LOGON-U
GREEN LOGISTICS

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Development and implementation of the master program ”Green logistics management”

CDIO

Björn Oskarsson

Logistics and Quality Management

Dept. of Management and Engineering

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CDIO
– what it is, and why

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What is CDIO?

The main idea is that an engineer in cooperation with others in a good manner should be able to work with complex products, processes and systems in the four phases:

Conceive

Design

Implement

Operate

The CDIO ”concept” is a framework for development and evaluation of engineering education.

CDIO is widely spread

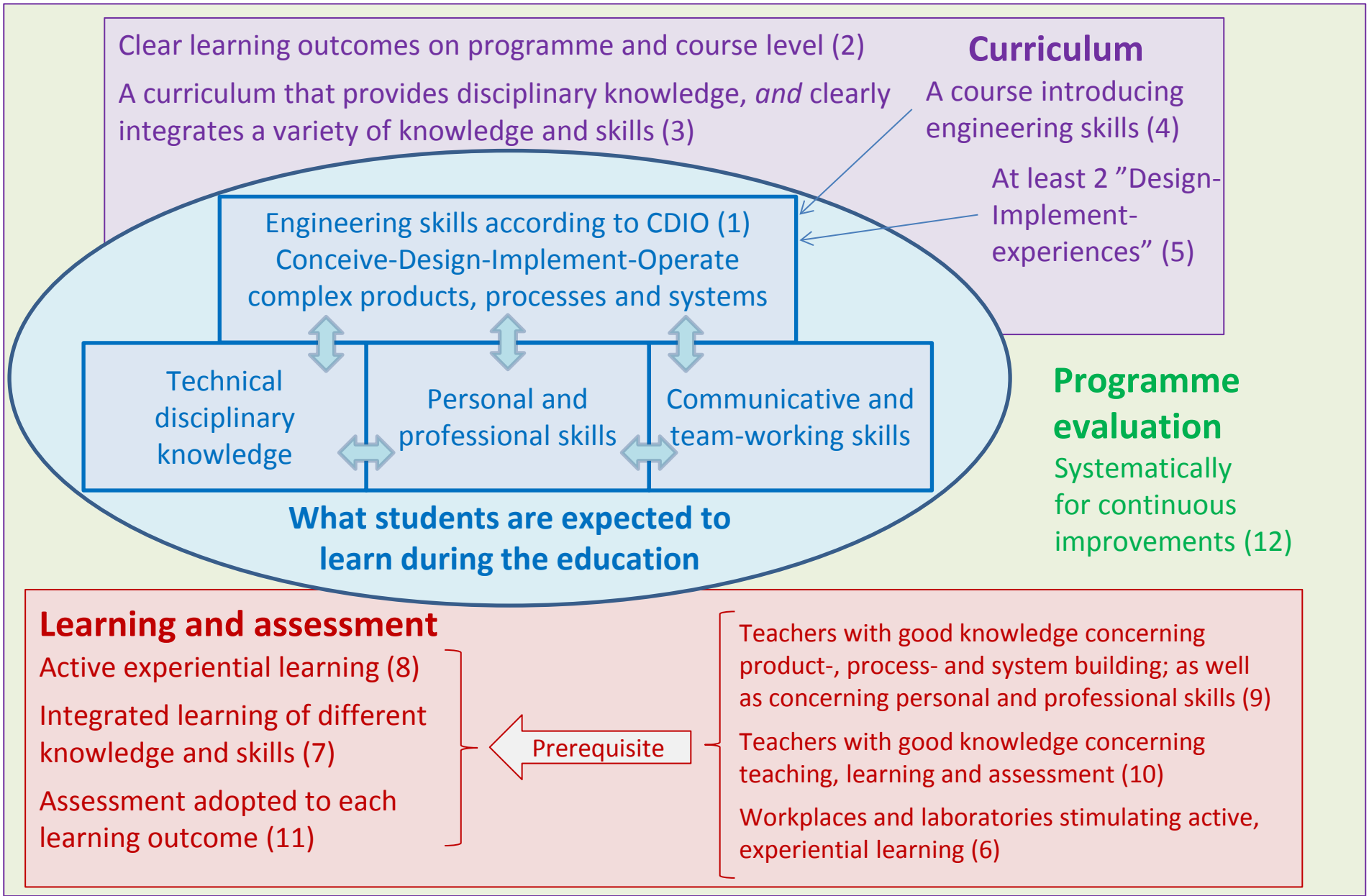
More than 130 H.E. institutions from all continents

26 of these are in the countries participating in our project

- Sweden: 10 (e.g. Linköping University)
- Germany: 3 (e.g. Wismar University)
- Russia: 13 (e.g. St Petersburg University)

Source: www.cdio.org (2016)

The 12 CDIO Standards



CDIO Syllabus

CDIO Syllabus is a structured compilation of expected learning outcomes, grouped in four main areas of knowledge and skills.

1 DISCIPLINARY KNOWLEDGE AND REASONING

2 PERSONAL AND PROFESSIONAL SKILLS AND ATTRIBUTES

3 INTERPERSONAL SKILLS: TEAMWORK AND COMMUNICATION

4 CONCEIVING, DESIGNING, IMPLEMENTING AND OPERATING SYSTEMS IN THE ENTERPRISE, SOCIETAL AND ENVIRONMENTAL CONTEXT – THE INNOVATION PROCESS

These four areas are "Level 1".
In total there are 5 levels, altogether containing almost 400 learning outcomes.

These four areas are based on the overarching ambition that the graduated engineers shall be able to:

"… *Conceive-design-implement-operate (#4) complex value-added engineering systems (#1) in a modern team-based environment (#3) and are mature and thoughtful individuals (#2).*

Sources: Crawley et al (2011); www.cdio.org (2015)

Example of goals on different levels

Level 2

- 4.2 ENTERPRISE AND BUSINESS CONTEXT
- 4.3 CONCEIVING, SYSTEM ENGINEERING AND MANAGEMENT
- 4.4 DESIGNING

Level 3

- 4.3.1 Understanding Needs and Setting Goals
- 4.3.2 Defining Function, Concept and Architecture
- 4.3.3 System Engineering, Modeling and Interfaces
- 4.3.4 Development Project Management

Level 4

- Project control for cost, performance and schedule
- Earned value recognition
- The estimation and allocation of resources
- Risks and alternatives
- Possible development process improvements

Level 5

- Appropriate transition points and reviews
- Configuration management and documentation
- Performance compared to baseline

Sources: Crawley et al (2011); www.cdio.org (2015)

Examples of CDIO projects

Subskimmer (KTH - Sweden)

Human powered vehicle (CSUN - US)

Driving simulator (CTH - Sweden)

The projects contain all CDIO phases, from Conception to Operation

CDIO applied on logistics education

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CDIO vs. Logistics education

CDIO is based on technical issues

Focus is on technical knowledge combined with skills for making use of this knowledge in their future careers.

In traditional technical disciplines, products can be developed (designed), built (implemented) and tested (operated), e.g.:

- Physical products (vehicles, industry robots etc…)
- Software (that controls vehicles, industry robots etc…)

Logistics is to a big extent a management-oriented discipline, with technical/mathematical components to a varying extent

Logistics management focuses development and improvement of logistics operations (processes, material flows, routines etc.)

Suggested improvements can hardly be implemented and operated in an educational setting, e.g.:

- Replacing a regional warehouses with a centralised one
- Switching from air to sea transports for goods imported from India

CDIO vs. Logistics education

If Implement and Operate is hard to include in logistics (and other management education), does that mean that the logistics education does not live up to the CDIO standards?

Or should we seek for alternative ways of interpreting what implement and operate stands for?

CDIO vs. Logistics education

The common view is that we are strong on *Conceive* and *Design*, but weak on *Implement* and *Operate*.
However, there are hopeful thoughts…

Logistics is cross-disciplinary, which is at the heart of the CDIO ambition. The needs and wishes of different parts of an organization have to be taken into consideration.
A good logistician / logistics engineer is a facilitator, with interpersonal skills, team-working skills, and a reasonable technical knowledge.

Simulation is a tool for testing complex scenarios that in reality would be practically impossible (costly; time-consuming etc.)

Simulation can be software-based, but some things can be simulated in more hands-on experiences.

Games and role-play – a kind of simulation

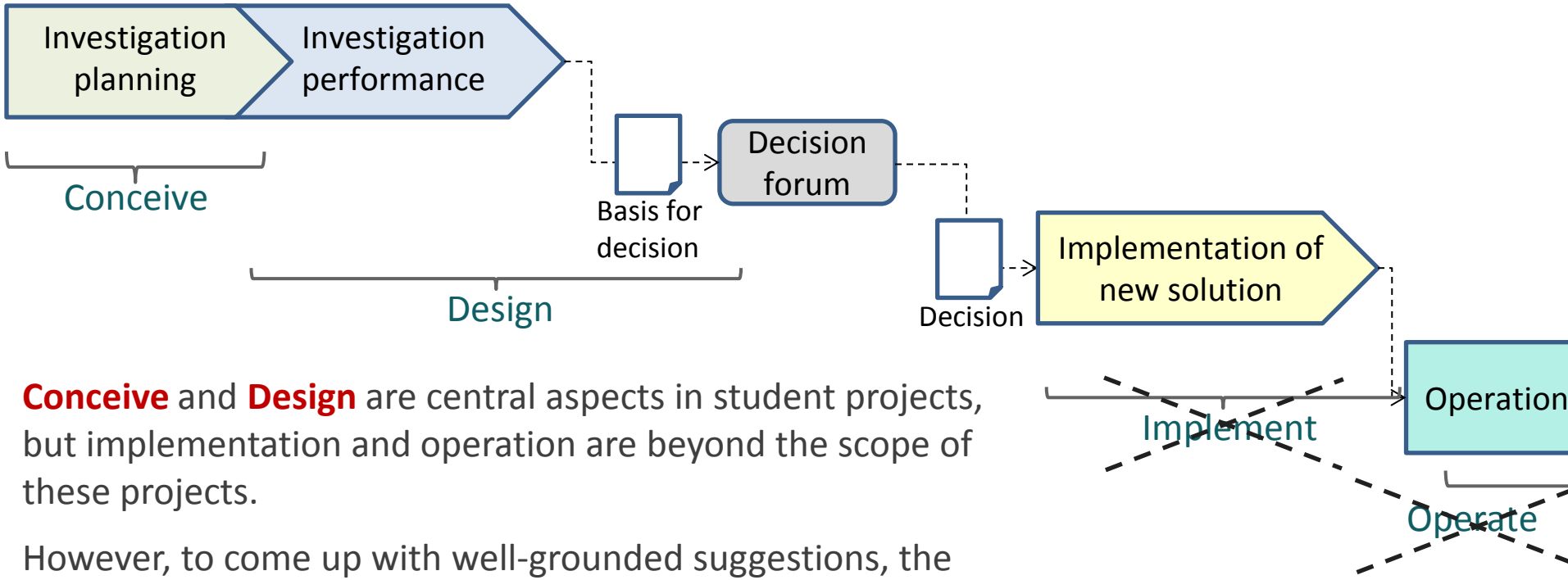
Beer Game – where the players are to manage different parts of a supply chain

Lean Production Game – where the team analyses its performance, suggests and implements improvements, and runs the production again

Industrial negotiation exercise – where the supplier and the buying company meet to solve a dispute and reach an agreement

Improvements based on solid investigations

An important task for an industrial engineer is to **perform investigations and present suggestions** to decision makers. Investigations are common in management education, connected to fabricated cases, or real ones (consultancy projects)



Conceive and **Design** are central aspects in student projects, but implementation and operation are beyond the scope of these projects.

However, to come up with well-grounded suggestions, the students must consider **implementation** and **operation** issues in their investigations.

Björn Oskarsson
Logistics and Quality Management

CDIO as a guiding principle

Even if your university is not part of the CDIO community…

Even if a specific program does not have an engineering focus…

… the bearing points in CDIO could still be useful.

It is positive if we can arrange education in a way that our graduates:

- … can come up with ideas and make them realisable (***C****onceive* and ***D****esign*)
- … have a fair knowledge about how theory and practice connects to each other – how the ideas will work in practice (***I****mplement* and ***O****perate*)
- … are prepared to work in teams, and have good communication and inter-personal skills

Björn Oskarsson
Logistics & Quality Management

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