# VINNOVA EXCELLENCE CENTRE THE FASTE LABORATORY

**COLLABORATION PERSPECTIVE** 

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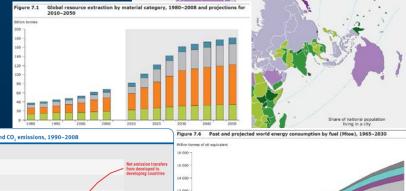
Director of MSc Program in Mechanical Engineering

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# **MEGA TRENDS**

- Increasing population
  - Especially the mid-class
    - ->Doubled need for products since 2010
    - ->Increased consumption
- Urbanisation and Mega towns
  - 60% of the global population lives in urban env.
- Increased resource outtake
  - Material
  - Energy
  - **–** ...
- Climate changes(e.g. the climate report 2018 by UN)



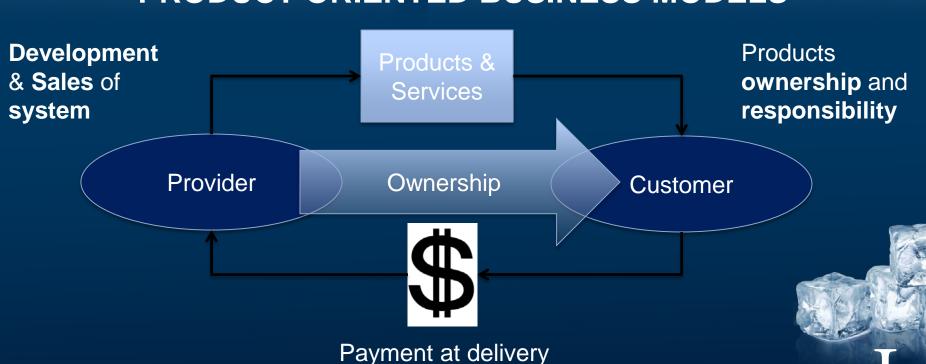
# **GUIDING PROBLEM FORMULATION**

How can a finite amount of resources be used to fulfill human needs and still increase the welfare for a growing population?









(same rate regardless of actual performance)

# **INCENTIVES**

- Revenue through
  - Product volumes
  - Aftermarket -> moderate product quality
- Environmental
  - Follow the law
  - Re-cycle, re-use, re-manufacture etc. if it pays of
- Product focus
  - The value is manifested completely through the product
- Customer responsibility



# **ALTERNATIVE BUSINESS KONCEPTS & TRENDS**

- During 1960th, Rolls-Royce introduced "power-by-the-hour"
- Leasing and rental agreements
- Servitisation
- Product-Service System
- **-** ...

From product orientation to performance focus

# **DISOWNERSHIP**

# DISOWNERSHIP IS THE NEW NORMAL

traditionally-owned items in the last two years (52%).

likely to engage in disownership now than they were five years ago (24%).

Rent, Lease, Borrow

of U.S. adults plans to rent, lease, or borrow these types of items in the next two years.

What's prompting this shift?

Top reasons why people are more likely to rent, lease or borrow traditionally-owned items are:

Cutting Down on Maintenance and/or Storage





# **POOLING**

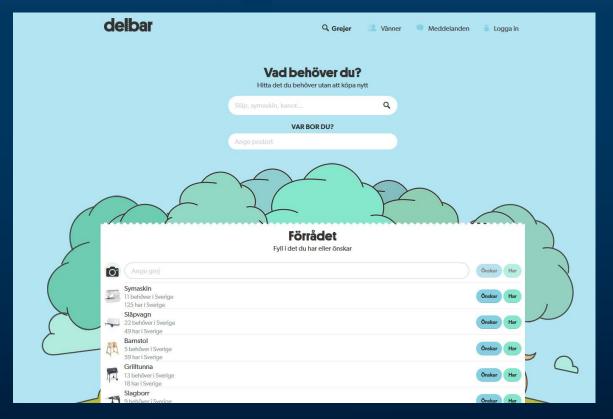
**CARPOOLING** Is it in your transport mix?







# SHARED ECONOMY





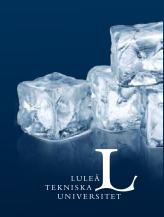
# **FUNCTIONAL PRODUCTS**

- During 1990 the business concept Functional Products was introduced jointly by representatives from academy and industry
- The main idea was to entirely focus on performance of function (i.e. no products and services in the contracts)
- Foreseen to be of particular interest for B2B setups.
  - Function often more important than the product itself

# EARLY CONCLUSSIONS OF PERFORMANCE FOCUS

- Changes in Incentive structures
- The same products were used (new business package)
- Difficult to manage risks in value chains
- Hardware and software is not enough to provide function
- Functional product development processes?
- Predictions (Simulation Driven Design)?
- Knowledge and information sharing?
- Organization?
- Insurances?
- Agreements?





# THE FASTE LABORATORY

- A VINNOVA Excellence Center starting 2007 where research on Functional Product Innovation were conducted
- 10 years funding with a turnover of ~250 MSEK
- Four stages (2+3+3+2) with international evaluation in-between
- Luleå University of Technology together with industries
- Results 2016
  - ~400 publications
  - ~20 Doctoral theses

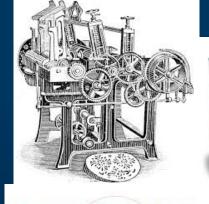


# WHAT IS A FUNCTIONAL PRODUCT?

- A business concept where organizations (themselves or collaboratively) commit to provide function at an agreed upon level of performance and to a reoccurring fee
- Realization of the function is entirely the provider's responsibility
- Ownership and life cycle responsibility for needed sub-systems remains at the provider
- The provider develop all needed systems

# WHICH SYSTEMS CONSTITUTES A FUNCTIONAL PRODUCT?

- Hardware
- Software
- Service support system
- Management of operation









# **EXAMPEL IRON ORE PELLETS PRODUCTION**

Software

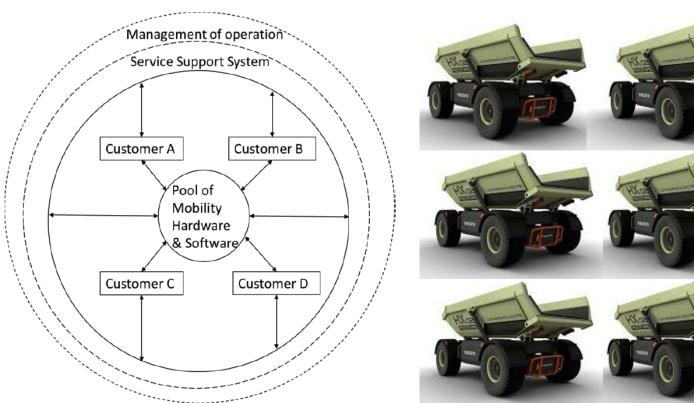


Hardware





# **EXAMPLE MOBILITY OF UTILITY MACHINES**







# PERFORMANCE BASED BUSINESS MODELS

-Mobility

- Wood availability

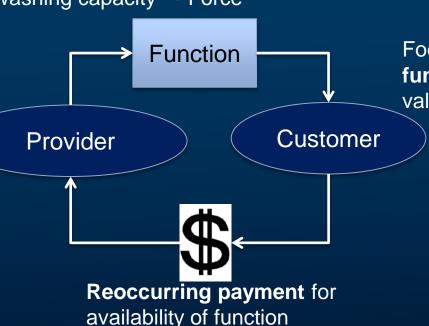
-Torque

- Milling performance

-Washing capacity

- Force

Develop, own and are responsible for needed systems to maintain availability of function over their life cycle



Focus on utilizing the function for their own value creation

# **COMPARISON OF INCENTIVES**

	Dev.	Sales	Ор.	Maint.	Re-use/cycle	Waste
Customer	0	-	-	-	+/0	-
Provider	-	+	0	+	0	0
Customer	0	0	-	0	0	0
Provider	-	0	+	-	+	-

Product orientation

Performance orientation

### Performance based incentives

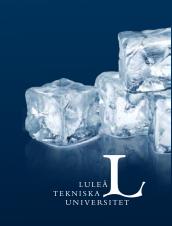
- Resource efficiency over the life cycle -> Win-Win in the value chain
- Life cycle responsibility/opportunity (down-cycling, re-use, re-cycling, re-manufacturing)
- Circularity
- Customer satisfaction focus
- Multi-disciplinary competences required -> Diversity

- ...

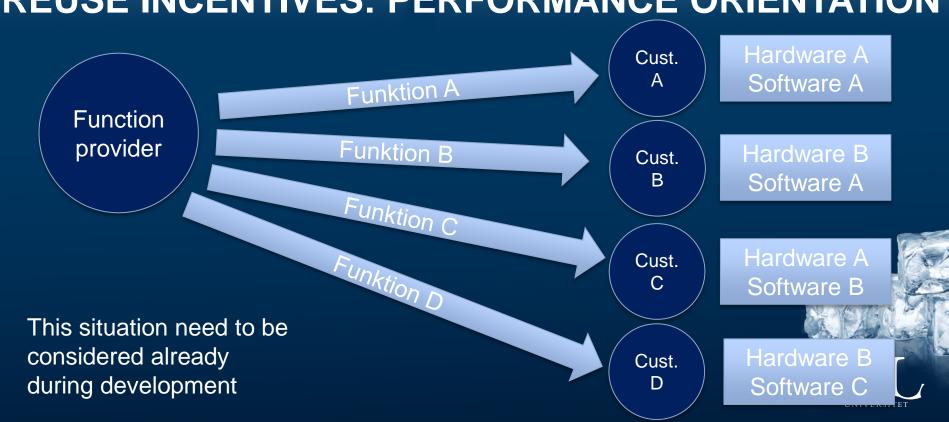


# **REUSE INCENTIVES: PRODUCT ORIENTATION**





# **REUSE INCENTIVES: PERFORMANCE ORIENTATION**



# TRENDS IN INDUSTRY



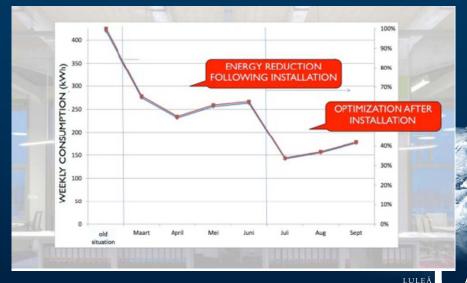
# LIGHT AS A SERVICE

Philips provide "Pay Per Lux" to terminal in Schiphol

(Amsterdam)

I told Philips, 'Listen, I need so many hours of light in my premises every year. If you think you need a lamp, or electricity, or whatever – that's fine. But I want nothing to do with it. I'm not interested in the product, just the performance. I want to buy light, and nothing else.

- Thomas Rau, Architect



# **MOBILITY AS SUBSCRIPTION**

"I believe that people will subscribe on cars in the future rather than own them"

Håkan Samuelsson, CEO Volvo Cars (spring 2017)





# **POSSIBILITIES WITH MOBILITY**

- If "everybody" must own a car, the degree of utilization will be very low
- The same or better mobility can be achieved through a much smaller car fleet
- If the provider owns the systems the mobility can be customized





# SEPARATION OF ROTATING SURFACES

- SKF have plans of performance based solutions
  - "SKF plans to charge a recurring fee based on a pre-agreed performance level of its customers' machinery rather than per bearing"
    - (Victoria Van Camp, chief technology officer at SKF, 2017)





# SUSTAINABILITY?

- △ Traditional Case 1
- ♦ Traditional Case 2
- Traditional Case 3
- × Functional Product Case

Selected traditional case 1 solution



Selected traditional case 2 solution



Selected traditional case 3 solution

Selected functional product case solution



Cost



# CONCLUSIONS

- In most (all) existing performance based businesses systems developed for traditional businesses are used -> sustainability potential remains unused
- To generate incentives for sustainable growth development, system ownership and responsibility over their life cycles should remain at the provider
- Functional product innovation requires new dedicated tools, methods, processes, organisations etc. and a holistic perspective
- Procurement actors have a key role in the transition to performance based businesses

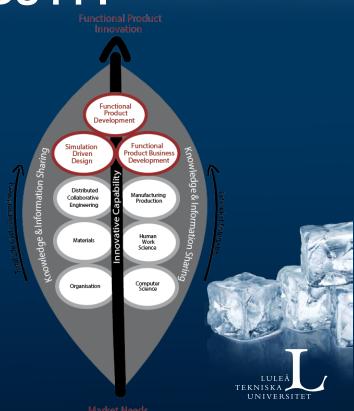


# **COLLABORATION INCENTIVES**

- Prerequisites at the time was that the competence should be concentrated at certain universities and institutes -> collaboration within universities rather than in-between
- Industrial and research collaboration needed
- To reach the High Level Objectives, collaboration between several different competences were needed (not all could be involved though)
- Strategy and Organization
- Review
- Research agreements

# STRATEGY TOWARDS FPI

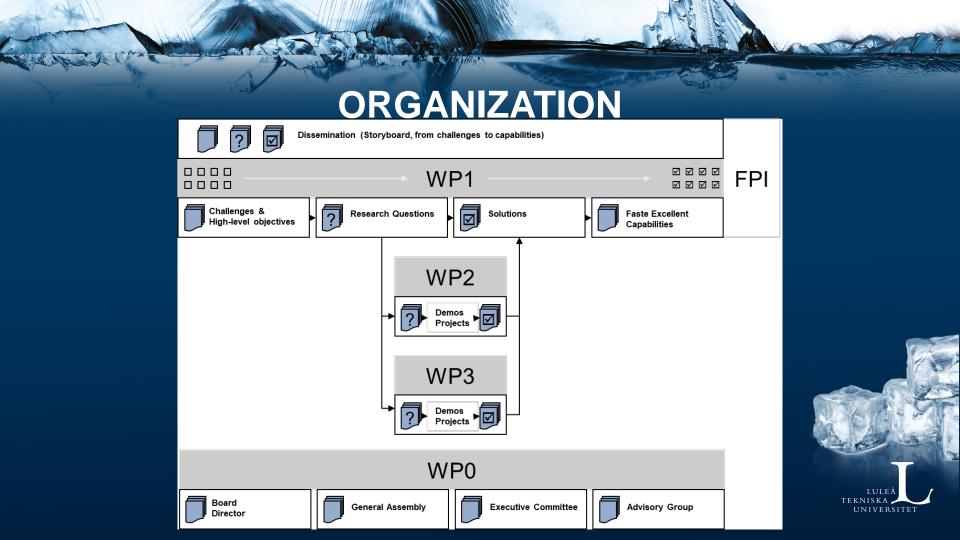
- 5 Challenges
- 14 High Level Objectives (HLO)
- 22 Short term goals (for Stage 4)
- Enabling Capabilities
  - Functional Product Development (FPD)
  - Simulation Driven Design (SDD)
  - Functional Product Business Development (FPBD)
  - Knowledge and Information Sharing (KIS)



# **COLLABORATION PARTNERS OVER 10 YEARS**

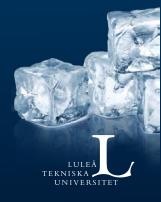
Luleå University of Technology	Stage 1	Stage 2	Stage 3	Stage 4
Accounting and Control			x	x
Computer Aided Design	x	x	x	x
Entrepreneurship & Innovation	x	x	x	x
Fluid Mechanics	x	x	x	x
Functional Product Development	x	x		
Industrial Work Environment			x	x
Material Mechanics	x	x	x	x
Solid Mechanics	x	x		
Industry Partners				
AB Sandvik Coromant	x	x	X	x
BAE Systems Hägglunds	X	x		
Bosch Rexroth AB	X	x	X	x
Gestamp HardTech AB	X	X	X	X
Infrafone			X	
LKAB	X	x	X	x
Metso Panelboard	X			
Volvo Aero AB	X	x		
Volvo Car Corporation	X	x	x	x
Volvo Construction Equipment		x	x	x
Volvo Truck Corporation	x			





# **ORGANIZATION**

- All projects had to involve at least 2 industrial partners (which had to be documented in the project description)
- Mandatory with deliverables to High Level Objectives HLO) in WP1
  - The HLO were decomposed in each project



# **REVIEW**

- External review often required and organized by the funder
  - Ex. VINNEXC Written report + interviews by experts and generalists
- In addition, internal reviews is typically carried out to monitor the progress at project level
  - Can be used to generate incentives for collaboration e.g. deliverables requiring cross-disciplinary actions

# **FASTE INTERNAL REVIEW**

- Three folded follow up strategy
  - Objective Readiness Level (ORL)
  - Key Performance Indicators (KPI)
  - International Advisory Board
- When?
  - Updated by the project leaders and reported to executive committee 4 times/year
  - Board meetings (Reported by director) ~ 4 times/year
  - International Advisory Board meetings ~ 1 time/year
  - Partner meetings 2 times/year

# RESEARCH AGREEMENTS

- Seems like the emphasis on research agreements is increasing
- Different levels
  - Consortium agreements on high level (Org., IPR, Foreground, Background, Commercialization of results etc.)
  - Researcher agreement coupled to the consortium agreement
- Can become quite complicated to take all prerequisites into account ("lärarundantaget", "offentlighetsprincipen", export control rules etc.)
- A good agreement can promote collaboration in R&I. However, bad one might prevent collaboration

# **IMPORTANCE OF MINDSET**

- The impact of a shared understanding about the common goal should not be underestimated
- Dedication to the shared goal is very important
  - It is possible to conduct good research without contributing too much to the common goal...
- Good leadership at different levels is crucial (director, executive committee, board, WP-leaders, project leaders etc.)

