CHALMERS

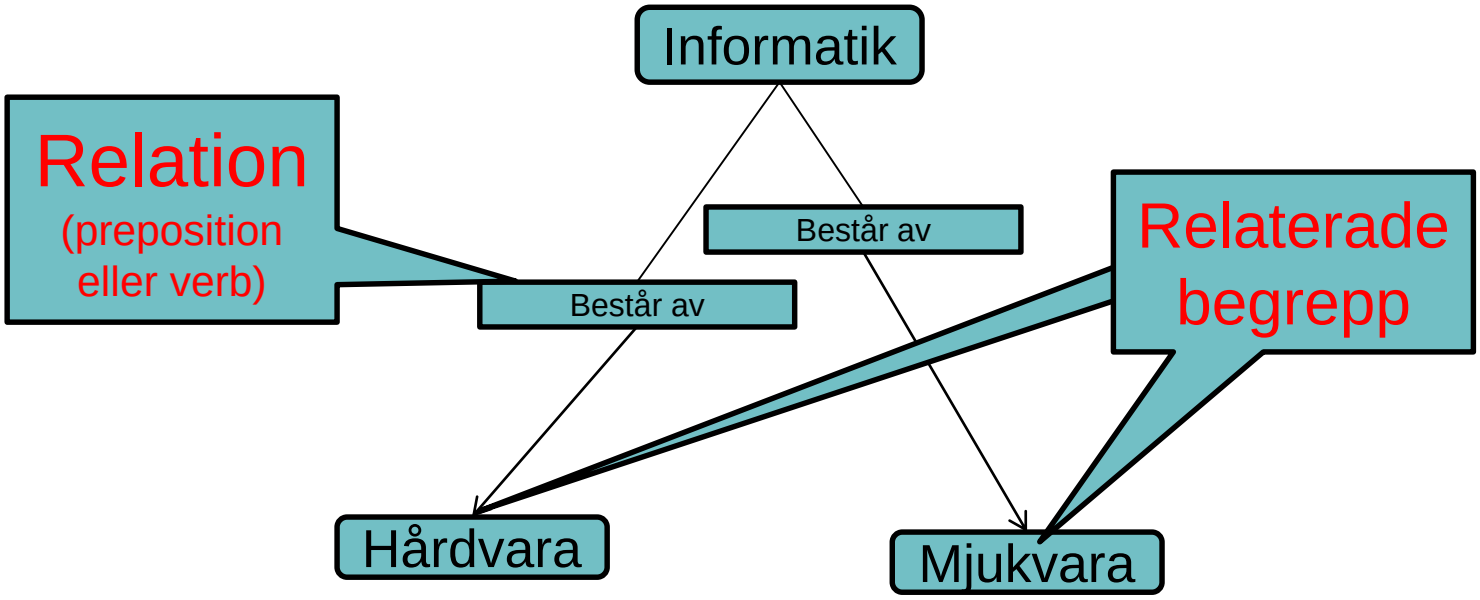
Sustainability and
UN Sustainable Development Goals

Björn Johansson
Professor Sustainable Production
Product and Production Development
Chalmers University of Technology
Sweden

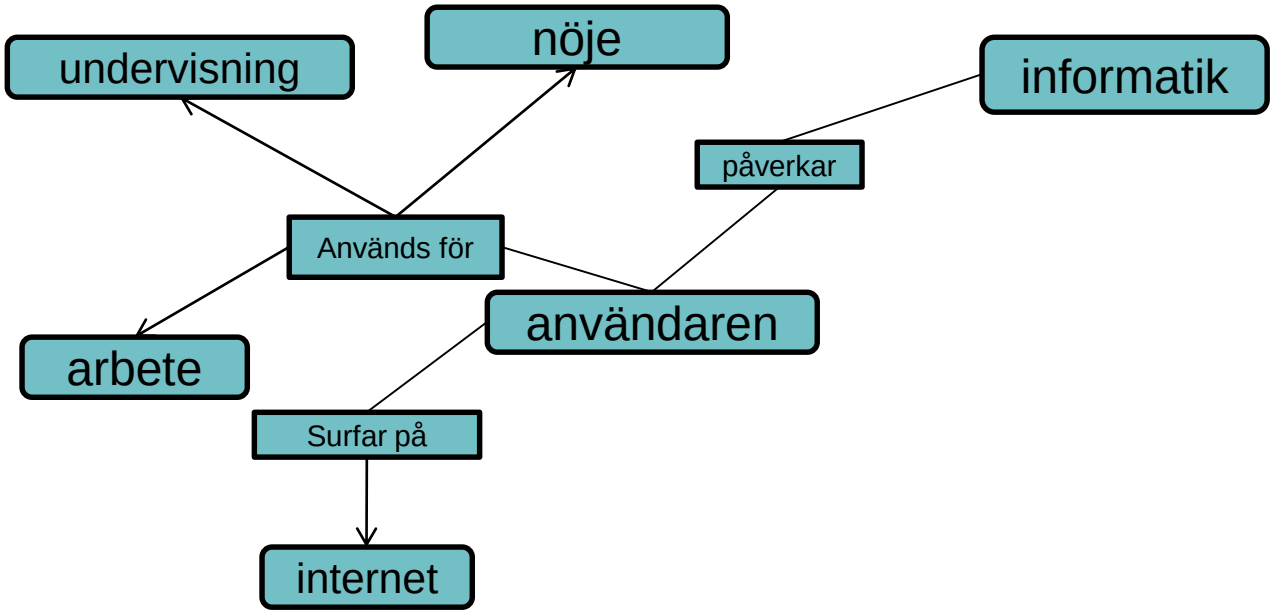
Concept map
(Begreppskarta)

En “**concept map”** är en karta som visar relationer mellan olika begrepp eller aktörer. Det är ett grafiskt verktyg för organisation och representation av information.

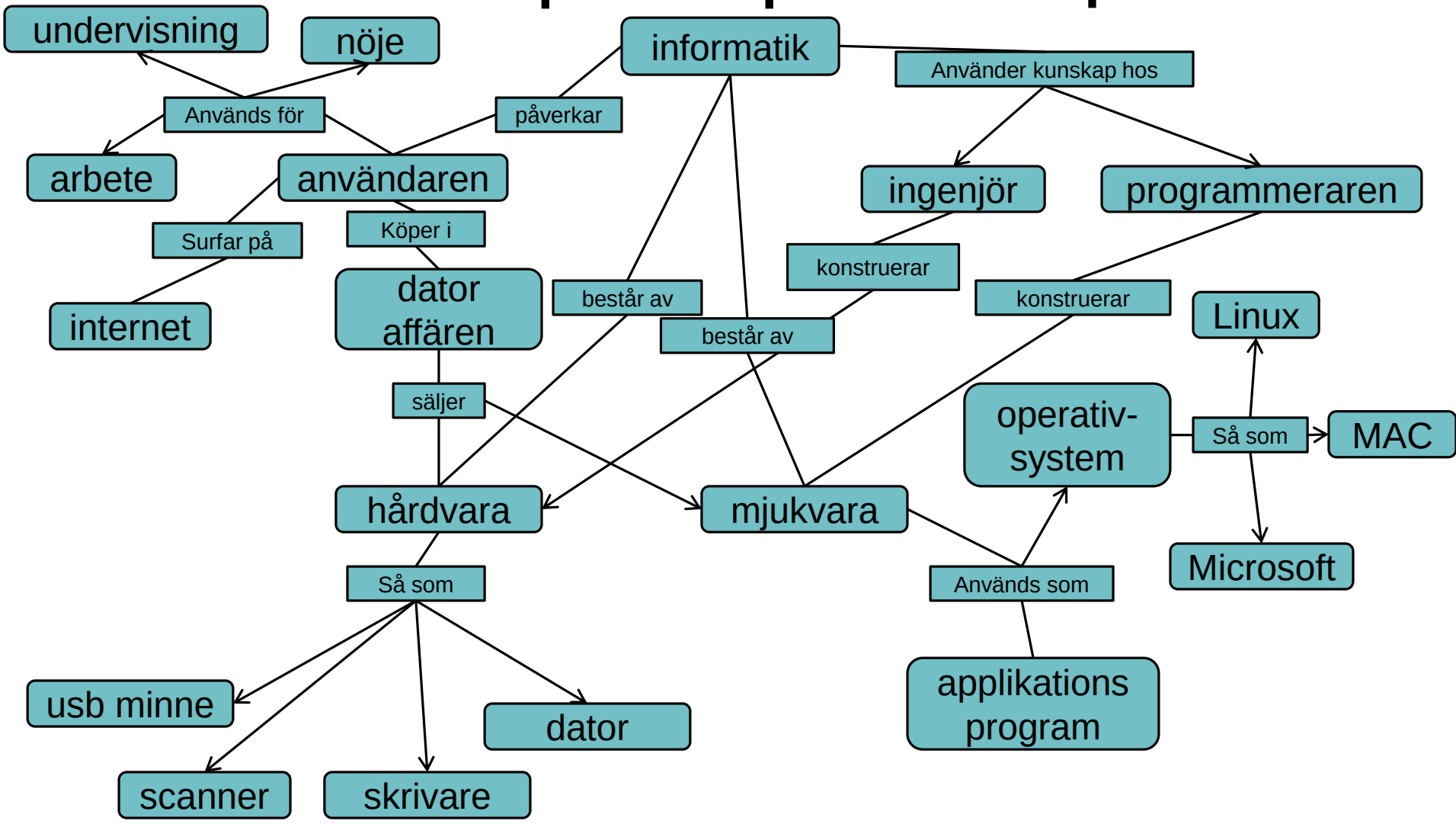
”Concept map” exempel



”Concept map” exempel



”Concept map” exempel



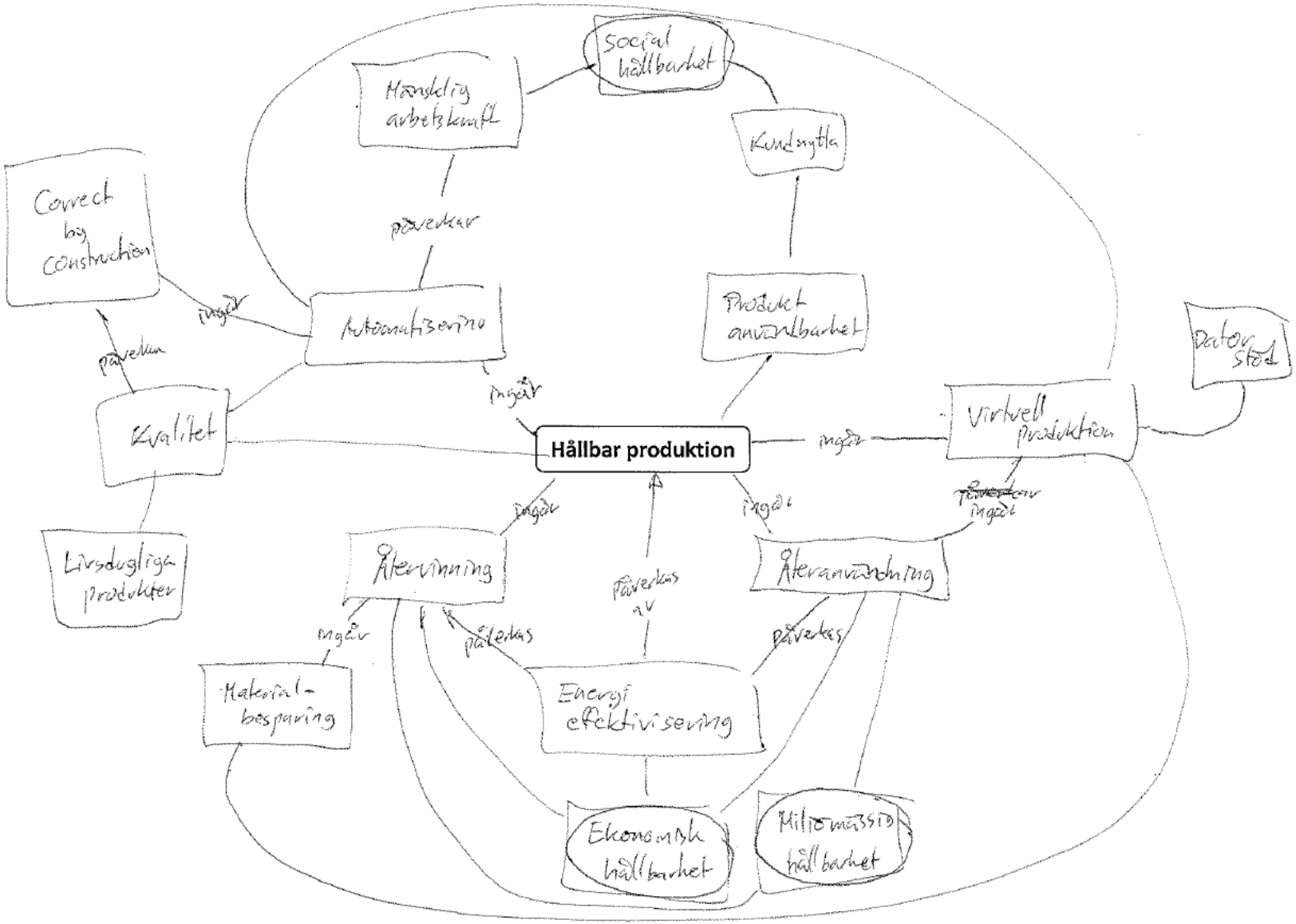
Med hjälp av övningen ”concept map” skall vi besvara frågan:

Vad är hållbarhet för dig?

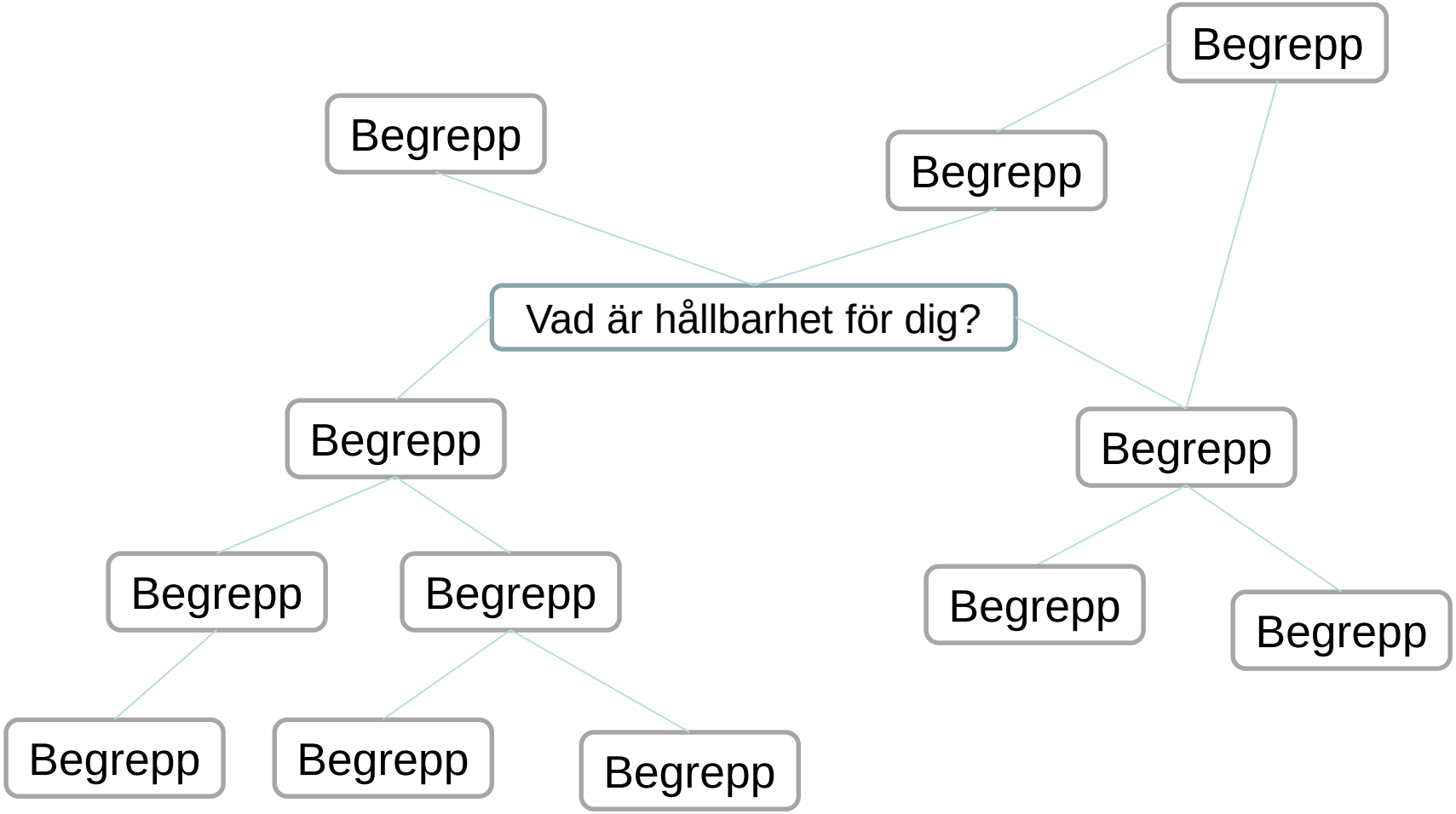
… och placeras mitt på pappret

Vad är hållbarhet för dig?

Concept map example



Utifrån frågan ska sedan kartan ritas

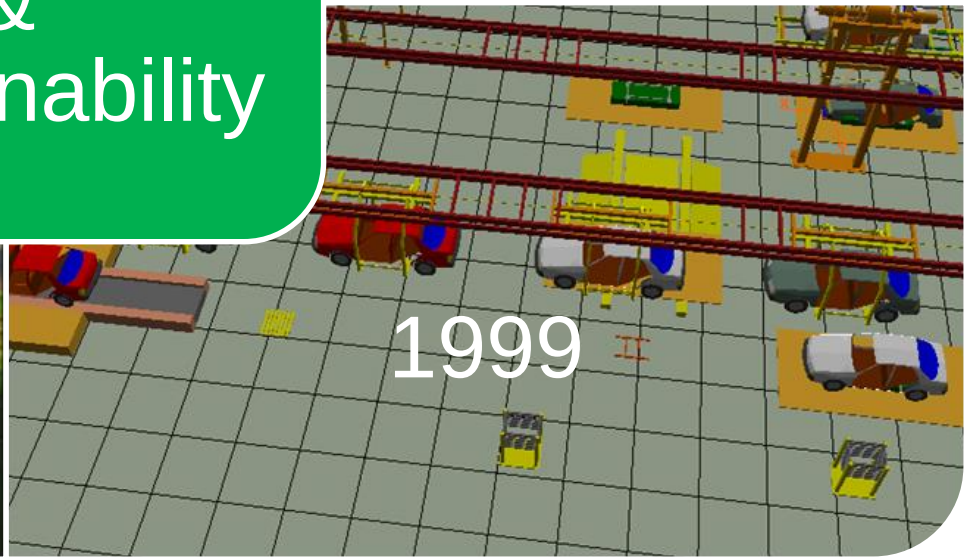


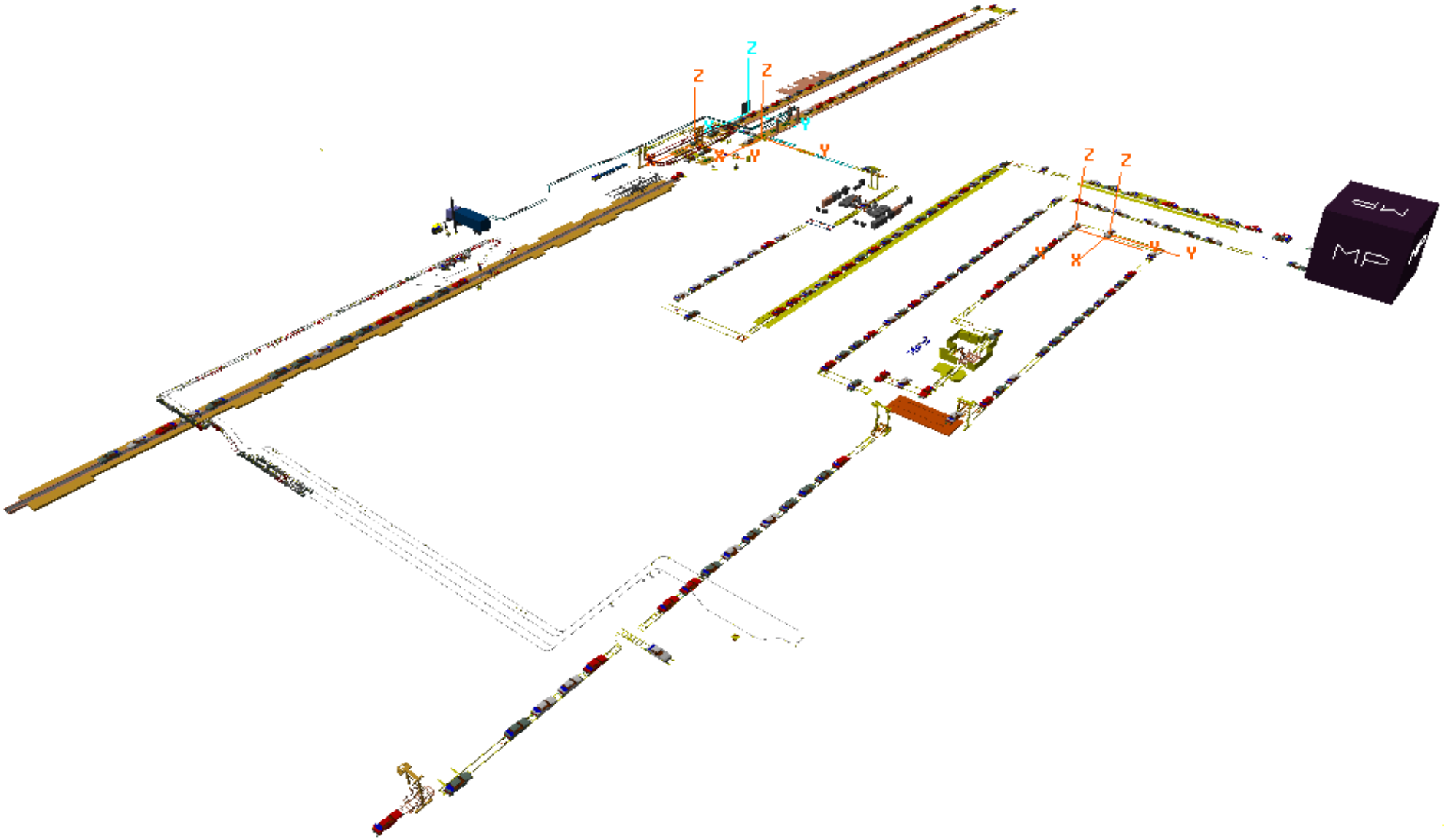
Genomför concept maps övning!

15 min

Background

Simulation
&
Sustainability




Z
Z
Z
Y
Y
X
Y
Z
Z
Y
X
Y
MP

AREAS OF ADVANCE

FOCUS & COLLABORATION

- Meetings across boundaries
- Visibility and focus
- Interaction across the knowledge triangle
- International alliances
- Impact on society

TRANSPORT

ENERGY

MATERIALS SCIENCE

PRODUCTION

BUILT ENVIRONMENT

LIFE SCIENCE

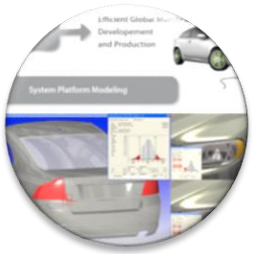
NANOSCIENCE & NANOTECHNOLOGY

INFORMATION & COMMUNICATION TECHNOLOGY

BASIC & APPLIED SCIENCE

Product and Production Development

Design & Human Factors



Product Development

Production Systems

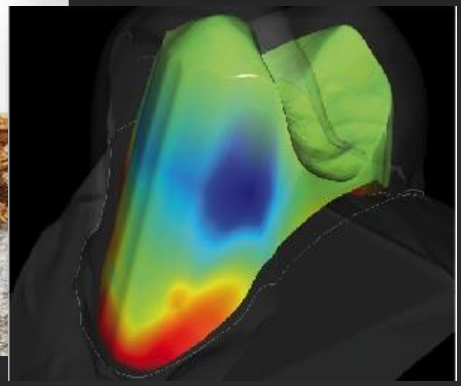
We shorten time from need to final product and add value for the customer!

Short Facts 2014

- **3 divisions**
- **96 employees**
  (full time equivalents 82,2)
- **Gender balance 30/70**
- **125 MSEK in turnover** *(2014)*
- **76 courses**
- **3 master programs**

PRODUCTION
A CHALMERS AREA OF ADVANCE

wingquist
LABORATORY



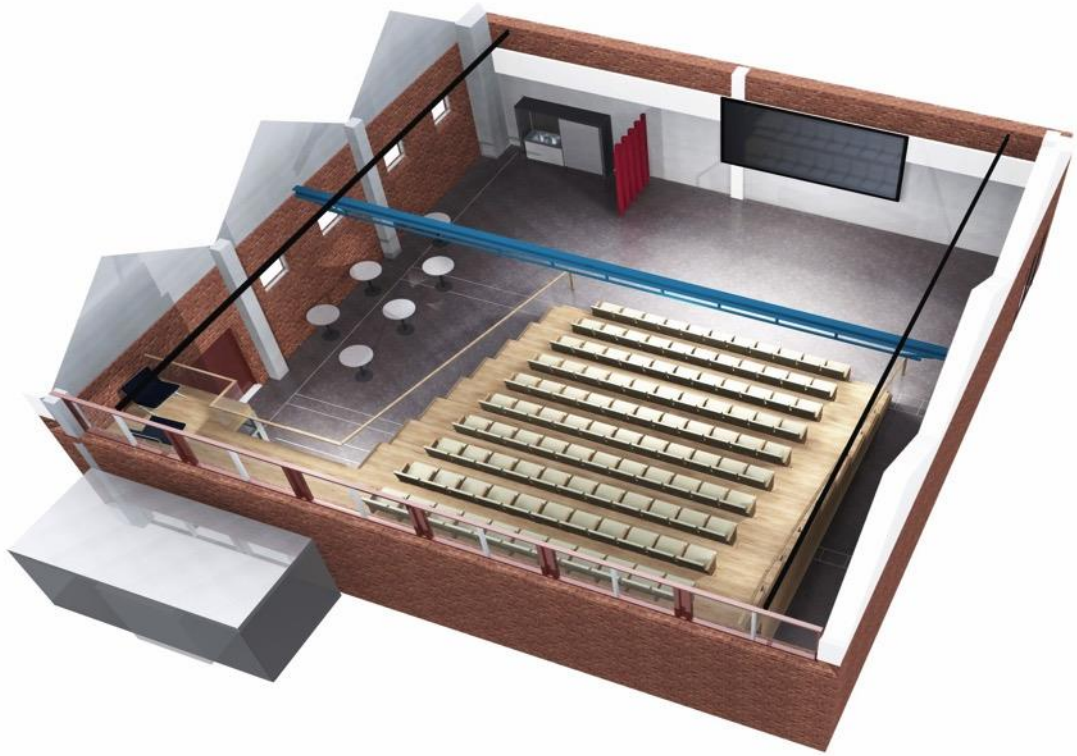
Production at Chalmers

PRODUCTION

AREA OF ADVANCE

Develops new resource-effective product and production processes, and contributes to new knowledge and tools within industrial simulation, automation and future working environments.

Virtual Development Laboratory



The Virtual Development Laboratory offers 110 fixed seats & 40 extra chairs. In the mingle area there are 12 stand tables.

TECHNICAL EQUIPMENT

- Two projectors with resolution1920x1080 (HD)
- Cinema screen full HD, size 5,0 x 2,8 m
- WIFI wireless network Chalmers NOMAD
- 3D, stereoscopic display
- 2 stationary motion picture cameras (for video conferences, recording and live broadcasting)
- Hearing aid loop

Production Systems Laboratory

Virtual and Digital Production Group

Erik Lindskog
PhD Student
- LEAN factory design
- 3D Scanning

Malin Tarrar
PhD student
- KPIs
- ICT-tool implementation

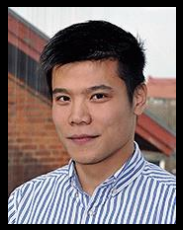
Björn Johansson
Professor, Group leader
- Sustainable factories
- Factory design and improvement

Ilaria Barletta
PhD Student
- KPIs
- Sustainable factories

Maja Bärring
PhD Student
- Simulation
- Layout planning
- 3D Scanning

Daniel Nåfors
PhD Student
- Simulation
- Layout planning
- 3D Scanning

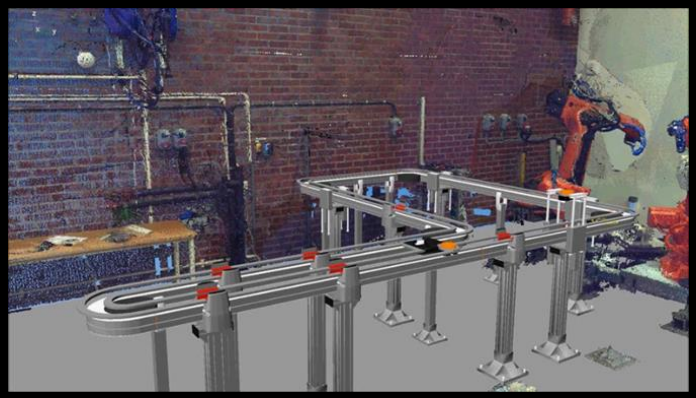
Jonatan Berglund
PhD Student
- Layout planning
- 3D Scanning

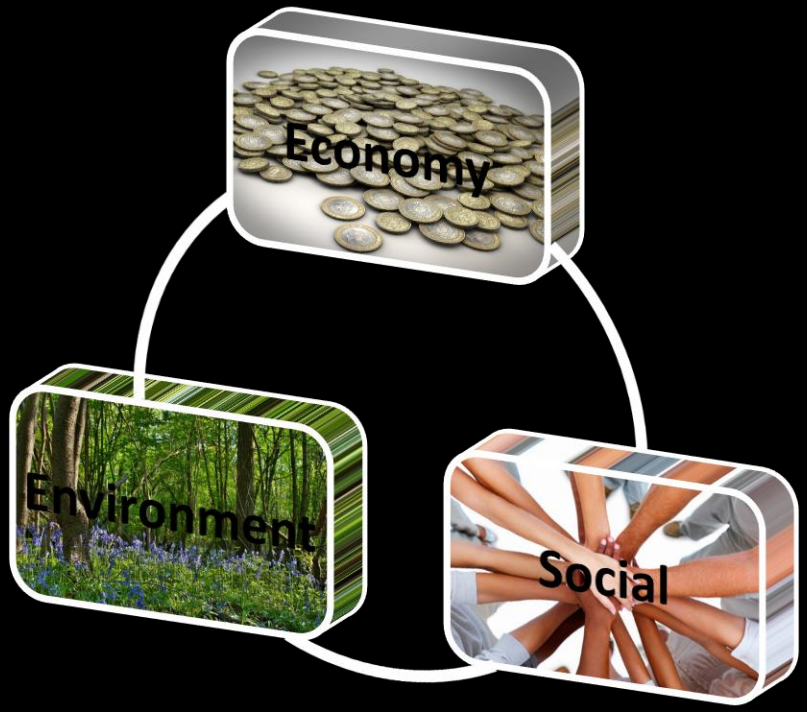


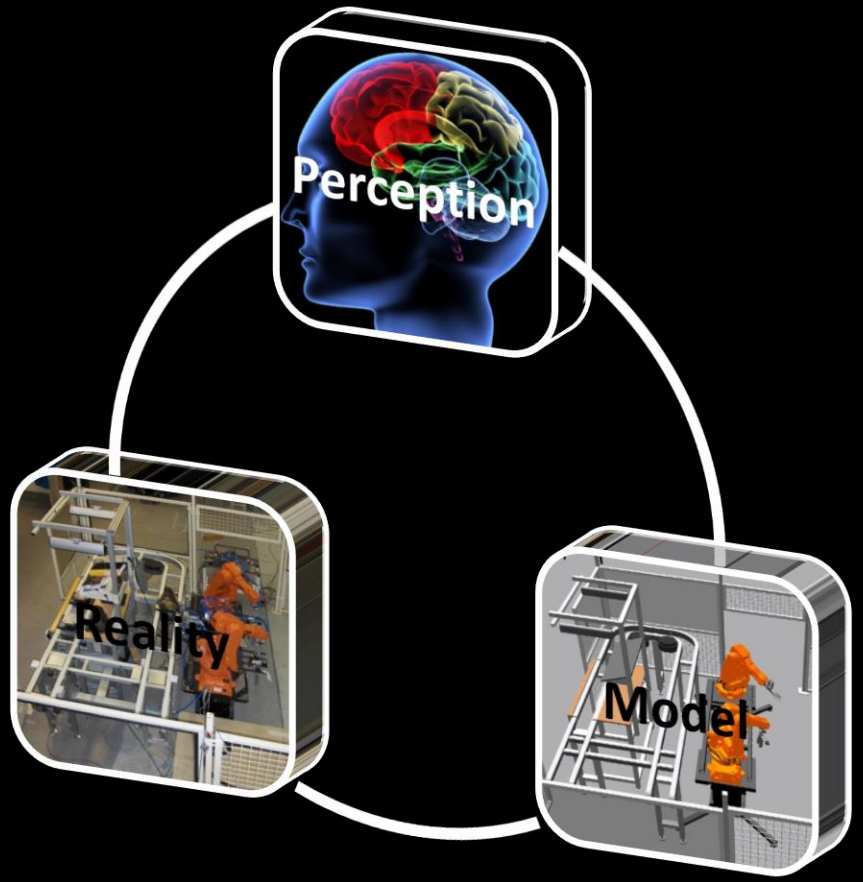
Liang Gong
PhD Student
- User interaction
- VR for production systems

Virtual Production Systems

- Awareness for sustainable decision-making
  - Aiding human perception
- Industrial Production KPI's
  - Lead-times, OEE, ROI, production rates
- Environmental lifecycle metrics
  - CO_2, SO_2, NO_X, Energy use





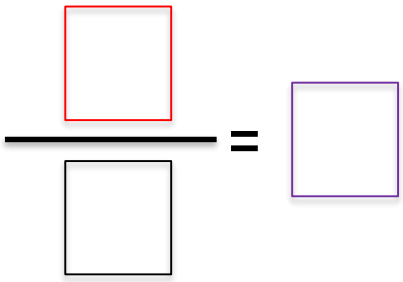


”Rätta” Concept map!

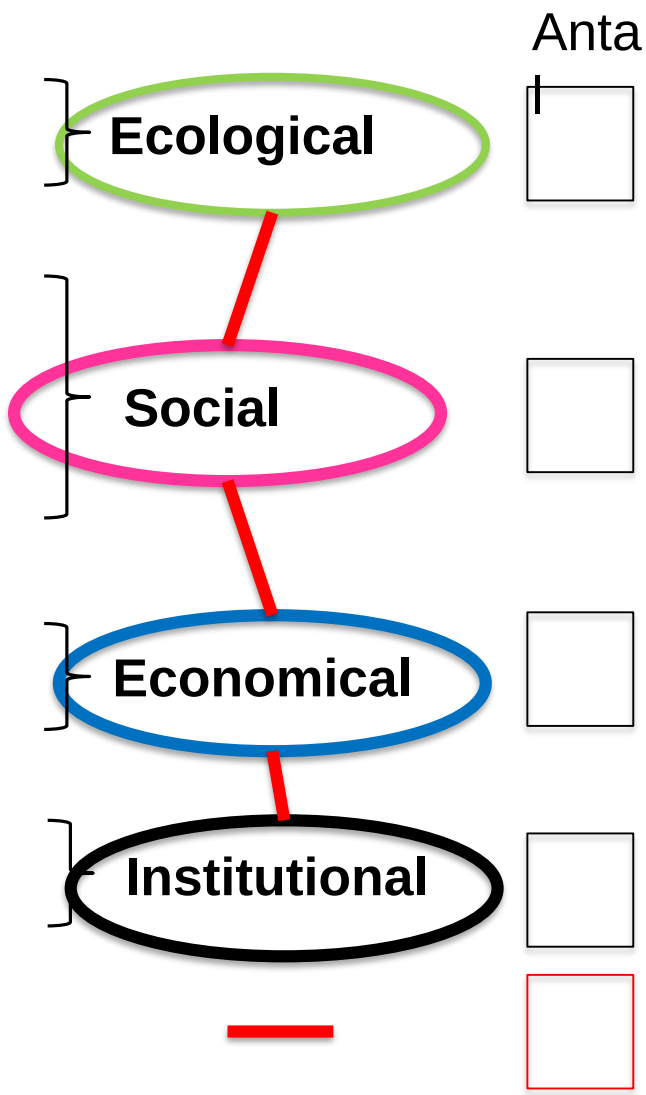
- Färgkoda boxarna baserat på kategorierna.
- Markera linjer som går mellan olika kategorier.
- Räkna antalet boxar per kategori.
- Räkna antalet markerade linjer.

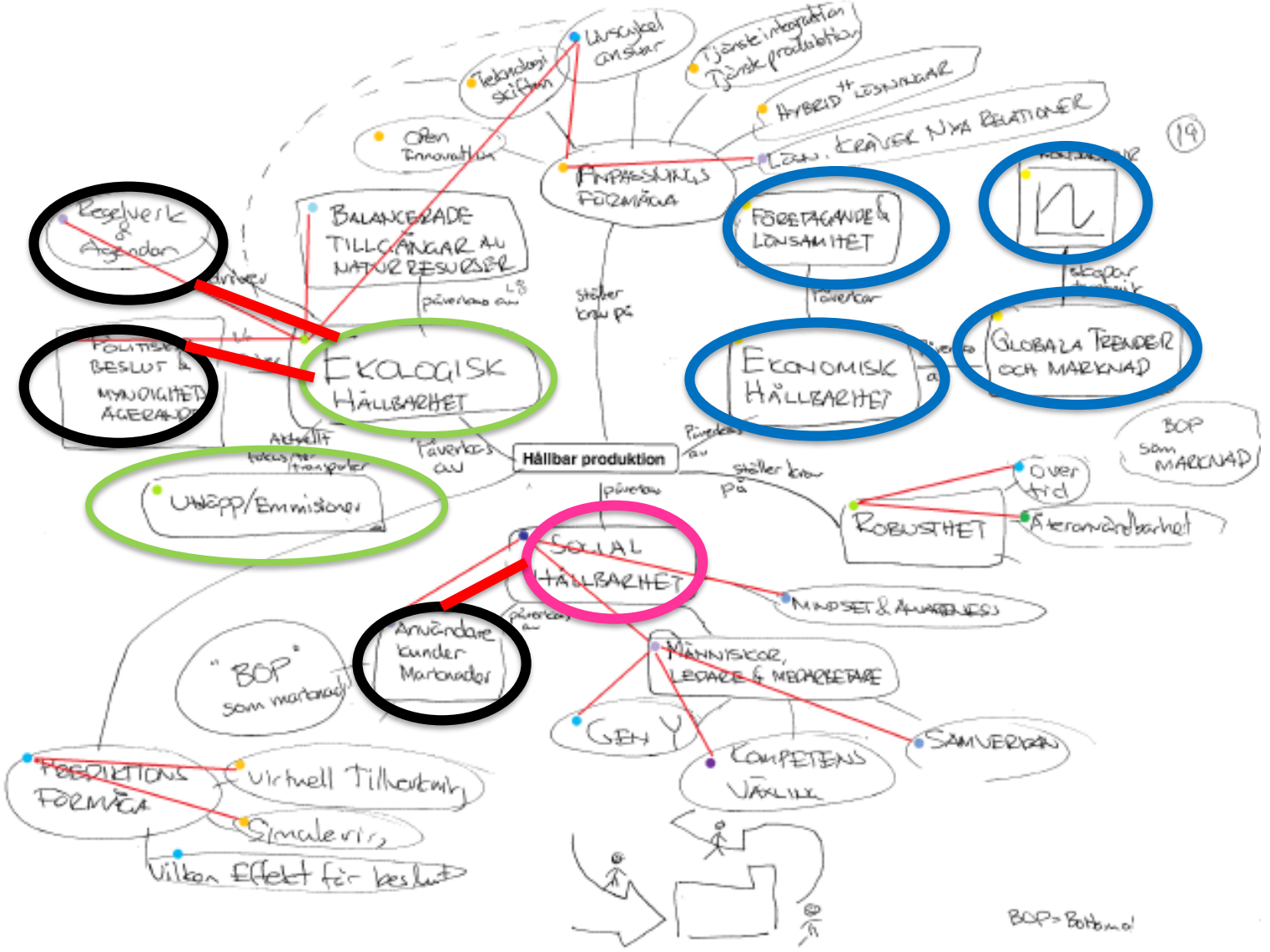
Analys av Concept maps

1. Färgkoda boxarna baserat på kategorierna.
2. Markera linjer som går mellan olika kategorier.
3. Räkna antalet boxar per kategori.
4. Räkna antalet markerade linjer.
5. Dividera antalet markerade linjer med det totala antalet boxar.



Grovt komplexitetsmått




Hållbar produktion
Regelverk & Agendan
Balancerade tillgångar av naturresurser
Anpassnings förmåga
Lösn. kräver nya relationer
Hybrid lösningar
Tjänsteintegration Tjänsteproduktion
Open Innovation
Teknologi skiftan
Livscykel ansvar
Företagande & lönsamhet
Ekologisk hållbarhet
Politisk beslut & myndighets agerande
Ekonomisk hållbarhet
Globala trender och marknad
Utläpp/Emmisioner
Social hållbarhet
Robusthet
Over tid
Återanvändbarhet
BOP som marknad
Mindset & awareness
Användare kunder Marknader
"BOP" som marknad
Människor, ledare & medarbetare
Gen Y
Kompetens växling
Samverkan
Prediktions förmåga
Virtuell Tillverkning
Simulering
Vilken Effekt för beslut
BOP = Bottom of
19

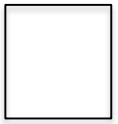
UN SDGs

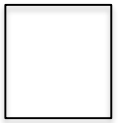
Sustainable Development Goals
TRANSFORMING OUR WORLD:
THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

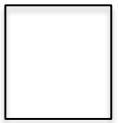
Analys av Concept maps

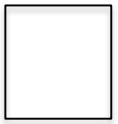
1. Färgkoda boxarna baserat på kategorierna.
2. Markera linjer som går mellan olika kategorier.
3. Räkna antalet boxar per kategori.
4. Räkna antalet markerade linjer.
5. Dividera antalet markerade linjer med det totala antalet boxar.

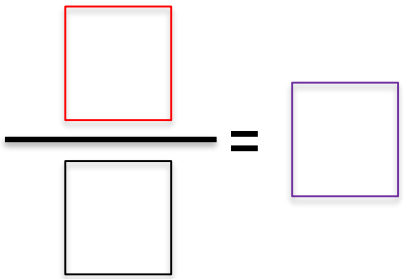
Antal

Environment
Resources scarcity
} **Ecological** 

Social impact
Values
Future (Temporal)
Unbalances (Spatial)
} **Social** 

Technology
Economy
} **Economical** 

Education
Actors and Stakeholders
} **Institutional** 



Grovt komplexitetsmått

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

- Component manufacture **Lars Nybnorg J-E Ståhl**
- Virtual production systems **Björn Johansson**
- Virtual robust design and simulation **Ida Genmyr**
- Micro-fabrication **Johan Liu**

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

- Human and automation optimisation **Johan Share**
- Perceived quality **Casper Wickman**

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

- Chemical processes and recycling **Christian Ekberg**
- Sustainability awareness and measures **Björn Johansson**

Goal 12. Ensure sustainable consumption and production patterns

- Multi-physics Methods and Process Development **Fredrik Edelvik**
- Rock processing systems **Magnus Evertsson**
- Sustainable product lifecycle platforms **Hans Johannesson**
- Process modeling and materials assessment **Ragnar Larsson**
- Production system performance **Peter Almström**
- Virtual assembly and disassembly simulation and planning methods **Andreas Dagman**

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

- 7.1 By 2030, ensure universal access to affordable, reliable and modern energy services
- 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix
- **7.3 By 2030, double the global rate of improvement in energy efficiency**
- **7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology**
- 7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support

- Reduction of energy consumption for robotics in manufacturing

Virtual robust design and simulation
Ida Genmyr

- Reduction of energy consumption in gears, engines and generators

Component manufacture
Lars Nybnorg J-E Ståhl

- Reduction of energy consumption in manufacturing systems

Virtual production systems
Björn Johansson

- Reduction of energy consumption in micro/nano electronics

Micro-fabrication
Johan Liu

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

- 8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries
- **8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors**
- 8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services
- **8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead**
- 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value
- 8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training

- Increased product quality as well as product life

Perceived quality
Casper Wickman

- Increased human perception, work environment and empowerment in production

Human and automation optimisation
Johan Share

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

- 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
- 9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
- 9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets
- **9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities**
- 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
- 9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States
- 9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities
- 9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020

- Increased share of reuse and recycling of materials

Chemical processes and recycling
Christian Ekberg

- Increased awareness on sustainability in all aspects for researchers and students

Sustainability awareness and measures
Björn Johansson

Goal 12. Ensure sustainable consumption and production patterns

- **12.1 Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead taking into account the development and capabilities of developing countries**
- **12.2 By 2030, achieve the sustainable management and efficient use of natural resources**
- 12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
- **12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment**
- **12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse**
- **12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle**
- 12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities
- **12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature**
- **12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production**
- 12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products
- 12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities

Multi-physics Methods and Process Development **Fredrik Edelvik**

Rock processing systems **Magnus Evertsson**

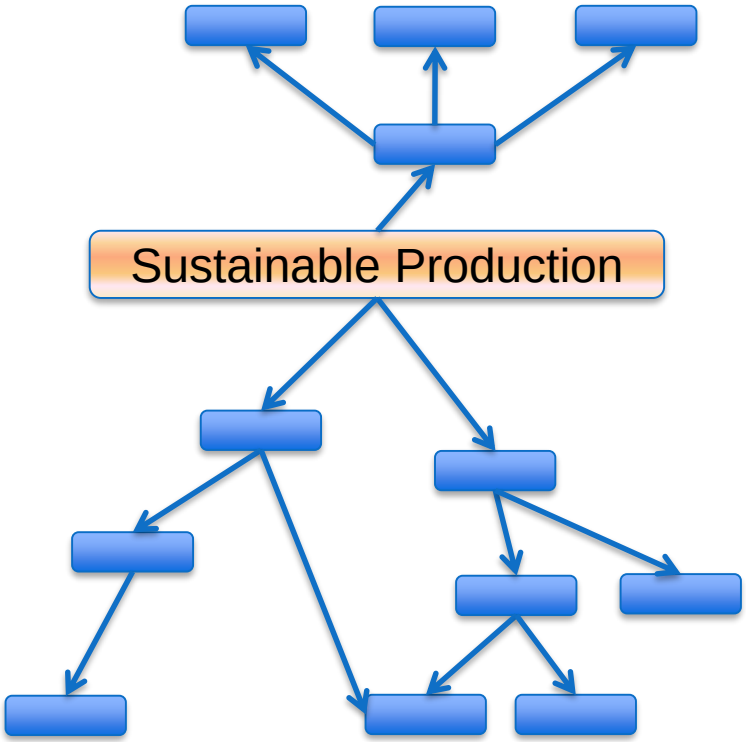
Sustainable product lifecycle platforms **Hans Johannesson**

Process modeling and materials assessment **Ragnar Larsson**

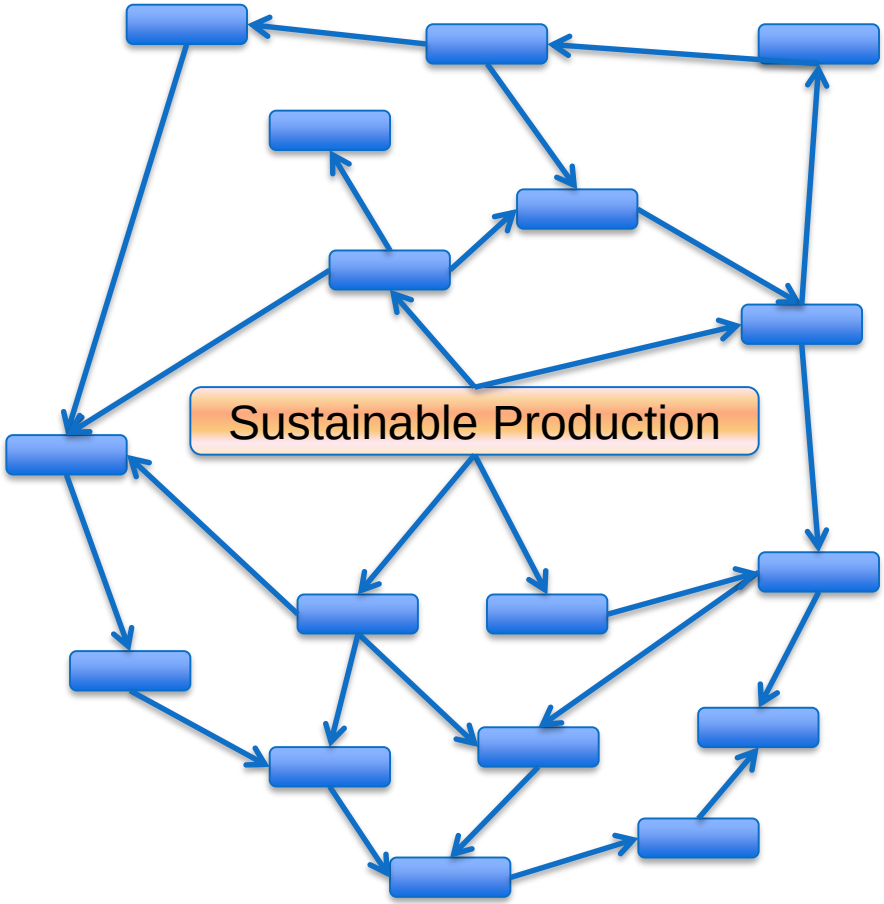
Production system performance **Peter Almström**

Virtual assembly and disassembly simulation and planning methods **Andreas Dagman**

Now (34p)

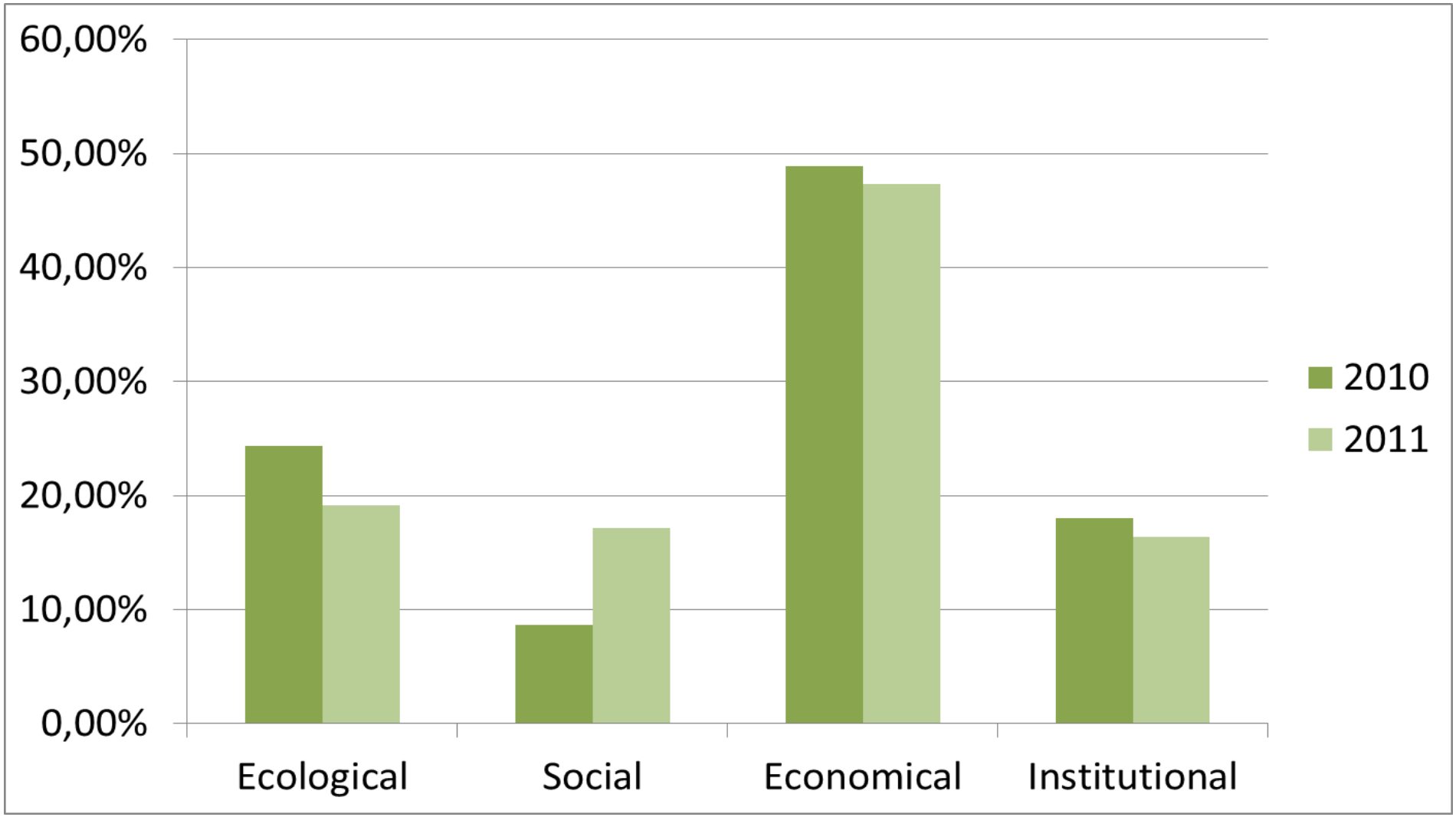


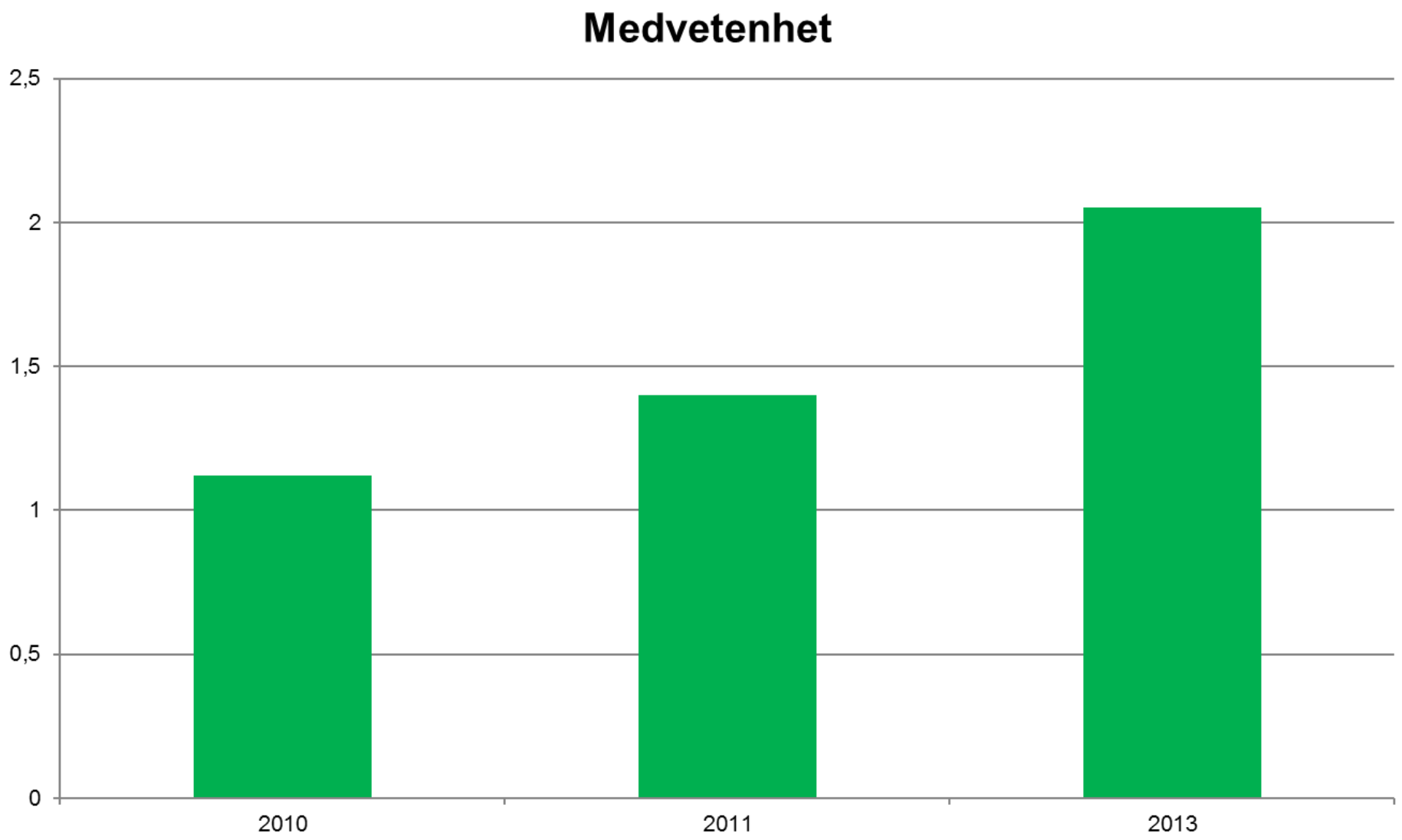
Later (46p)



Resultat: Kategorier

Kategorirelevans




Medvetenhet
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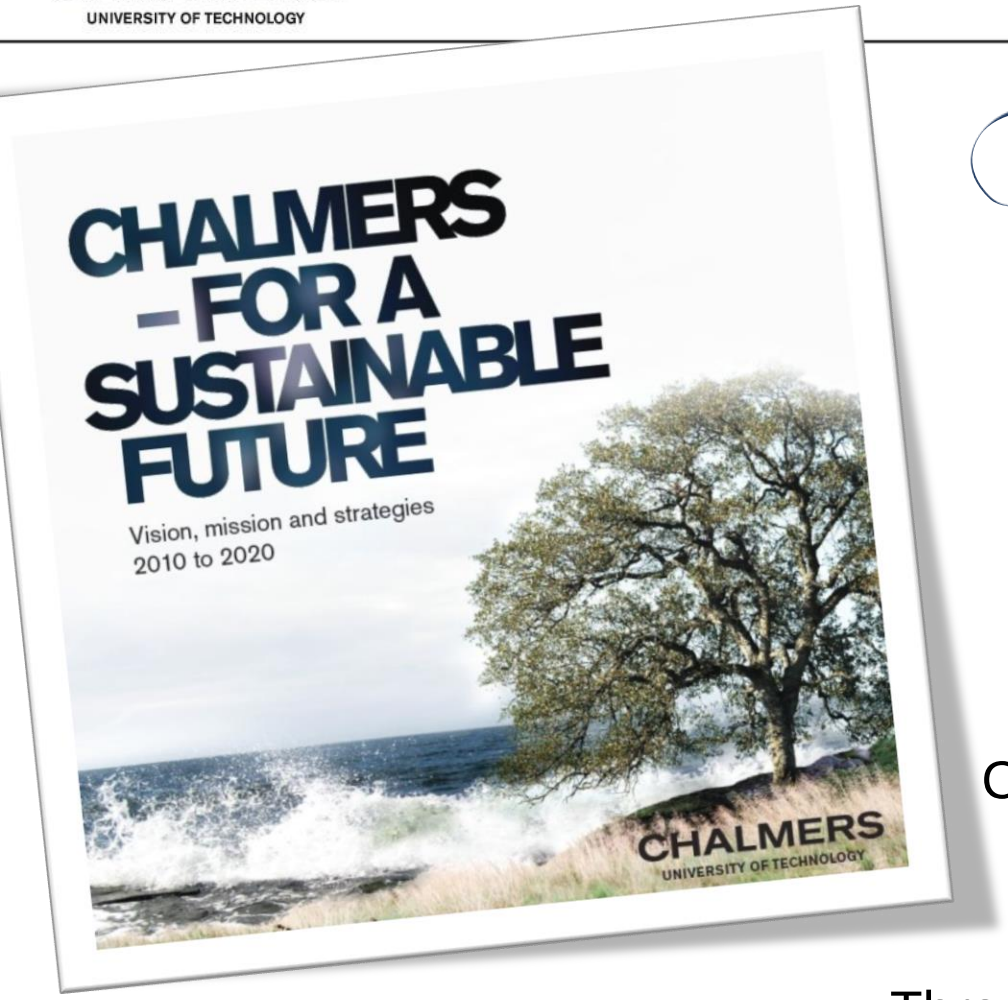
2
1,5
1
0,5
0
2010
2011
2013



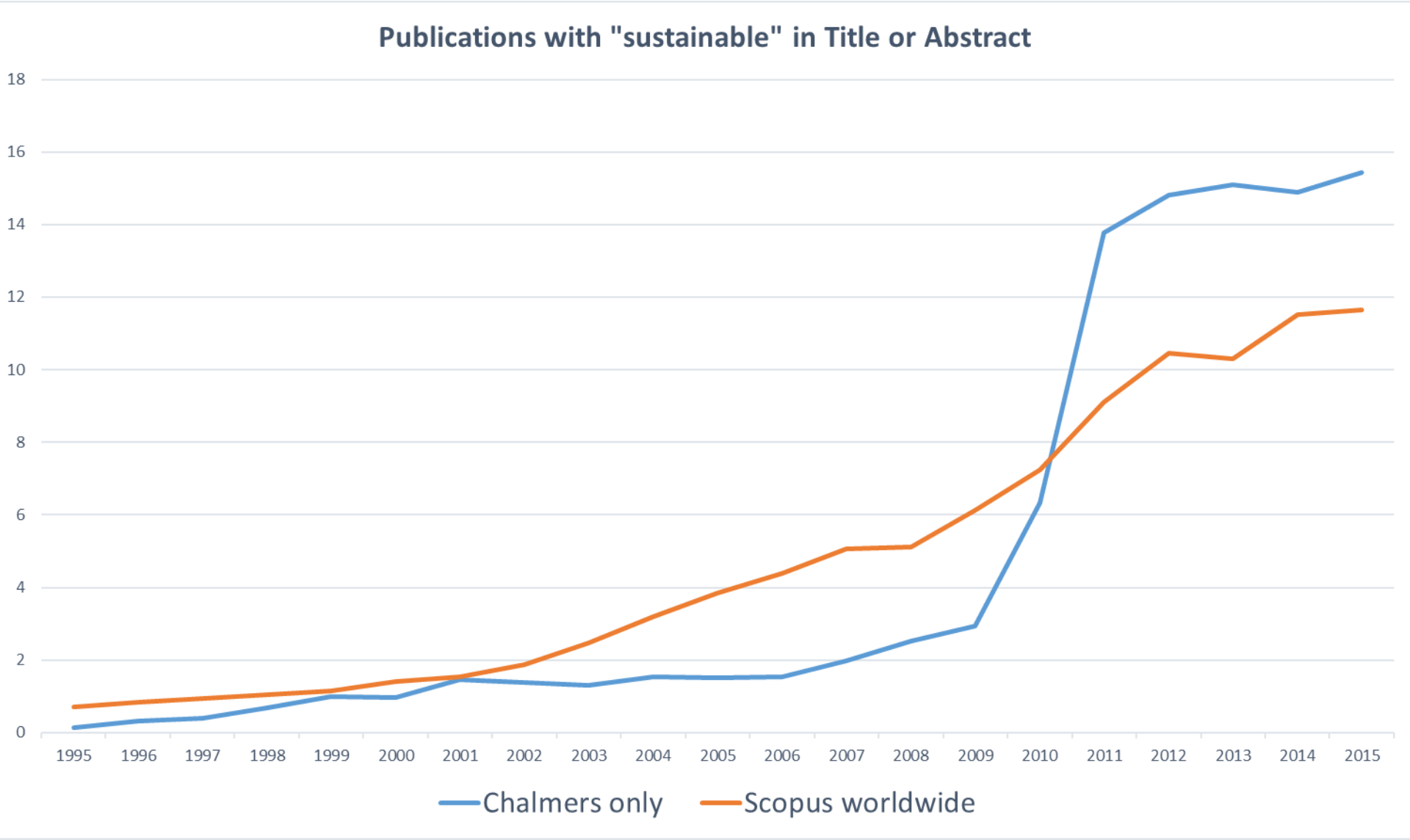
VISION & MISSION

VISION

Chalmers – for a sustainable future

MISSION

Through internationally acclaimed education and research combined with a professional innovation process, Chalmers' mission is to become one of the world's most attractive universities.


Publications with "sustainable" in Title or Abstract
18
16
14
12
10
8
6
4
2
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Chalmers only
Scopus worldwide

"… development that meets the needs of the present without compromising the ability of future generations to meet their own needs"[Brundtland]

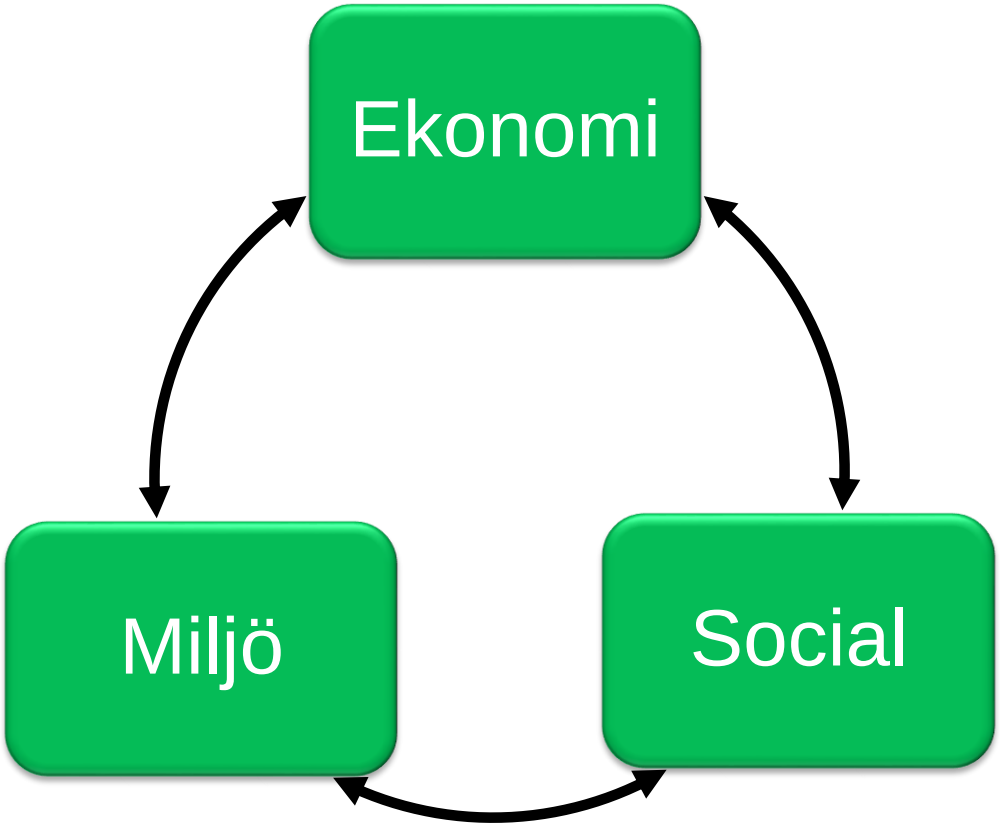
"..the creation of goods and services using processes and systems that are non-polluting; conserving of energy and natural resources; economically viable; safe and healthful for employees, communities and consumers; and socially and creatively rewarding for all working people."
[Un. of Mass: Lowell center for sustainable production]

Fairness in space and time

- Intra-generational distribution
  - How well-being is distributed among people on Earth
  - Brundtland: *”Sustainable development is development that meets the needs of the present…” … overriding priority to the poor….*
- Inter-generational distribution
  - How well-being is distributed among different generations, including future ones
  - Brundtland: *”…without compromising the ability of future generations to meet their own needs.”*

Andra källor

(22 CSI)	Lowell Center for Sustainable Production, University of Massachusetts
(DJSI)	Dow Jones Sustainability Index
(EPI-EU)	Environmental Pressure Indicators for the European Union
(OECD Env)	OECD Core Set of Environmental indicators
(UN-CSD)	United Nations Commission on Sustainable Development Indicators
(FORD's PSI)	Ford Product Sustainability Index
(GM M4SM)	General Motors Metrics for Sustainable Manufacturing
(UTILIZATION)	Peter Almström, Carin Andersson, Abid Muhammad, Mats Winroth
(UNEP)	Social LCA
(TNS)	The Natural Step
	Etc...


Ekonomi
Miljö
Social

Lazy persons tip for sustainability

http://www.un.org/sustainabledevelopment/takeaction/

Info on coming 3 slides

Things you can do from your couch

- Save electricity by plugging appliances into a power strip and turning them off completely when not in use, including your computer.
- Stop paper bank statements and pay your bills online or via mobile. No paper, no need for forest destruction.
- Share, don't just like. If you see an interesting social media post about women's rights or climate change, share it so folks in your network see it too.
- Speak up! Ask your local and national authorities to engage in initiatives that don't harm people or the planet. You can also voice your support for the Paris Agreement and ask your country to ratify it or sign it if it hasn't yet.
- Don't print. See something online you need to remember? Jot it down in a notebook or better yet a digital post-it note and spare the paper.
- Turn off the lights. Your TV or computer screen provides a cosy glow, so turn off other lights if you don't need them.
- Do a bit of online research and buy only from companies that you know have sustainable practices and don't harm the environment.
- Report online bullies. If you notice harassment on a message board or in a chat room, flag that person.
- Stay informed. Follow your local news and stay in touch with the Global Goals online or on social media at @GlobalGoalsUN.
- Tell us about your actions to achieve the global goals by using the hashtag #globalgoals on social networks.
- Offset your carbon emissions! You can calculate your carbon footprint and purchase climate credit from Climate Neutral Now.

Things you can do at home

- Air dry. Let your hair and clothes dry naturally instead of running a machine. If you do wash your clothes, make sure the load is full.
- Take short showers. Bathtubs require gallons more water than a 5-10 minute shower.
- Eat less meat, poultry, and fish. More resources are used to provide meat than plants
- Freeze fresh produce and leftovers if you don't have the chance to eat them before they go bad. You can also do this with take-away or delivered food, if you know you will not feel like eating it the next day. You will save food and money.
- Compost—composting food scraps can reduce climate impact while also recycling nutrients.
- Recycling paper, plastic, glass & aluminium keeps landfills from growing.
- Buy minimally packaged goods.
- Avoid pre-heating the oven. Unless you need a precise baking temperature, start heating your food right when you turn on the oven.
- Plug air leaks in windows and doors to increase energy efficiency
- Adjust your thermostat, lower in winter, higher in summer
- Replace old appliances with energy efficient models and light bulbs
- If you have the option, install solar panels in your house. This will also reduce your electricity bill!
- Get a rug. Carpets and rugs keep your house warm and your thermostat low.
- Don't rinse. If you use a dishwasher, stop rinsing your plates before you run the machine.
- Choose a better diaper option. Swaddle your baby in cloth diapers or a new, environmentally responsible disposable brand.
- Shovel snow manually. Avoid the noisy, exhaust-churning snow blower and get some exercise.
- Use cardboard matches. They don't require any petroleum, unlike plastic gas-filled lighters.

Things you can do outside your house

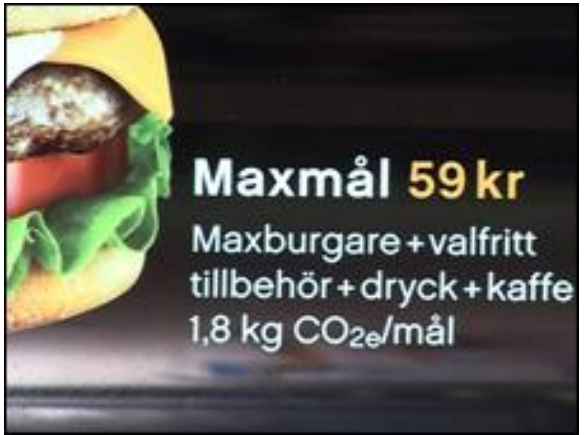
- Shop local. Supporting neighbourhood businesses keeps people employed and helps prevent trucks from driving far distances.
- Shop Smart—plan meals, use shopping lists and avoid impulse buys. Don't succumb to marketing tricks that lead you to buy more food than you need, particularly for perishable items. Though these may be less expensive per ounce, they can be more expensive overall if much of that food is discarded.
- Buy Funny Fruit—many fruits and vegetables are thrown out because their size, shape, or color are not "right". Buying these perfectly good funny fruit, at the farmer's market or elsewhere, utilizes food that might otherwise go to waste.
- When you go to a restaurant and are ordering seafood always ask: "Do you serve sustainable seafood?" Let your favorite businesses know that ocean-friendly seafood's on your shopping list.
- Shop only for sustainable seafood. There are now many apps like this one that will tell you what is safe to consume.
- Bike, walk or take public transport. Save the car trips for when you've got a big group.
- Use a refillable water bottle and coffee cup. Cut down on waste and maybe even save money at the coffee shop.
- Bring your own bag when you shop. Pass on the plastic bag and start carrying your own reusable totes.
- Take fewer napkins. You don't need a handful of napkins to eat your takeout. Take just what you need.
- Shop vintage. Brand-new isn't necessarily best. See what you can repurpose from second-hand shops.
- Maintain your car. A well-tuned car will emit fewer toxic fumes.
- Donate what you don't use. Local charities will give your gently used clothes, books and furniture a new life.
- Vaccinate yourself and your kids. Protecting your family from disease also aids public health.
- Take advantage of your right to elect the leaders in your country and local community.

Example

- Reduction of CO_2-emmisions by 44% 2007 - 2008 by evaluating and improving their product value chain

- Market research shows that 13 times more customers relate their brand to environmental friendly products compared to their main competitor (= increased brand value)

MAX
HAMBURGARE



Quiz

- What are the CO_2 Emissions (g CO_2 Eq.) of:
  - 1 Pair of forklift brakes
  - Driving 1 km with a mid sized car
  - 1 Hamburger meal at MAX
  - Due date is over on 1 Kg Sausages
  - Due date is over on 1 Kg Apple Juice
  - Due date is over on 1 Kg Yogurt

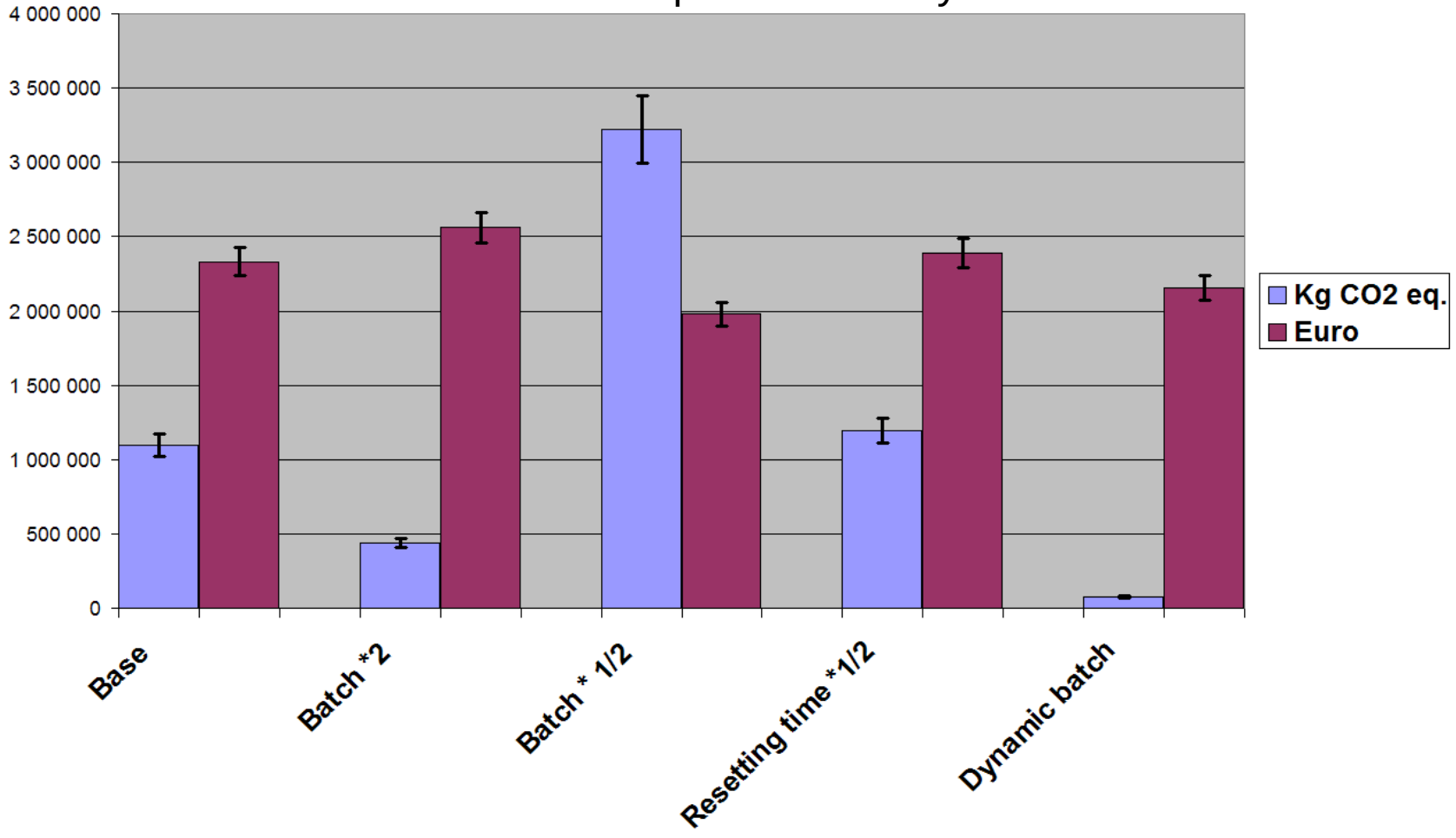
GWP Example

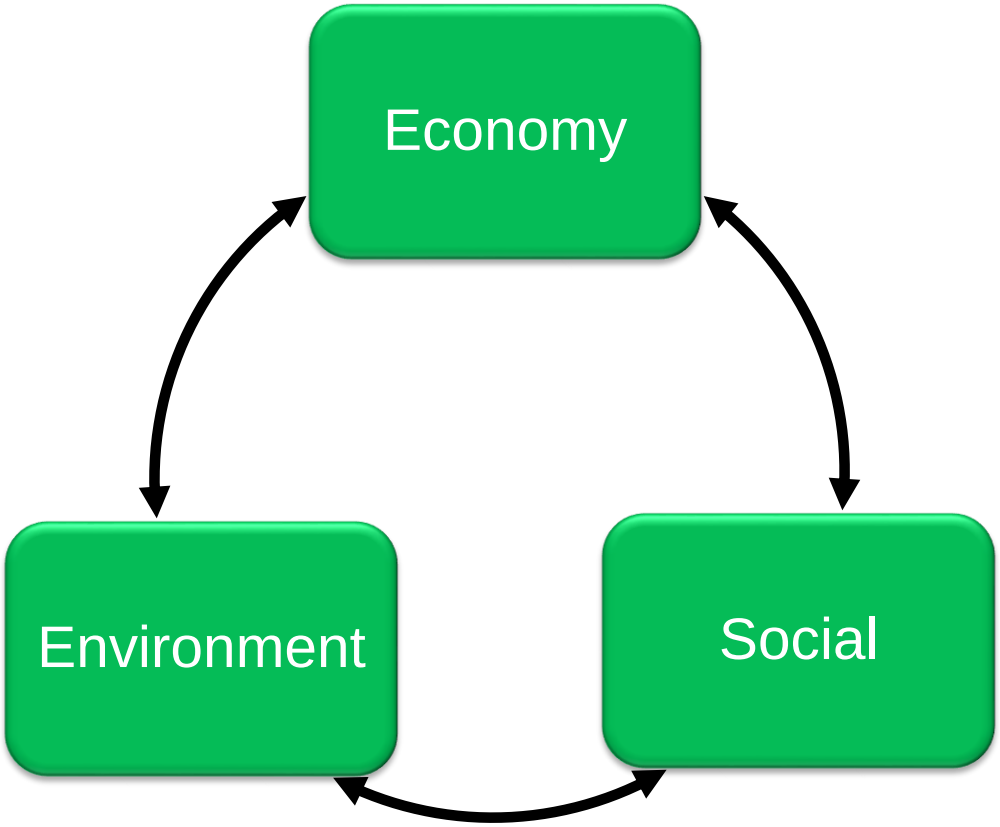
What	Kg CO_2 equivalents
1 Pair of forklift brakes	663,5
1 Km cardriving	0,2
1 Hamburger meal at MAX	1,8
1 Kg sausage	9
1 Litre Applejuice	0,1
1 Litre Yoghurt	4

A pinch of salt

Result Examples from Food Industry

Product Realization scenario results on environmental and economical impact over one year




Economy
Environment
Social

Extra material

Vill du veta mer om de globala målen för hållbar utveckling?

Kontakta GMV:

Göteborgs miljövetenskapliga centrum, GMV har i uppdrag att skapa samverkan, mellan och inom Chalmers och Göteborgs universitet samt med andra samhällsaktörer, för att generera och nyttiggöra kunskap om hållbar utveckling. Genom detta arbete bidrar GMV till att uppnå de globala målen för hållbar utveckling.

www.gmv.chalmers.gu.se

Kontakt: mikael.ostblom@chalmers.se

Föreläsningsserie och andra event om de globala hållbarhetsmål

I en serie öppna, populärvetenskapliga föreläsningar berättar forskare från Göteborgs universitet och Chalmers om ett av hållbarhetsmålen utifrån sin forskning och vad vi kan göra för att uppnå målet. Arrangeras en onsdagskväll i månaden på Ekocentrum.

GMV arrangerar även vetenskapskaféer, lärarfortbildningar och en rad olika seminarier som tar upp de globala målen

Se: http://gmv.chalmers.gu.se/Aktuellt/GMV+och+Globala+målen+för+hållbar+utveckling

Bra länkar för fördjupning:

- Regeringens sida om de globala målen

http://www.regeringen.se/regeringens-politik/globala-malen-och-agenda-2030/

- Agenda 2030 för hållbar utveckling

http://www.sou.gov.se/wp-content/uploads/2016/11/Agenda-2030-svensk-översättning.pdf

- Global goals

http://www.globalgoals.org/

Story of stuff se fimen

http://storyofstuff.org/movies/story-of-stuff/