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SE implications for MNCs of the UN Sustainable Development Goals

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- Sustainability failure in Systems Engineering (SE)
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- Future work

Twitter: @brksim

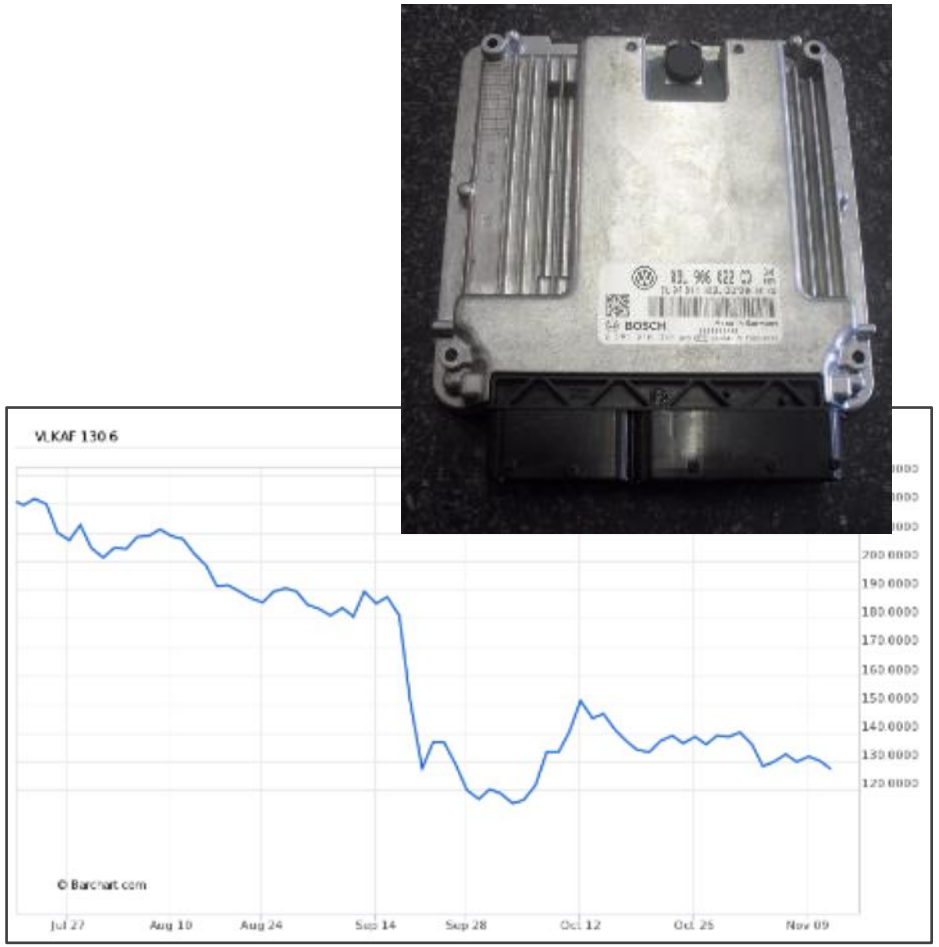
University of the West of England

- With over 29,000 students and 3,000 staff, UWE Bristol is one of the largest providers of Higher Education in the South West of UK. We are globally connected and regionally embedded, with strong employer and partner connections.
- UWE Bristol hosts the Software Engineering Research Group (SERG).

Implications of sustainability failure in SE

Implications of sustainability failure in SE

- Sept 2015. Volkswagen lost over $30 bn market capital on confirmation some diesel engines had software engineered to defeat emissions testing.
- Potential 5000 excess deaths per annum in EU.
- VW Software Engineer James Liang sentenced in US to 40 months in prison and fined $200,000 (Aug 2017)



Sources: Volkswagen Aktiengesellschaft, 2015, Barchart.com Inc, 2016, german.performance, 2015, Jonson et al, 2017, McCarthy, 2017

SUSTAINABLE DEVELOPMENT GOALS

Source: United Nations General Assembly, 2015

SDG 1. No Poverty

End poverty in all its forms everywhere

1.1 By 2030, eradicate extreme poverty for all people everywhere, [defined as] people living on less than $1.25 a day

1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty […]

1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable

1.4 By 2030, ensure that all men and women[…] have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance

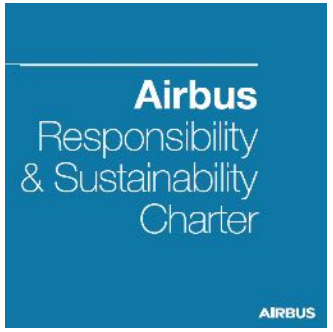
1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters

Source: United Nations General Assembly, 2015

MNC adoption of SDGs is increasing

- “the SDGS are a critical part of investors’ fiduciary duty” (UNEP Finance Initiative and U N Global Compact 2017)
- “60% of corporate respondents state their businesses are integrating the SDGs into their business strategy” (Dowd 2017)

Example: Airbus



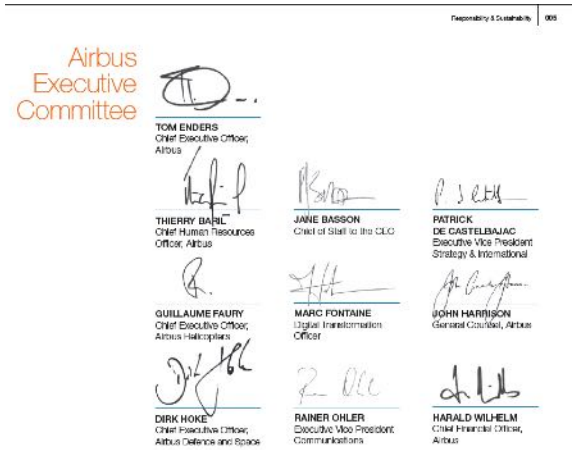
Helping to Solve Societal Challenges

We believe in the potential of responsible businesses to help make the world a better place. We are committed to applying our resources and energies to seeking solutions for societal challenges.

We strive for excellence in engineering, manufacturing and customer service. Airbus people are focused on delivering innovative solutions to improve the way we live, travel, connect and protect ourselves.

Our approach to sustainable development is guided by the internationally recognized UN Sustainable Development Goals. We first set our commitments against the relevant UN goals.

- A commitment to achieving inclusive and quality training or development aligns to our belief that education is one of the most powerful vehicles for progress.
- We believe empowering women, promoting equal opportunity and ending all forms of discrimination is not only a human right, but also has a multiplier effect across all other development areas.
- Promoting inclusive and sustainable economic growth, full and productive employment, decent work and equal pay for everyone is at the heart of our business philosophy.
- We believe sustained investment in infrastructure and innovation are crucial drivers of economic growth and development.
- Reducing environmental footprint and ensuring responsible health and safety management are key to achieving sustainable development. We are focused on meeting both the short and long-term challenges we face.
- We are committed to reducing our contribution to climate change by reducing the carbon intensity of our operations. We are also working in partnership with suppliers, industry and government stakeholders to achieve our ambitious sectorial emissions reduction goals.
- We work together with national governments, international organizations and customers to develop defense solutions that help to keep our world safer. In doing so, we are committed to innovation in civil and defense solutions to make them even more effective in addressing societal needs.
- At Airbus, we come together as one in partnerships so that we can act together as responsible citizens tin meeting societal and environmental challenges.



Source: Airbus, 2018

Why MNC adoption?

- Anticipatory Compliance (Engau and Hoffmann 2011)
- Increase in shareholder value (Robinson et al. 2011)
- Brand value
- Risk reduction
- Reporting standards (Global Reporting Initiative 2015)

“There is no business case for enduring poverty. We have an opportunity to unlock trillions of dollars through new markets, investments and innovation. But to do so, we must challenge our current practices and address poverty, inequality and environmental challenges. Every business will benefit from operating in a more equitable, resilient world if we achieve the Sustainable Development Goals.” (Unilever 2017)


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
SUSTAINABLE DEVELOPMENT GOALS

MNC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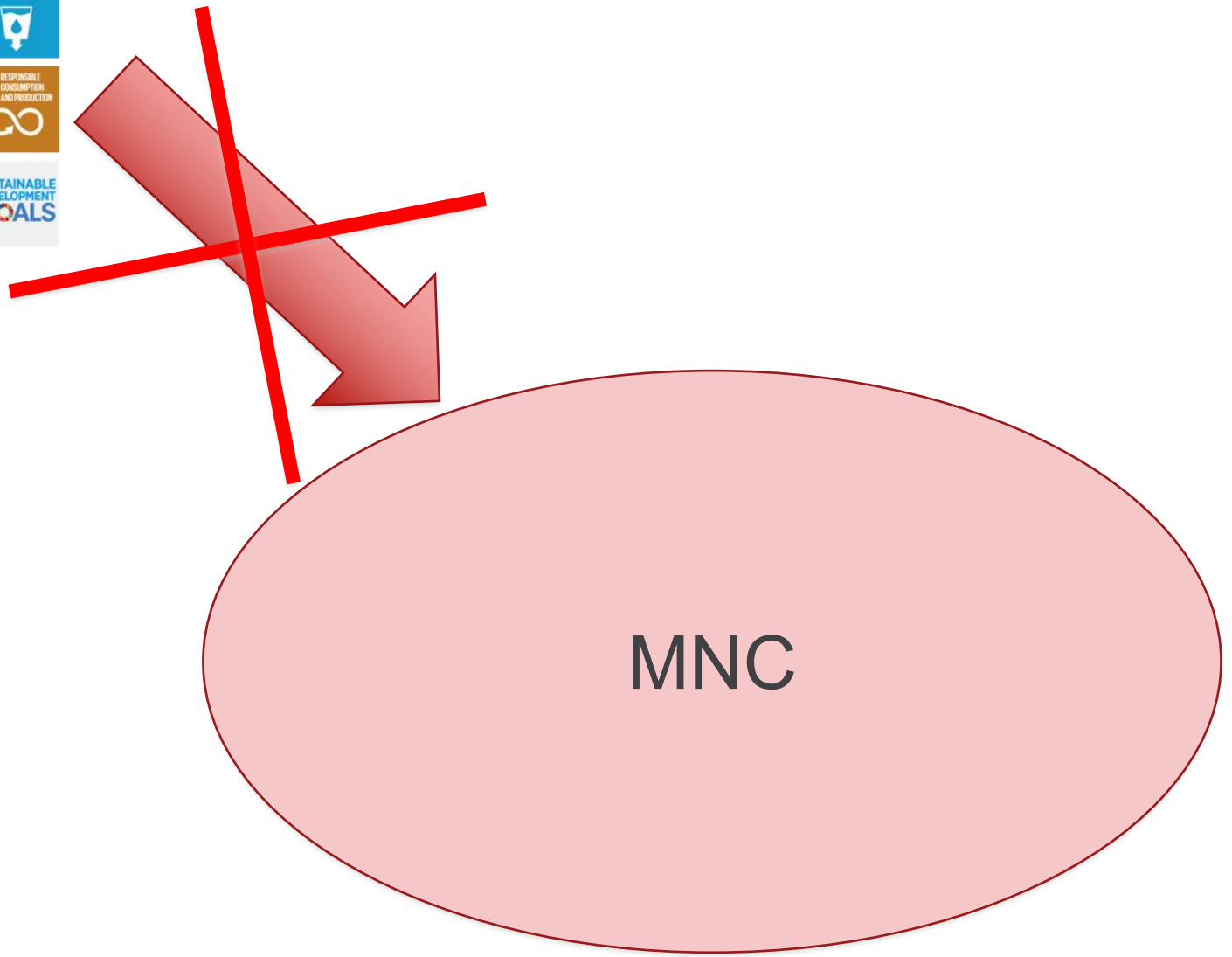
MNC


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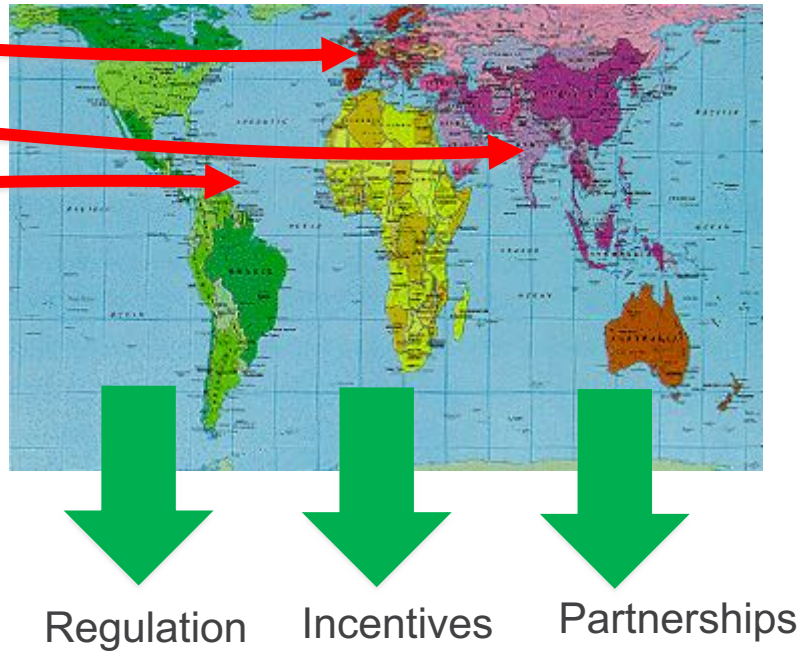
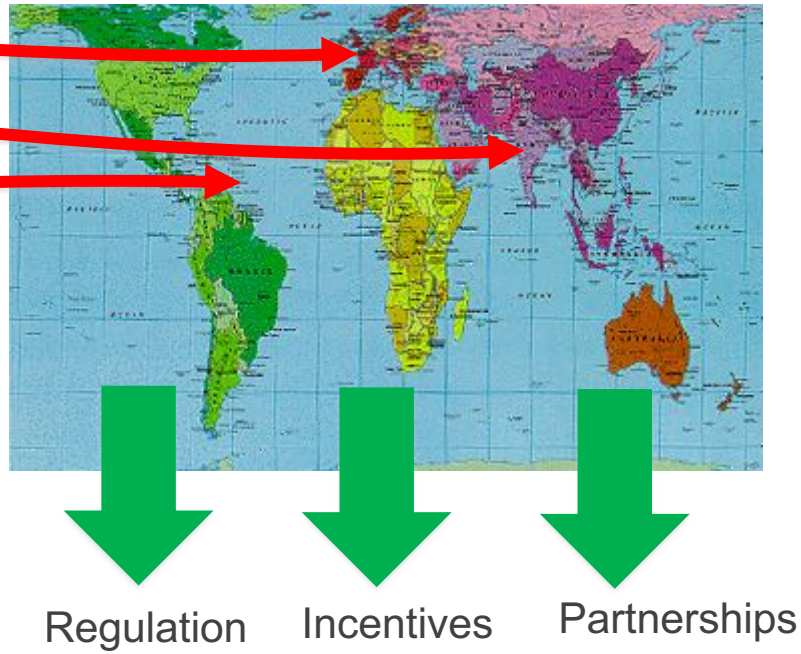
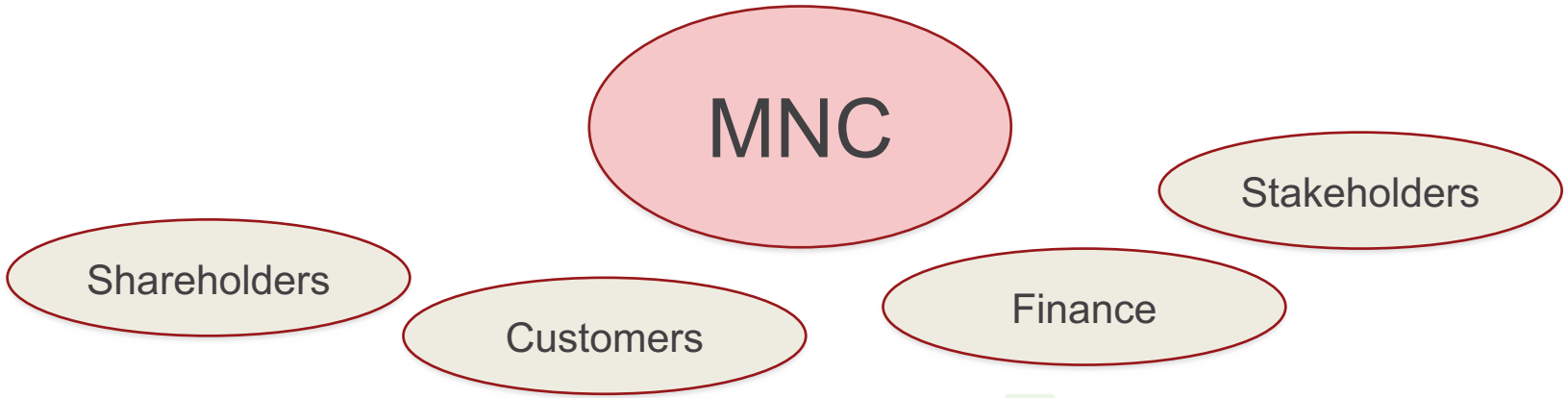

Regulation
Incentives
Partnerships

MNC



Non compliance	Min compliance	Leadership



Impacts on SE in MNCs?

- The **actual systems** to be developed or those already in service might receive new system requirements that are based on the SDGs and related technical requirements;
- The **SE organisation** of the MNC may receive allocations of SDGs derived business requirements, which the SE organisation has to implement by accepted means of compliance.
- The **SE processes** (including applied methods and supporting tools) will receive allocations of SDGs derived business requirements, which the SE processes have to implement by accepted means of compliance;
- Requirements Owners?
- Scope boundary challenge

Some of the impacts on SE in MNCs

Operations / Manufacturing	Supply Chain	Finance	Human Resources	Strategy
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	8 DECENT WORK AND ECONOMIC GROWTH	8 DECENT WORK AND ECONOMIC GROWTH	
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	5 GENDER EQUALITY	
13 CLIMATE ACTION	16 PEACE, JUSTICE AND STRONG INSTITUTIONS	16 PEACE, JUSTICE AND STRONG INSTITUTIONS	4 QUALITY EDUCATION	

Illustrative examples, not exhaustive

Are the SDG targets good requirements?

[Requirements] shall possess the following characteristics:

- Necessary.
- Implementation Free.
- Unambiguous.
- Consistent.
- Complete.
- Singular.
- Feasible.
- Traceable.
- Verifiable.

ISO / IEC / IEEE 29148:2011 Systems and software engineering — Life cycle processes — Requirements engineering

INCOSE Guide for Writing Requirements v2.1

A simple requirement

Target 1.1

By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day

- Potential internal corporation requirement: The MNC shall pay employees at least a minimum rate of $1.25 per day net by 2030

A complex requirement

Target 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

- Potential internal corporation requirement: The MNC products / services shall be viable after rationalization of fossil-fuel subsidies

Badly formed requirements

Target 12.4

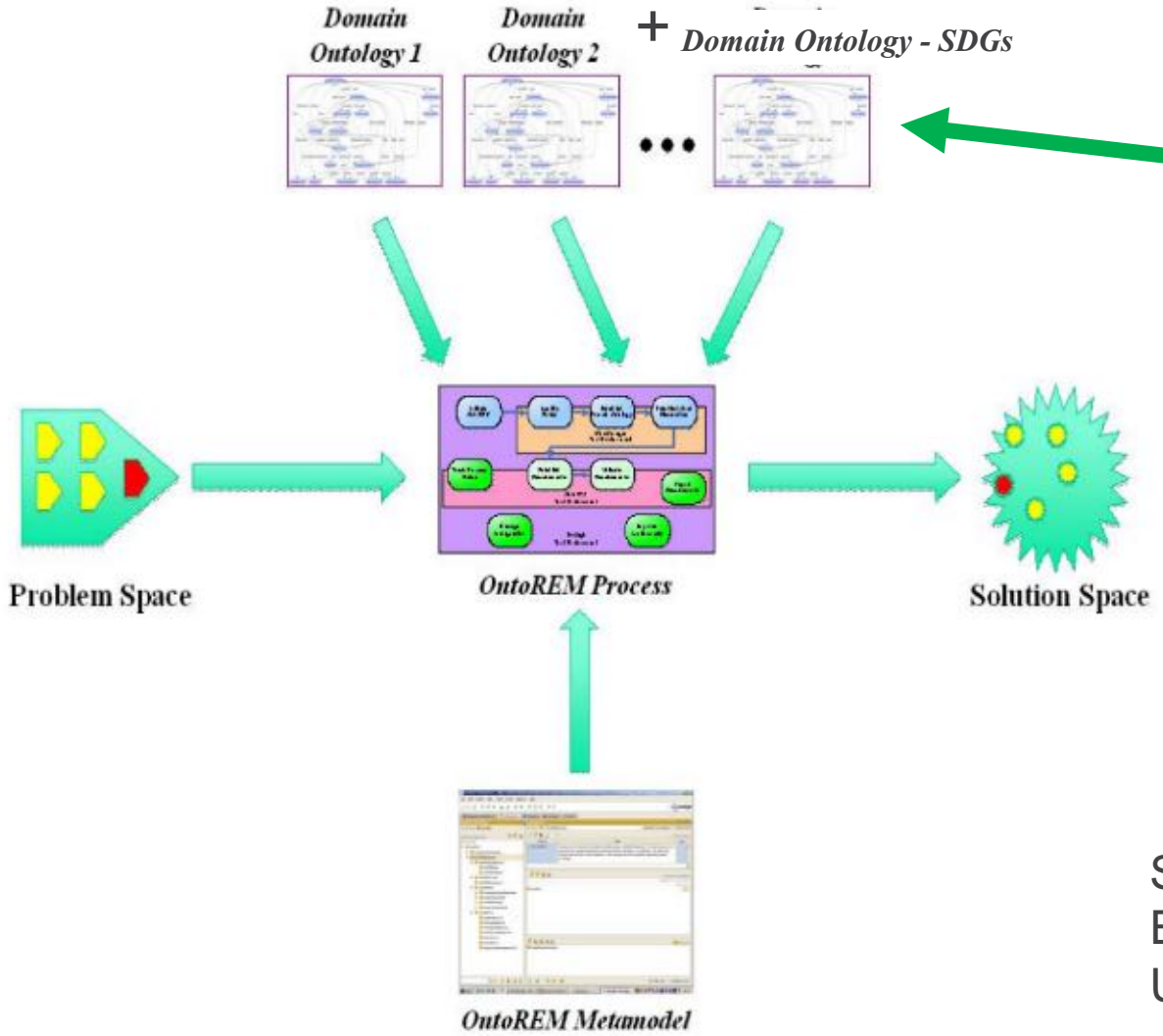
By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

Target 3.8

Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all

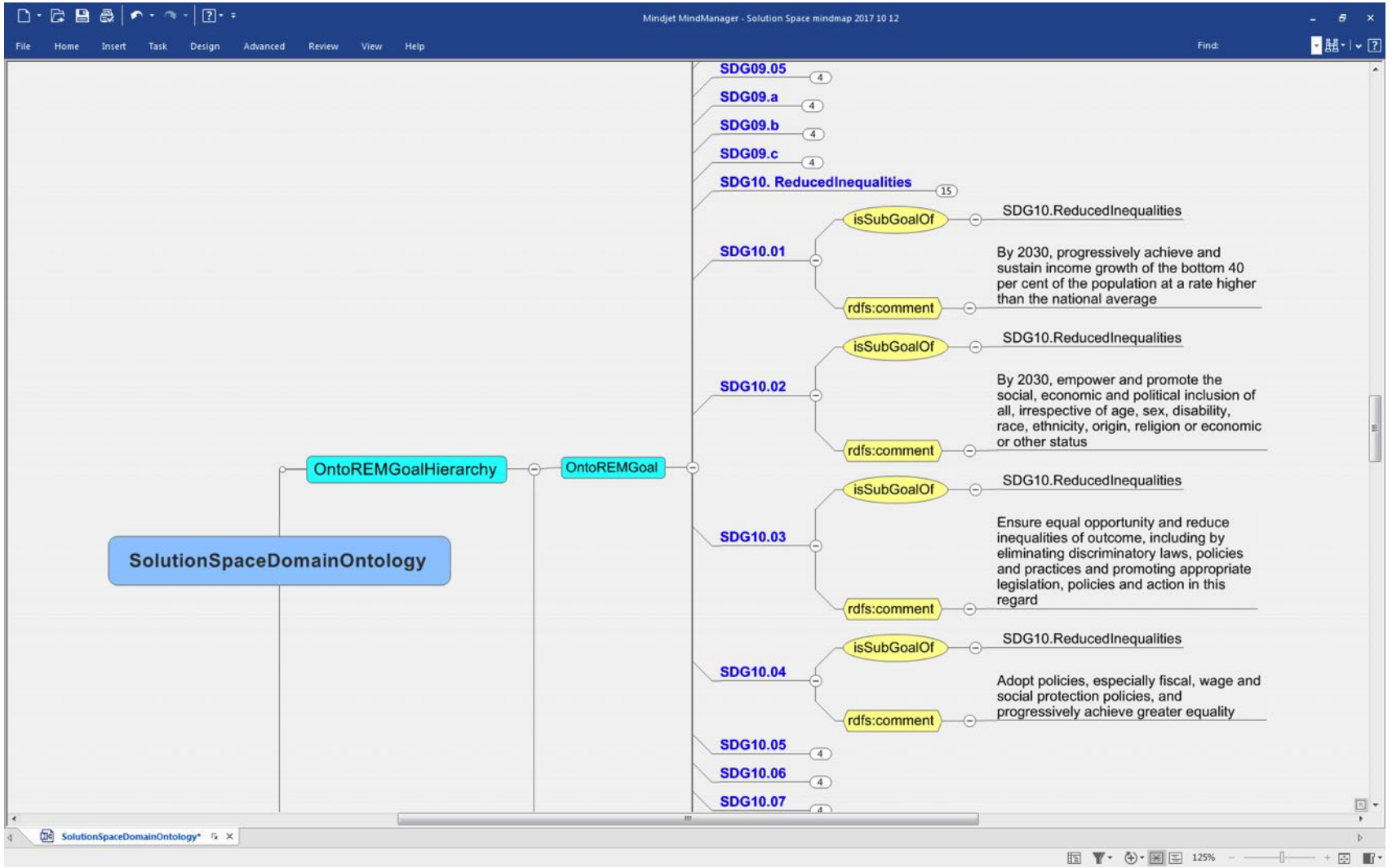
17% (29) of the targets “require significant work” before they could be considered well developed (ICSU and ISSC 2015)

Realising the value to SE with OntoREM



Sources: OntoREM, "Ontology-driven Requirements Engineering Methodology" Kossmann and Odeh, 2010. US patent US9372667B2

Instantiating the SDG targets



Future work

- Case studies: expressing the SDG targets as well formed requirements.
- Cataloguing the experiences of MNCs
- Using ontologies to bridge the gap
  - between human thinking about sustainability and machine processing for sustainable development

Summary

- Contribution of MNCs to Sustainable Development
- SDG targets, helpful framework, not all well-formed
- Unique experiences by MNCs of SDG targets
- Systems Engineering challenge to turn intention into systemic action

Questions? Ian.Brooks@uwe.ac.uk

Source: United Nations General Assembly, 2015

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www.incose.org/symp2018

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