



Requirements Engineering for Sustainability

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@twinkleflip
#SustainabilityDesign
#KarlskronaManifesto

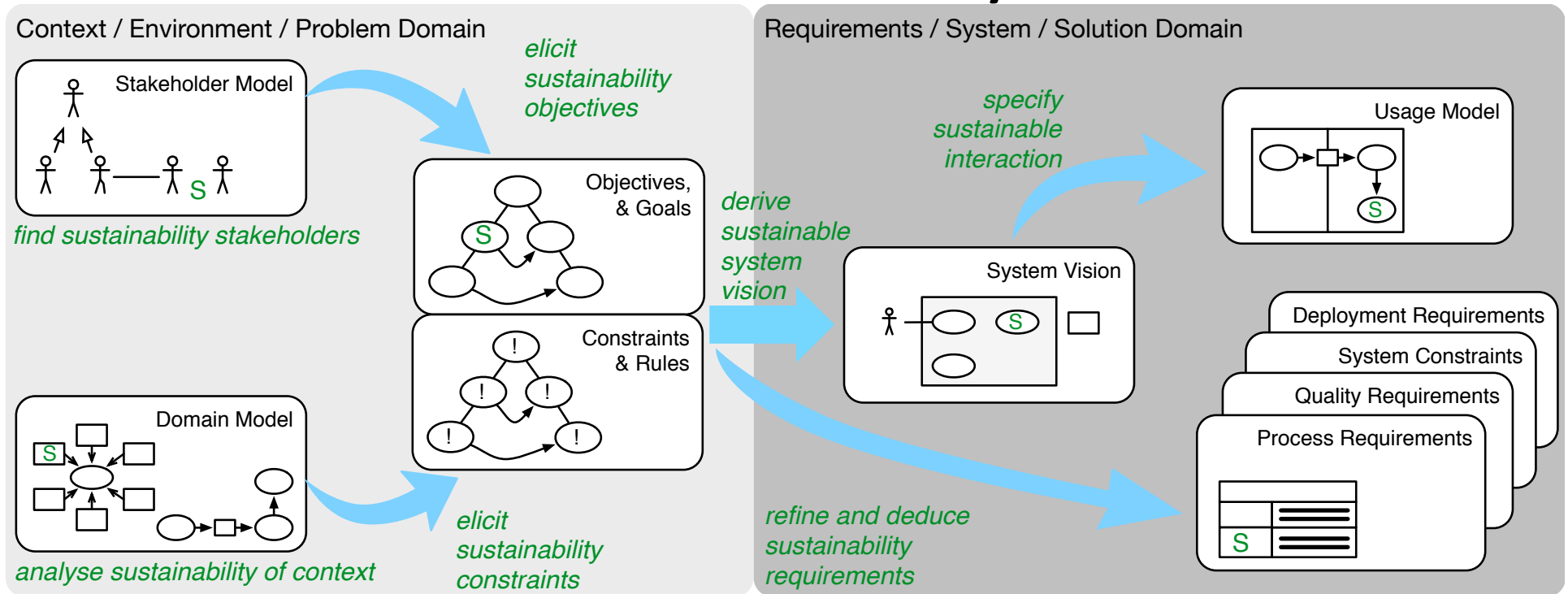
Timeline

- Tuesday 29.3
 - 10-12 Open lecture “Software engineering for sustainability – The Karlskrona manifesto”, Room 4511
 - 12-16 Opening of the course, Room 7441
- Wednesday 30.3
 - 18-22 LUT Beach Sauna, student idea presentations & discussions
- Thursday 31.3
 - 10-12 Stakeholder model and goal modelling, Room 4511
 - 12-14 Course work, Room 4511
- Friday 1.4
 - 10-12 System vision, Sustainability analysis and use cases, Room LS204
 - 12-14 Course work, Room LS 204
- Monday 4.4.
 - 10-14 Intermediate presentations, Room 7441
- Tuesday 5.4
 - 12-16 Course work, Room 7441
- Wednesday 6.4
 - 8-10 Briefing for presentations, Room 7441
 - 10-12 Course work, Room 7441
- Thursday 7.4
 - 10-14 Course work, Room 7441
- Friday 8.4
 - 12-16 Final presentations, Room 7441

Outline & Overview

1. Stakeholder Model
2. Goal Model

Requirements Engineering for Sustainability



Example checklist for analyzing environmental sustainability for a software system.

Guiding Questions for Green RE:

1. Does the system have an explicit sustainability purpose?
2. Which impact does the system have on the environment?
3. Is there a stakeholder for environmental sustainability?
4. What are the sustainability goals and constraints for the system?

Stakeholders

What is a Stakeholder?

Definition

A stakeholder is a person or organization who influences a system's requirements or who is impacted by that system.

Addition

Interest in the system does not necessarily mean interest in project success (Example: legislation, staff association)

Stakeholder Reference Model

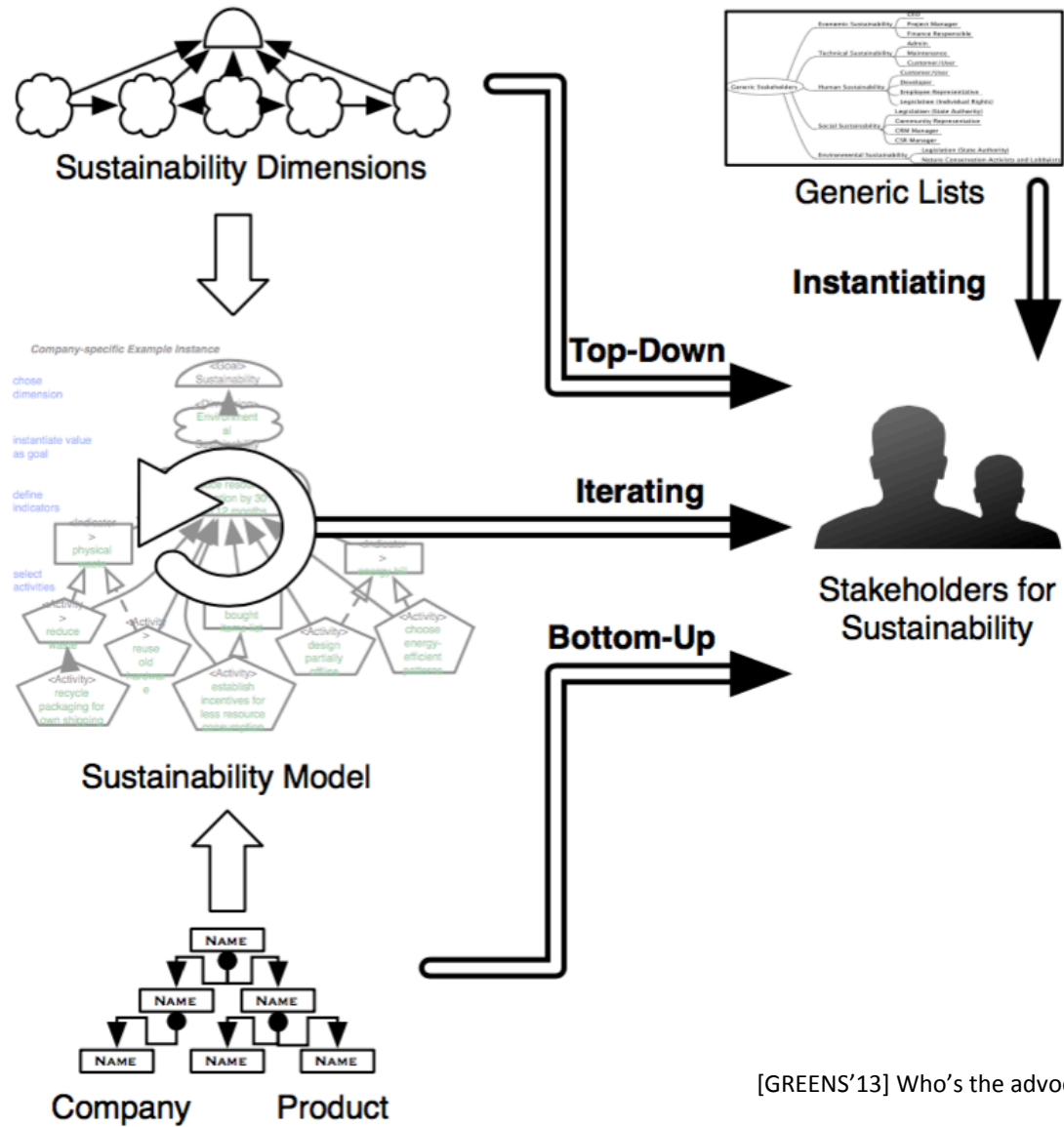


TABLE I
A GENERIC LIST OF SUSTAINABILITY STAKEHOLDERS

Dimension	Stakeholder	Description/Rationale
Individual	User	The user is affected by the system in various ways. For example, users of online learning courses educate themselves through software.
	Developer	The developer is heavily involved in creating the system. Aspects like sustainable pace and growth of the developer must be considered.
	Employee represent.	The mental and physical safety of individuals needs to be maintained. Employee representatives watch rights of employees involved.
Social	Legislation (indiv. rights)	Systems must respect the rights of their users. A legislation representative is a proxy for privacy and data protection laws.
	Legislation (state authority)	The state has a strong interest in understanding a system's influence on the society. In contrary to the individual rights legislation representative, the state authority representative speaks from the perspective of the state as a whole.
	Community represent.	In addition to the state authority, other communities such as the local government (e.g. the mayor) or non-government clubs might be affected by a software system. A complete analysis must take their views into account.
Economic	CRM	The Customer Relationship Manager (CRM) is in charge of establishing long-term relationships with their customers and creating a positive image of the company.
	CSR manager	Some companies created the dedicated position of the Corporate Social Responsibility (CSR) manager, who develops a company-specific vision of social responsibility.
Economic	CEO	The chief executive officer integrates sustainability goals into a company's vision.
	Project manager	It is very important to have the project manager agree in what ways the project should support sustainable aspects as he decides on prioritization with conflicting interests.
	Finance responsible	As sustainable software engineering often also affects the budget, many financial decisions have to be made to implement a sustainable software engineering model in a company.
Environm.	Legislation (state authority)	Environment protection laws are in place to ensure sustainability goals. These laws must be reflected in the model.
	CSR manager	The CSR manager is often also responsible for environmental aspects.
	Activists /Lobbyists	Nature conservation activists and lobbyists (e.g., WWF, Greenpeace, BUND)
Technical	Admin	The administrator of a software system has a strong motivation for long-running, low-maintenance systems, making his work easier.
	Maintenance	The hardware maintenance is interested in a stable, long-term strategy for installation of hardware items.
Customer	Customer	Users are interested in certain longevity of the systems they are using. This refers to user interface and required soft- and hardware.

[GREENS'13] Who's the advocate?

Identifying Stakeholders

There are different possible approaches to identifying stakeholders, and most likely the best way to make sure all have been identified is a mix or iteration of these approaches, for example in the order they are presented in:

- **Phases:** Analyzing the aspects and development phases of software systems development to find the responsible roles. This approach is an easy way to set up early elicitation meetings with the most important, rather obvious stakeholders.
- **Reference list:** Instantiating generic reference lists of stakeholders (see below) for the concrete project context. This second step takes standard roles into account that have been included in reference models and enhance the initial quick list of stakeholders. One simple reference model that is being used in software engineering to map out stakeholders is the so-called *Onion Model* with its four concentric spheres: product, system, containing system, and the wider environment.
- **Context:** Inspecting the business and operational context of the system under development, and understanding which concrete roles are involved. This step makes sure that the specifics of the project under consideration are all met and special roles are considered.
- **Goals:** Iteratively analyzing and refining a generic goal model and deducing the related roles. This approach is especially suitable for finding passive stakeholders that do not have an active interest in issuing own goals, but whose constraints have to be adhered to, for example legislative representatives.

Classifying Stakeholders: Roles

There are different types of and roles for **stakeholders** with **different interests** and, consequently, **differing requirements**:

- Owners (e.g., individual, shareholders, even the public)
- Partners (e.g., other companies providing related services)
- Department heads, managers
- Staff, developers
- Regulatory bodies, legislative representatives
- Suppliers
- Customers
- Competitors

Classifying Stakeholders: Functions

All of these stakeholders hold one or more functions with regard to the software system under development:

- Decision makers (e.g., sponsors, artefact approvers)
- Information providers (e.g., domain experts)
- Regulatory (e.g., legal body)
- Implementers (e.g., developers, testers)
- End users
- Post-implementation support (e.g., trainers, managers)



MULTI-CLASSING

Because wizards run out of spells

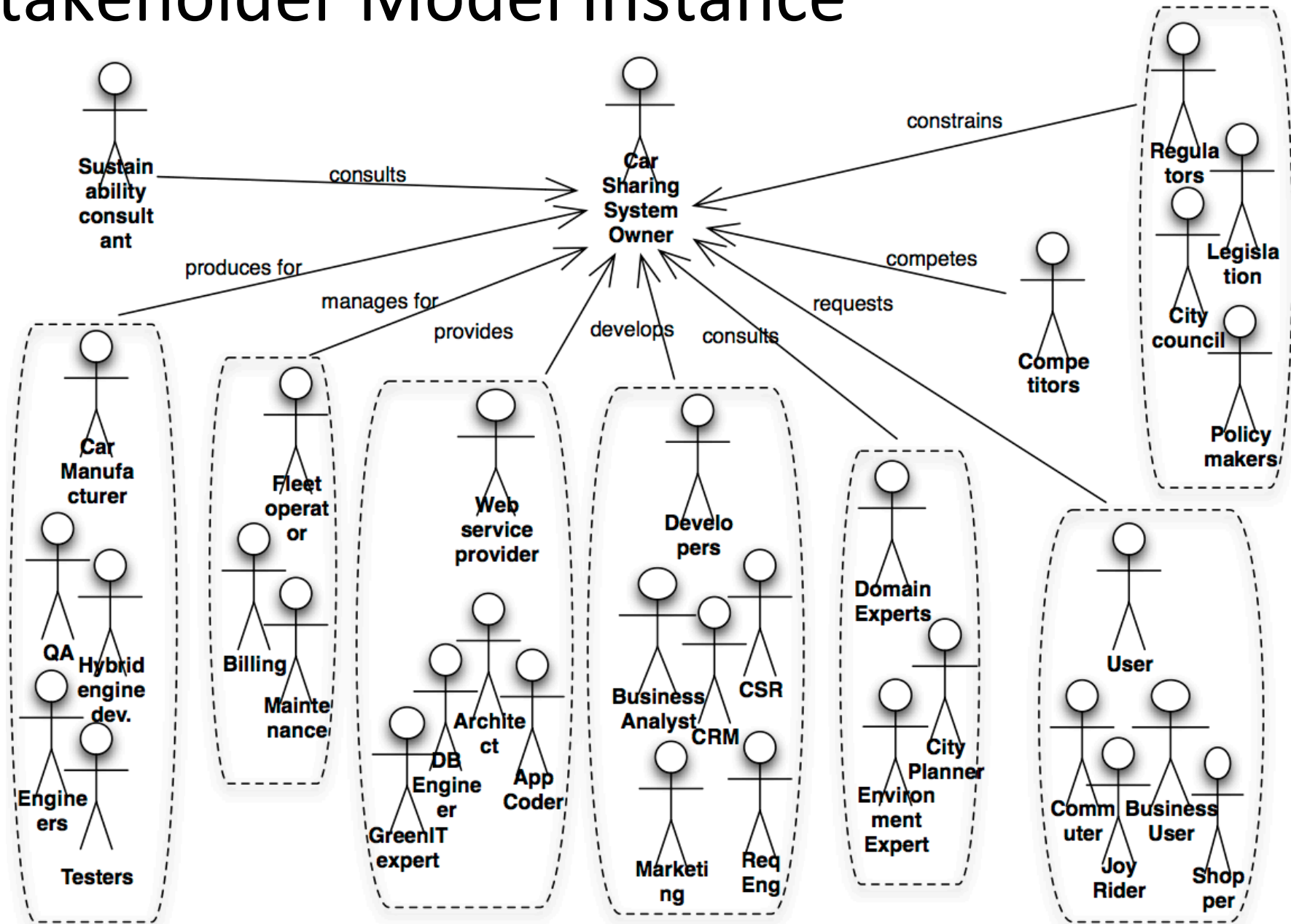
Analysing Stakeholders

Stakeholder analysis includes developing a stakeholder model and a stakeholder matrix that gives an overview of the following information:

- What is their **motivation**?
 - How much power or influence do they have?
 - Are they supporters or detractors of the project?
 - Are they fully engaged, or disinterested?
- What are their **expectations**? (needs, concerns, wants)
- What do we expect of them? (task and result)
- How **expert** are they at what they do?
- Where are they? What is their **availability**? (for communication and/or negotiation)
- What is their **authority**? (level of influence, impact, or enhancement)
- What is their **relation** to other stakeholders? (hierarchical and official relations as well as informal friendships or rivalries)

This list is a simple version of a **stakeholder analysis template**. Using such a template ensures that the major characteristics and needs of a stakeholder are taken into account.

Stakeholder Model Instance



Elaborating a Stakeholder Matrix

Stakeholder role (the job title, department, or organization that indicates a stakeholding)	Stakeholder name (the name(s) of the responsible stakeholder(s))	Necessary involvement (estimate of when and how much time)	Classes of Knowledge					
			Business Goals	Technical constraints	Functionality	Look and Usability	Performance	
Client								
Customer(s)								
Business/ subject experts								
Future idea specialists								
Current system specialists								
Clerical user								
Technical user								
Potential user								
Sales specialist								
Marketing specialist								
Aesthetics specialist								
Graphics specialist								
Usability specialist								
Safety specialist								
Security specialist								
Cultural specialists								
Legal specialists								
Environmental specialists								
Maintenance specialists								
Packaging designer								
Manufacturer								
Product installer								

Alexander & Robertson
 “Understanding project sociology
 by modeling stakeholders”

CSULB spring 2015

Figure 3. A fragment of a stakeholder analysis template. The complete template contains many more stakeholder roles and knowledge classes.

For stakeholder models in this course

- Model
 - Start with customer segments and key partners
 - Add from other categories in this slide set
- Matrix
 - One table with row per stakeholder
 - Role, function(s), knowledge/skills, priority, and responsibilities as far as makes sense for you

Goals

What is a goal?

Definition

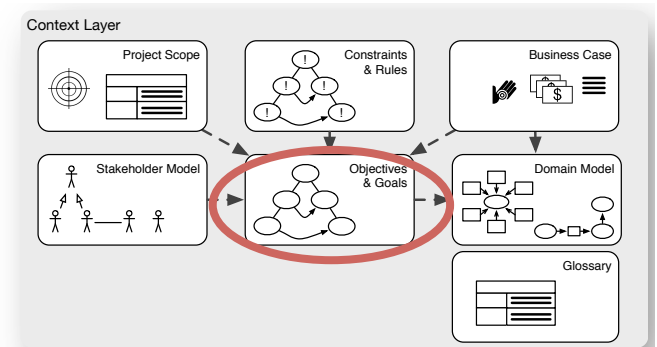
Discretionary abstract characteristic, which

1. the system shall fulfill w.r.t. it's operational environment
or
2. the development process of the system shall fulfill.

Critical points

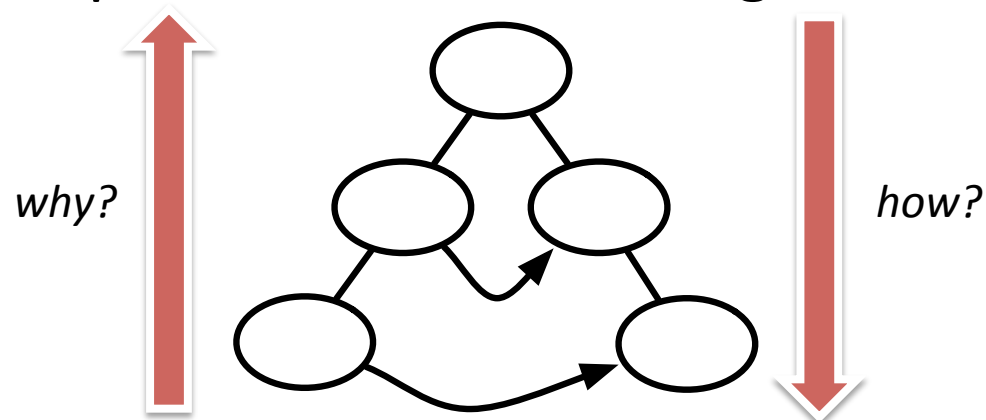
- No hint w.r.t. the solution and often not quantified.
 - Unmistakeable clarity, when a goal is reached
 - Basic achievability of a goal

Goal models: Idea



Goal models for structuring all relevant:

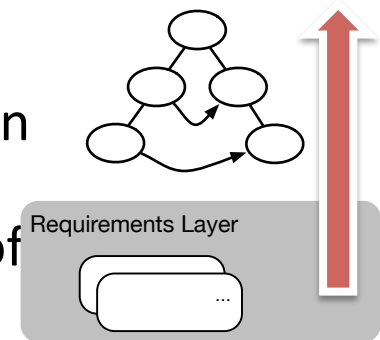
- Goals and subgoals
- Relations between goals:
 - Hierarchy/decomposition of goals and/into subgoals
 - Interdependencies between goals



Goal abstraction and goal refinement

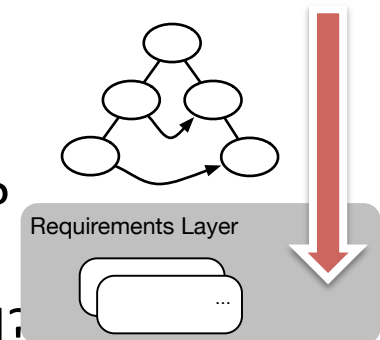
Goal abstraction

- What goals are behind the requirements and might open up the design space?
 - Which goals are determining the currently present set of requirements?
- „Why“ questions: retrieval of application domain knowledge



Goal refinement (Re decisions) and Scoping:

- Problem scoping: for which tasks or functions of the system do we need requirements?
For which context do we need to deduce requirements?
- System scoping: How can the design space of the problem under consideration be technically determined?

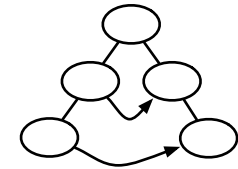


Do we have a goal conflict here?



Usage of goal models for conflict analysis

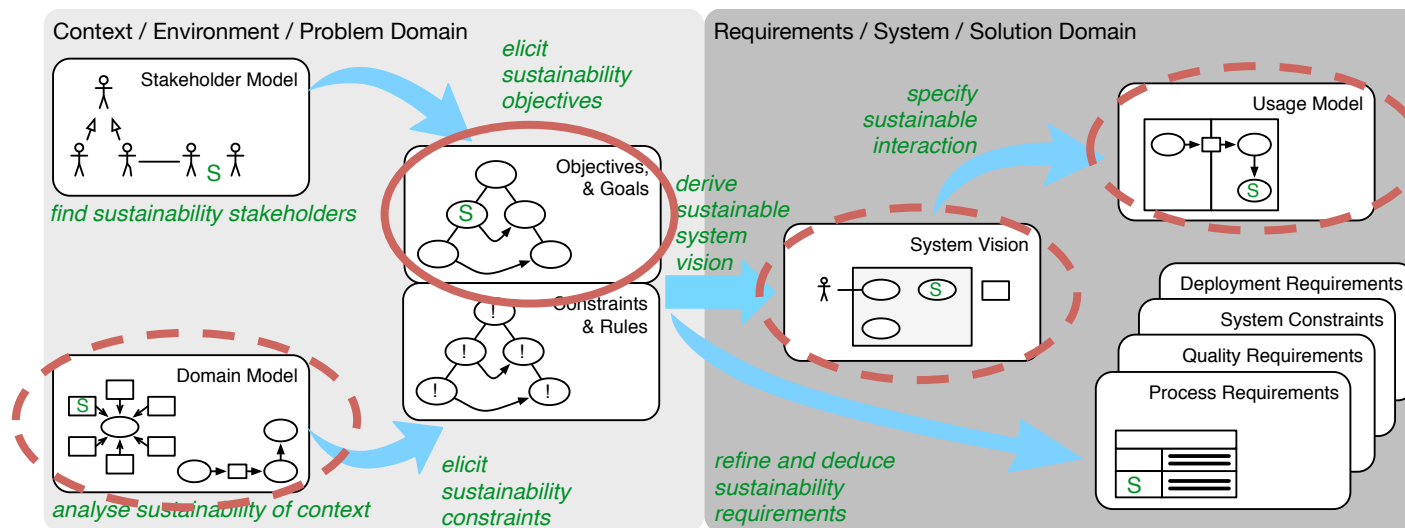
Resolving goal conflicts



1. Goals are made measurable by evaluation and prioritization – and thereby made comparable.
2. For goals, specific threshold levels are determined as standards that can be reached by all.
3. Goals are prioritized.
4. Conflicts are resolved by negotiation.

The goal model is the basis for

- Early identification and resolution of conflicts
- Rationale of a requirement
- Modeling of the system behavior on different levels of abstraction (Domain Model, System Vision, Usage Model)



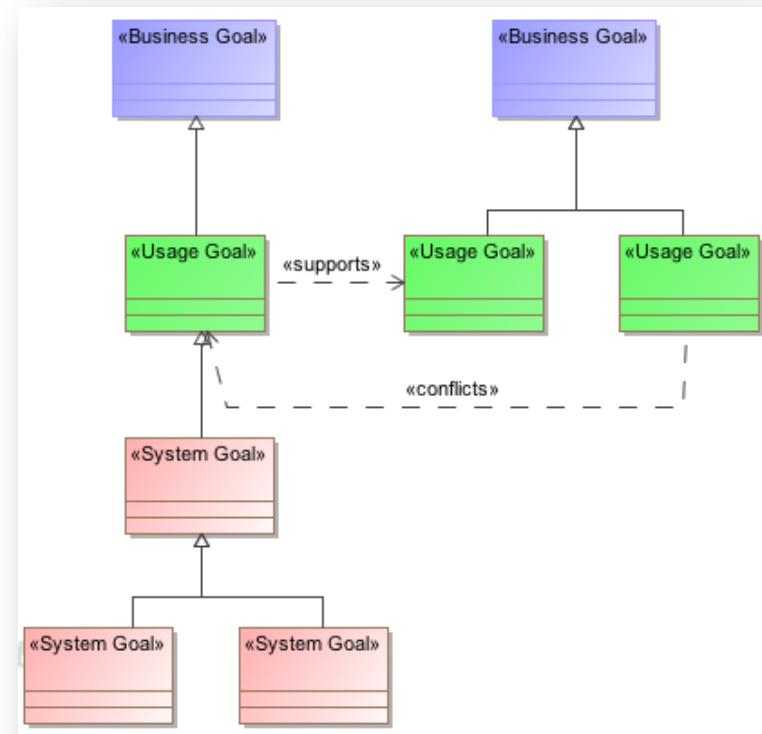
Goal categories and dependencies

Categories

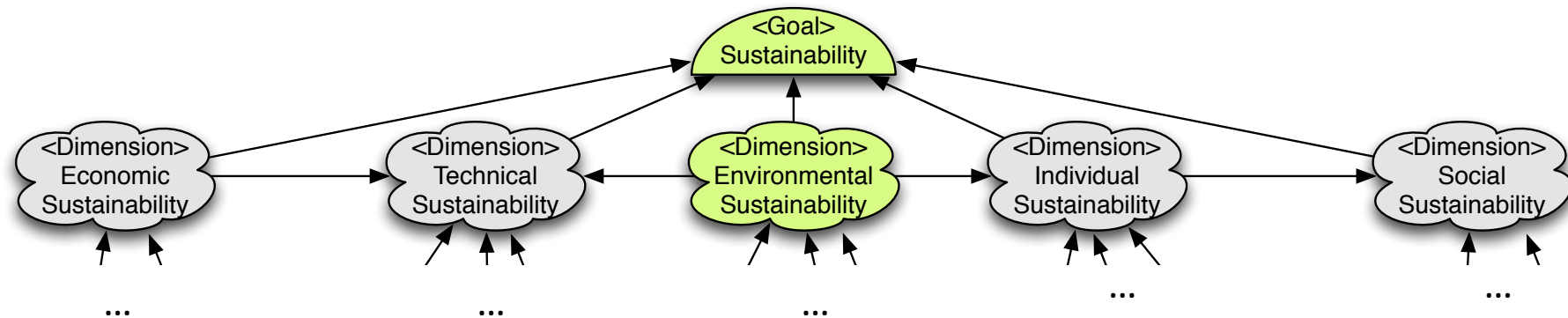
- **Business Goals:** all business-relevant (strategic) goals as well as goals with direct impact on the system or project.
- **Usage Goals:** direct relation to functional context and usage of the system (user perspective)
→ for behavior modeling
- **System Goals:** system-related goals that target system characteristics
→ to determine system characteristics

Dependencies (selection)

- **Subgoal:** Decomposition of goals into subgoals.
- **Supports:** A goal supports in achieving another goal.
- **Conflicts:** A goal is in conflict with another goal.

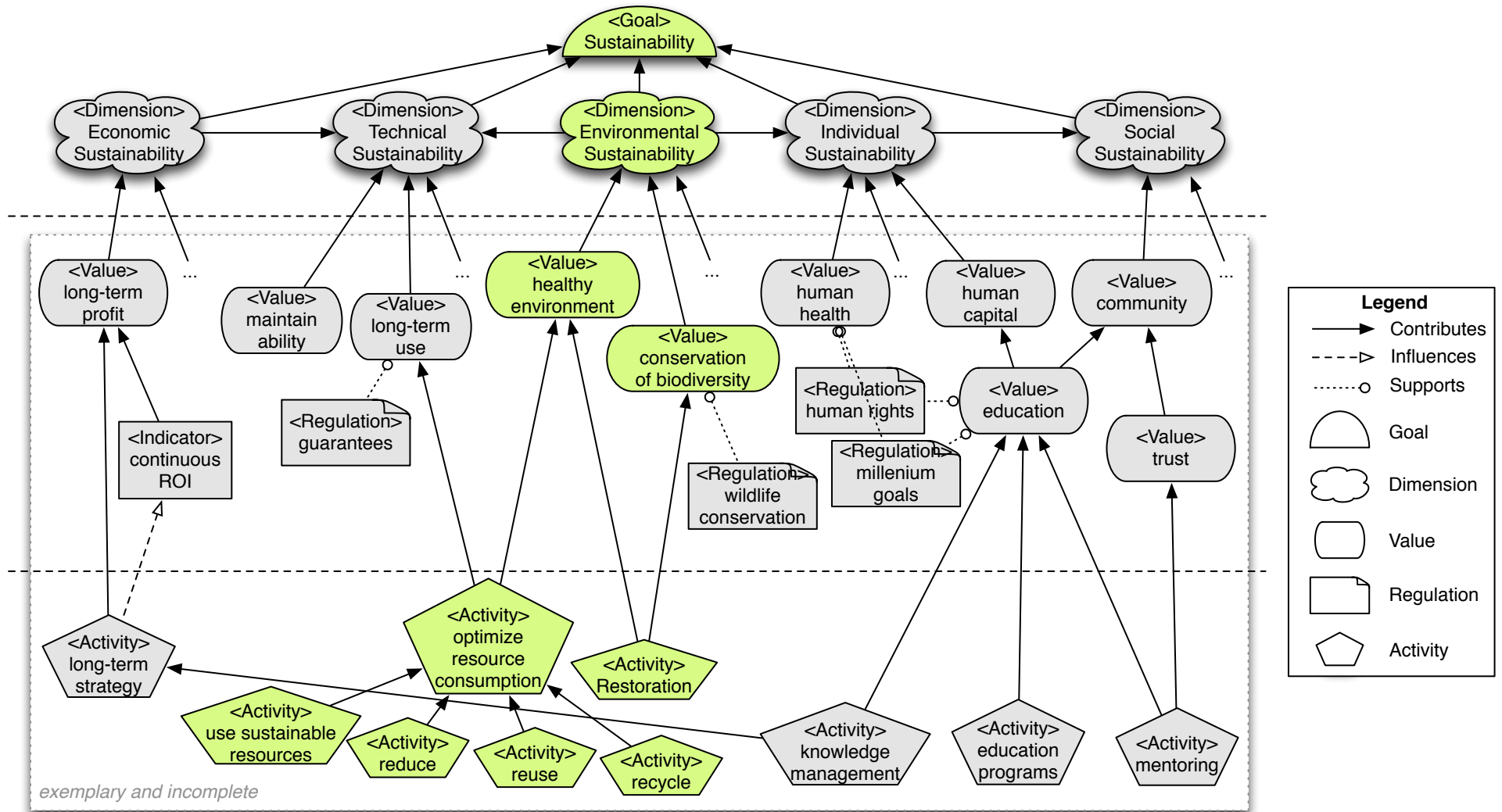


Sustainability Reference Model

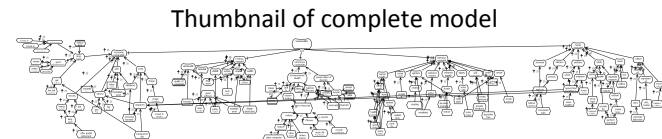


- 5 dimensions of sustainability
- Decompose into values and supporting activities

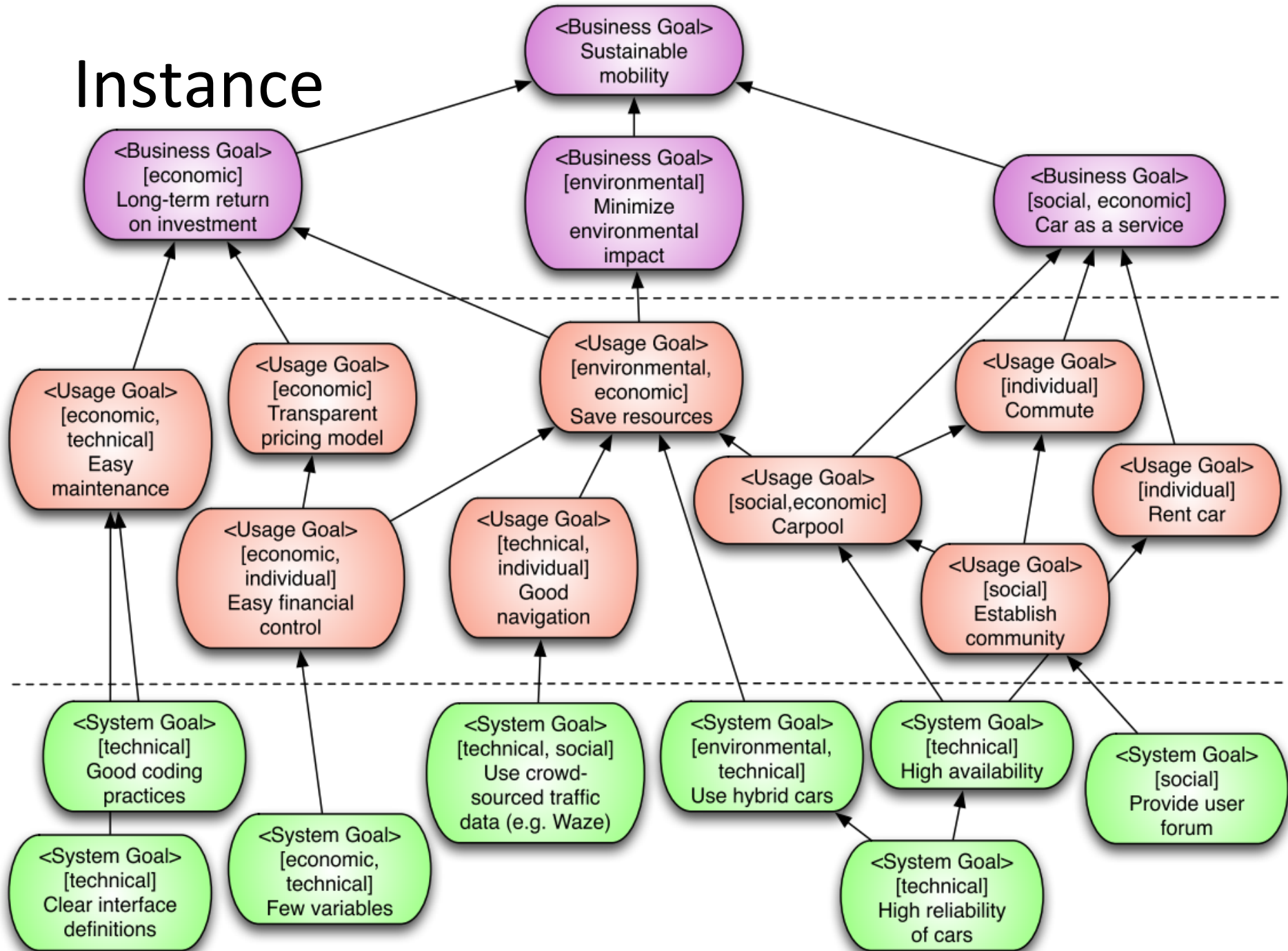
Sustainability Reference Model (Excerpt)



5 dimensions of sustainability
 Decompose into values and supporting activities



Instance





Todos



Stakeholder Model

1. Diagram

- Start with customer segments and key partners
- Add from other categories in this slide set

2. Matrix

- One table with row per stakeholder
- Role, function(s), knowledge/skills, priority, and responsibilities as far as makes sense for you

Goal model

- Define a goal model with business goals, usage goals and system goals that denotes sustainability aspects.
- Include the relations between goals (hierarchy and cross-relations)

Submit both to me as one PDF file per team by the end of today.



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