cleaners with different quantified structures. (See also Figure 21). (Courtesy of Nilfisk and Miele)

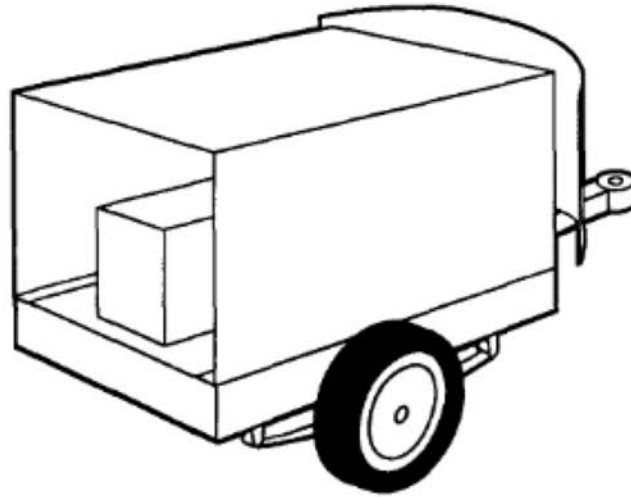
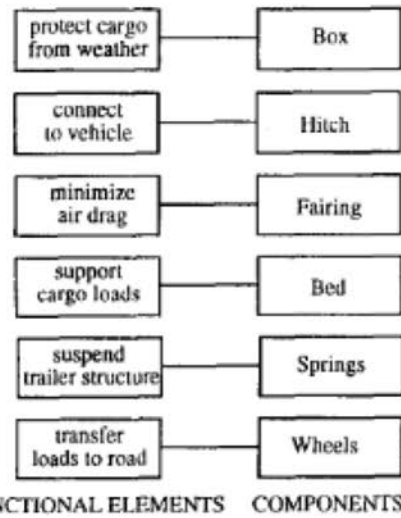


Fig. 2. A modular trailer architecture exhibiting a one-to-one mapping from functional elements to physical components.

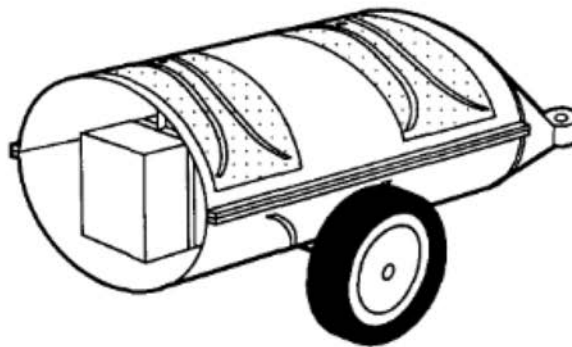
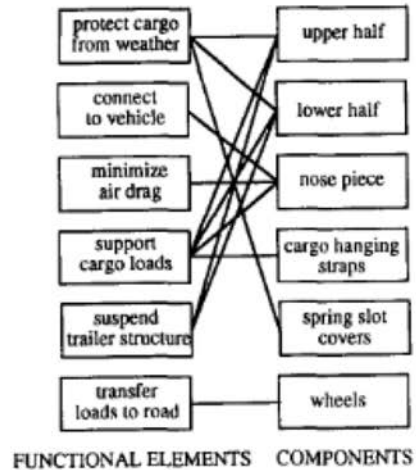


Fig. 3. An integral trailer architecture exhibiting a complex mapping from functional elements to physical components. (The upper and lower halves of the trailer have slots cut in them. The strip of material remaining between two slots acts as a leaf spring. The cargo is hung by straps from the two springs in the upper half. The axle is attached to the spring in the lower half. Covers, shown shaded, are attached over the slots. The nose piece is the component containing the trailer hitch.)

Ulrich, K. (1995). The role of product architecture in the manufacturing firm. *Research Policy*, 24(3), 419–440.

Vuorovaikutus

- Tilallinen: läheisyys tai suunta elementtien välillä
- Energia: Energian siirto elementtien välillä
- Informaatio: Tiedon tai viestin vaihto elementtien välillä
- Aine: Aineen välitys elementtien välillä

Järjestelmä

- Järjestelmä (systemi) on joukko yksiköitä ja suhteita, joissa suhteet ovat liityntöjä ja vuorovaiktuksia yksiköiden välillä
- Yksiköt järjestelmässä ovat elementtejä, joita voidaan ajatella suhteessa siihen sen osatekijöiksi tai alajärjestelmiksi
- A module is a component or subsystem in a larger system that performs specific function(s) and emerges as a tightly coupled cluster of elements sharing dense intra-module interactions and sparse inter-module interactions (Sarkar et al., 2013).





https://www.whatdigitalcamera.com/technology_guides/camera-construction-advanced-technology-guide-60492

Sisäinen ja ulkoinen monimutkaisuus

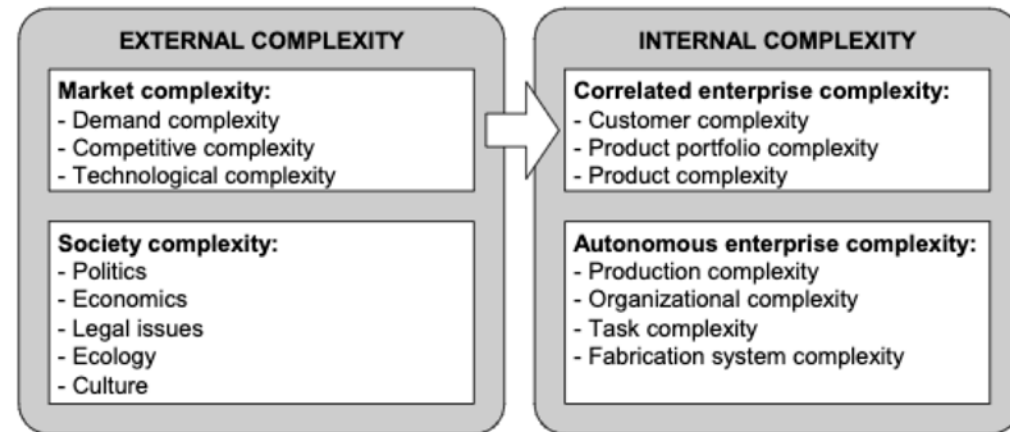
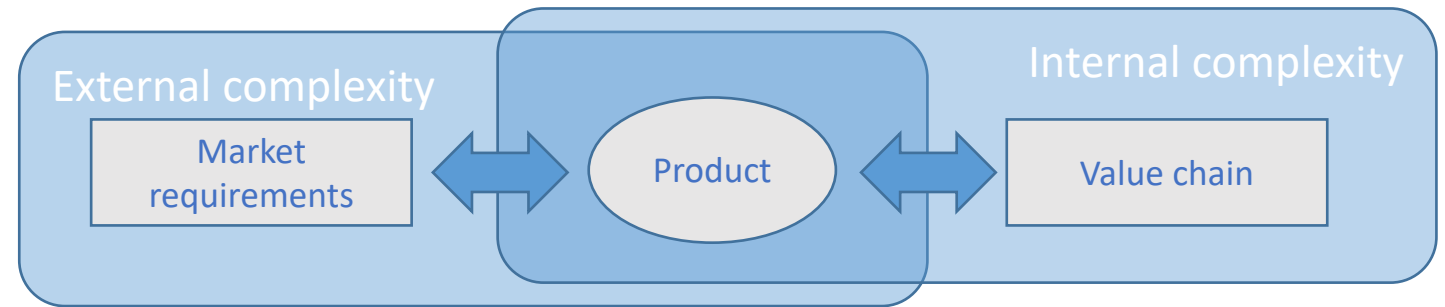
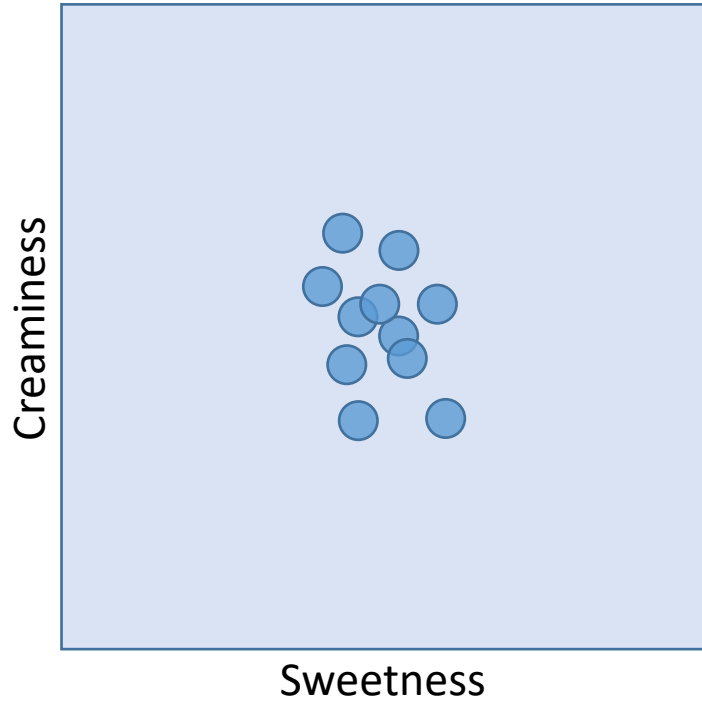


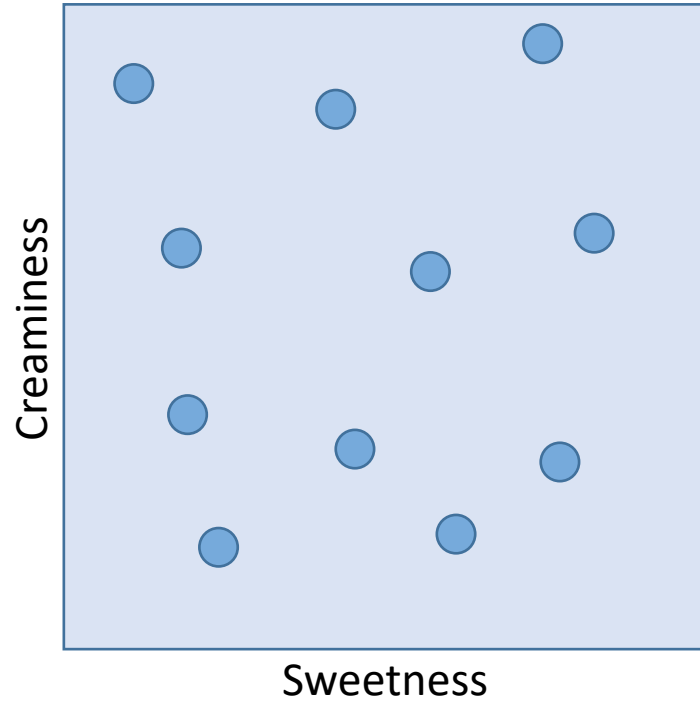
Figure 2.2 Complexity drivers forming external and internal complexity; slightly altered from Sekolec (2005, p. 15)

Monimutkaisuutta jäätelömarkkinoilla

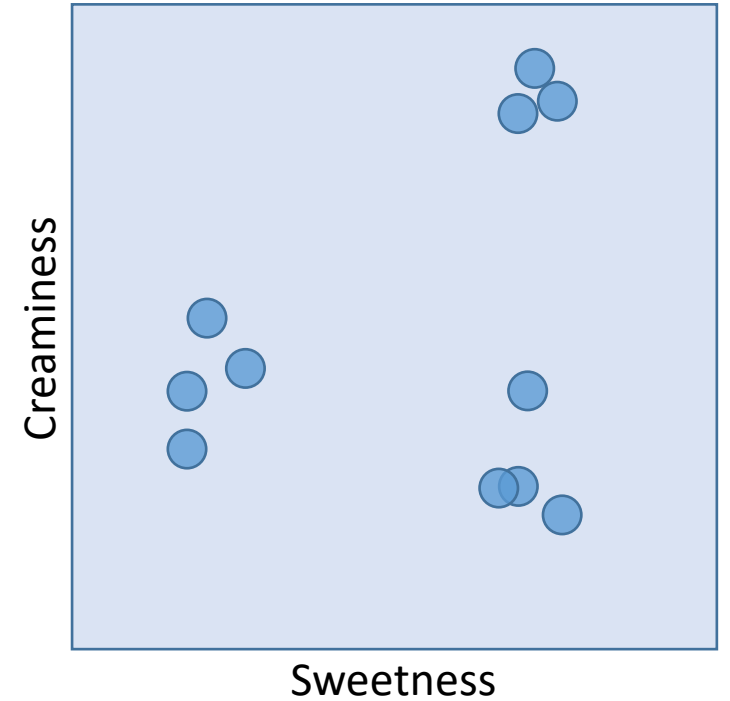
Homogenous preferences



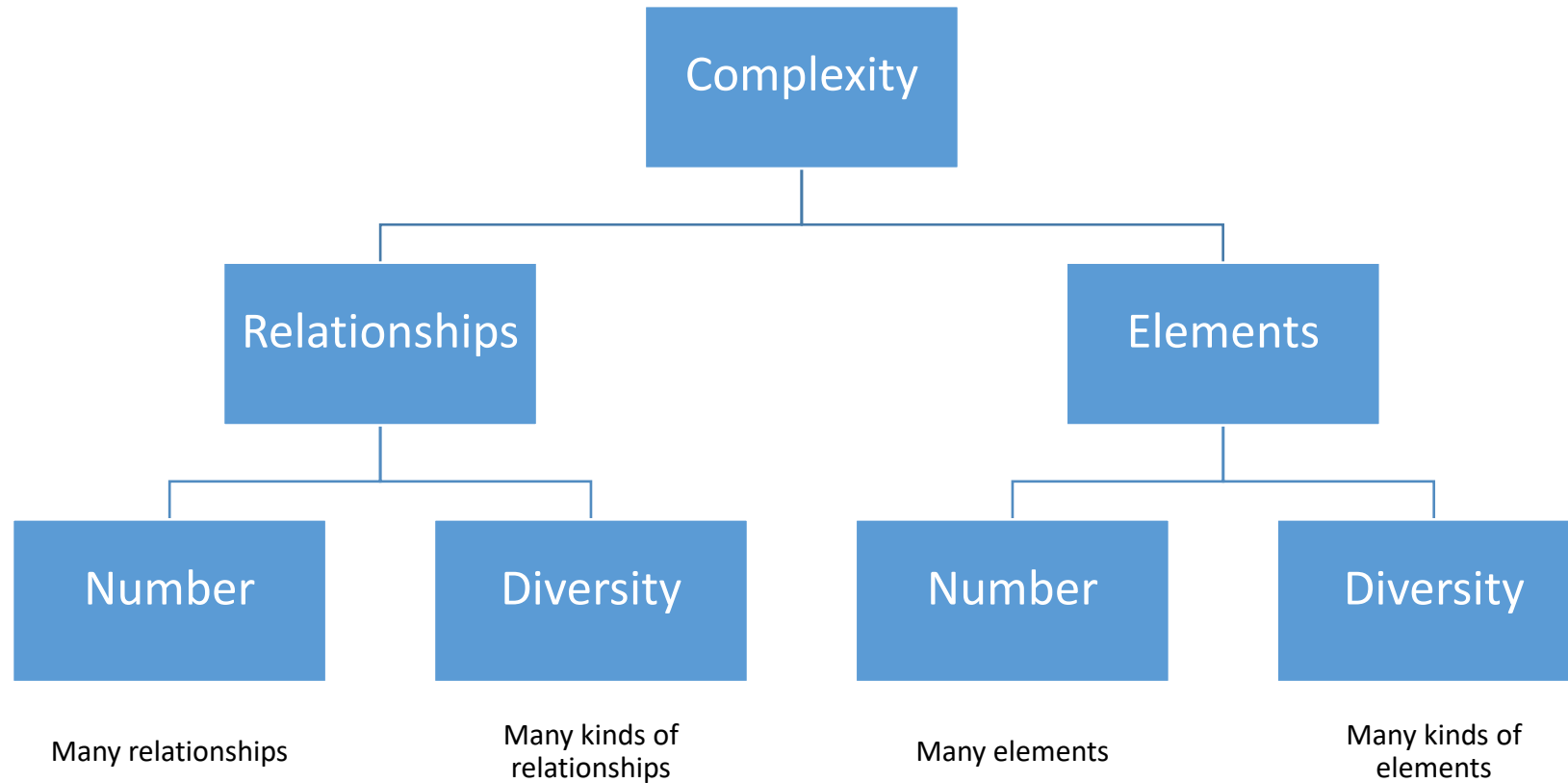
Diffused preferences



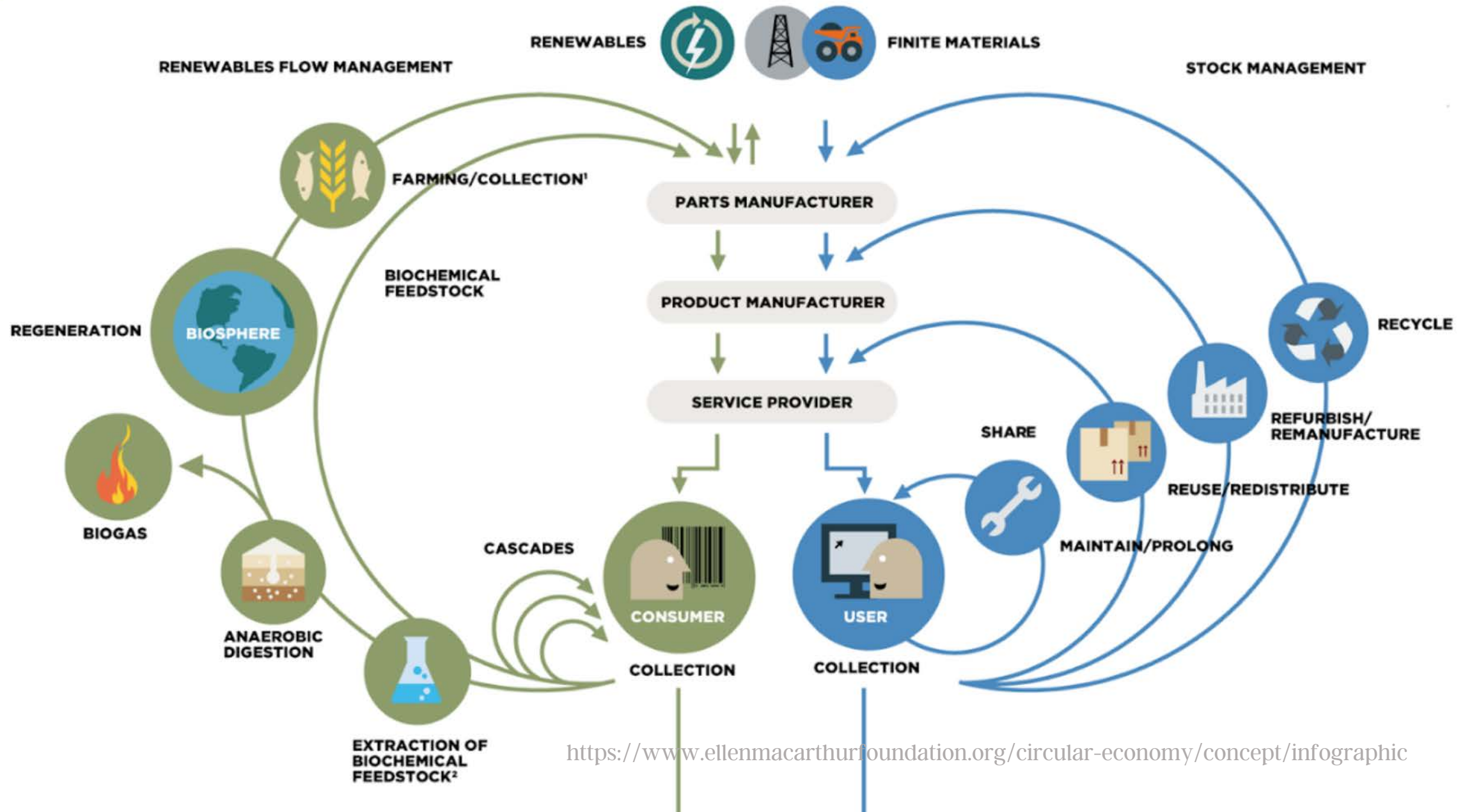
Clustered preferences



Monimutkaisuuden aiheuttajat järjestelmissä



THE CIRCULAR ECONOMY SYSTEM **DIAGRAM**



Monimutkaisuuden kustannukset



FIG. 1.4 Who casts the biggest shadow? (From Ref. 10.)

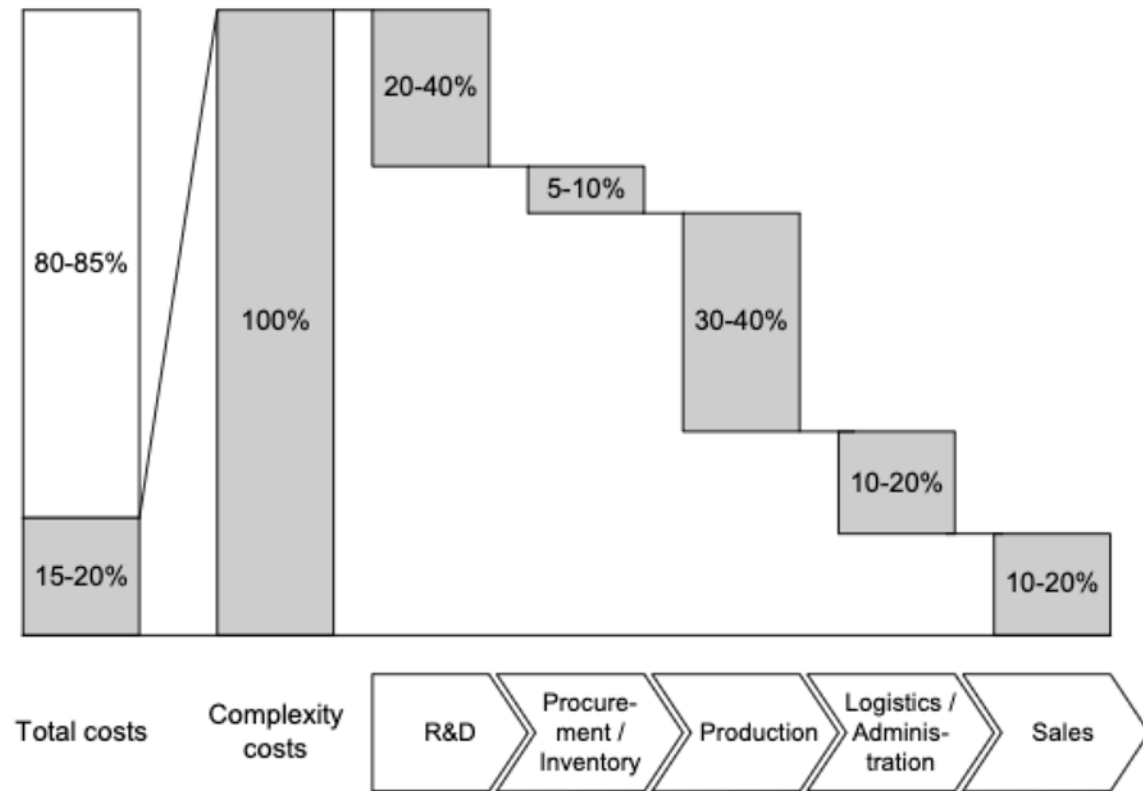


Figure 2.10 Complexity cost structure of an automobile manufacturer (Rommel et al., 1993, p. 24)

- 1) Boothroyd, G., & Dewhurst, P. (1987). *Product design for assembly*. Boothroyd Dewhurst Incorporated.
- 2) Marti, M. (2007). *Complexity management: optimizing product architecture of industrial products*. Springer Science & Business Media.

Katse eteenpäin

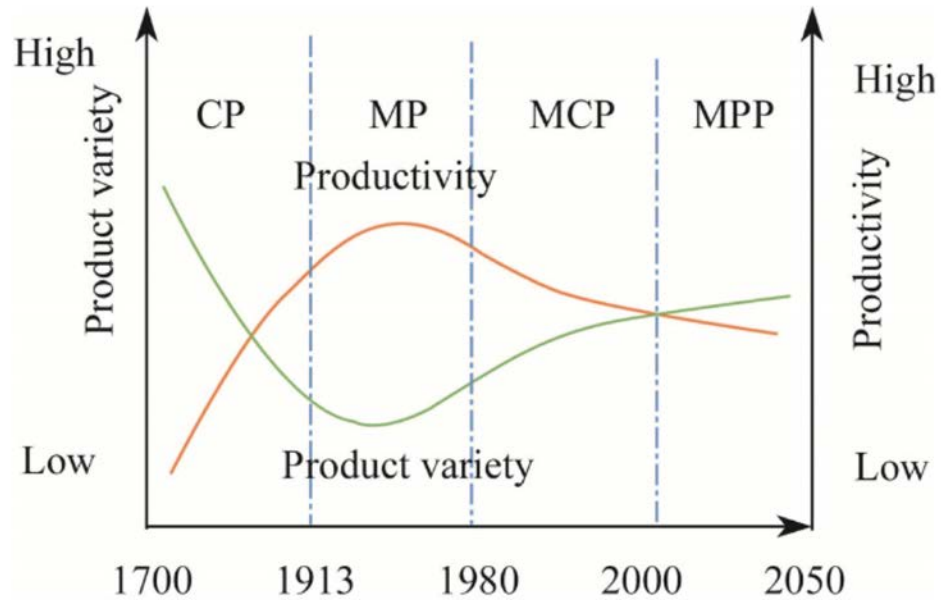


Fig. 1 Evolution of production paradigm

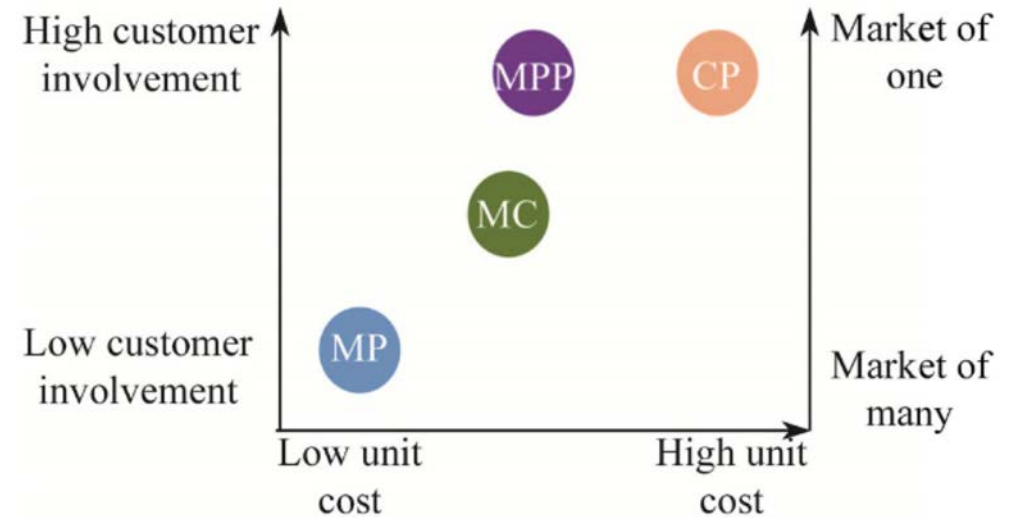


Fig. 2 Taxonomy of paradigms of production

Wang, Y., Ma, H.-S., Yang, J.-H., & Wang, K.-S. (2017). Industry 4.0: a way from mass customization to mass personalization production. *Advances in Manufacturing*, 5(4), 311–320.