

Thesis Projects Spring 2019

Product Development Research Lab is a research lab within the Department of Mechanical Engineering¹.

Our vision is

With practice and science we support innovation teams in product development through new work methods, tools and processes that will empower them to create and develop new product and services for the sustainable society.

The research is applied and considers methods and tools that will support companies, and organisations, to enhance their capabilities to deliver value towards customers based on products. The goal is to support companies and organisations both in being more efficient in their development (i.e. incremental improvements) and in finding totally new value adding solutions for the market (i.e. radical innovation). Our platform is the subject of Mechanical Engineering.

For the upcoming spring we're looking for some skilled students who want to join in a collaborative effort to support our ongoing research projects with Volvo Construction Equipment.

Preferably you are a thesis worker ready to do your final project.

#1-3 contacts: Alessandro Bertoni (alessandro.bertoni@bth.se) & Tobias Larsson (tlr@bth.se)

¹ <http://www.productdevelopment.se/>

#1 - Digital models of manufacturing for early product development

Collaborating with aerospace manufacturer or construction equipment manufacturer
The recent development of IoT and the emergence of industry 4.0 have created unprecedented opportunities for product service systems innovation. One of the most interesting innovation direction consists of the possibility of simulating manufacturing performances since the early stage of product development creating considerable competitive advantages for the manufacturers. The aim of the thesis is to develop an approach to integrate a digital model of a manufacturing process as a part of a model driven development approach for early design decision making. The work will consist in:

- Systematically review the current literature about the integration of Industry 4.0 in early product development, with a focus on the integration of manufacturing data.
- Propose an approach to integrate data for manufacturing in a model-driven environment for early decision making.
- Test the integration of the approach in an industrial case study of either an aerospace engine component or a construction equipment machine

The expected results of the thesis are:

- A map of relevant initiative in the area of Industry 4.0 and early product development
- A description of which type of data from manufacturing can be used and how
- A prototype of the model to simulate manufacturing performances in early design

The thesis work is fitted for potentially 1 or 2 students, most likely with a mechanical engineering background. Basic skills in discrete event simulations (e.g. Simio) are welcome, otherwise, they should be acquired during the time of the thesis.



Picture credit www.inspirage.com "Leverage Industry 4.0 to Drive Value in Product Development"

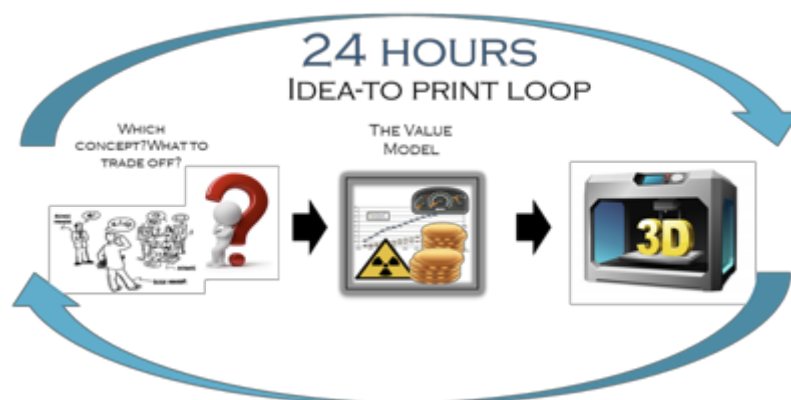
#2 - 24-hours idea-to-print loop: radically accelerating the product development process

Digitalization and 3D printing allow the rapid prototyping of new products and component to be preliminary tested and studied in the development process. Although the methods used to select new design ideas in conceptual design still relies on the use of analogous methods (e.g. tables/pugh matrixes) based on the subjective and qualitative assessment of experts. This creates a gap in time and efficiency in moving from an evaluation matrix to the 3D printing model of potential solutions. The aim of the thesis is to combine available methods and technology to develop the first demonstrator of an “all-in-one” design process loop encompassing design concept trade-off, selection, digitalization and 3D printing in 24 hours. The activities of the thesis will be:

- Identify a suitable product to be redesign in a 24-hour activity and created a parametrize CAD model of it
- Develop a trade-off model for design alternatives, using EVOKE and the new capabilities for automated design space exploration
- Ideate a system to automatically launch the 3D printing from EVOKE
- Test the new system in a design session with practitioners.

Expected results

- The first demonstration of an ideate-to-print loop in less than 24 hours
- The description of a consistent process to be generalized for other design activities
- The description of a successful implementation of a 24-hour ideate-to-print process is expected to lead to a scientific publication (facultative and outside the frame of the thesis)



The thesis work is fitted for potentially 1 student, most likely with previous knowledge the EVOKE approach.

#3 - 10x innovation of communication devices for football referees

Possible collaboration with Karlskrona Referee Club and Blekinge Football Association.

The use of advanced technological devices to support the activities of referees in professional sports competitions is constantly evolving. Communication devices (visual, audio or vibration based), remote video assistance and line monitoring technologies are commonly used in professional high-level sports competitions. One of the major barriers to the application of such technologies in non-professional sports events is cost. Some technologies, such as remote video assistance, requires an infrastructure of devices and people to be deployed to each event, making them not practical to be applied in non-professional contexts. Other technologies instead, such as the communication devices between the main referee and assistant referees, do not require changes in infrastructures of people commitment, but still hasn't seen any particular innovation in the last decade.

The thesis focuses on the development of a radically new product to support the communication between the main referee and assistant referees to be deployed in non-professional sports events. The work is focused, but not limited to, the application in football matches. The price of the current communication devices lands around 4.000 sek for remote-controlled bracelet vibrations and around 10.000 if the audio communication function is added, and are offered as stand-alone products. The aim of the thesis is to reach at 10x innovation level developing product prototypes providing the same functionalities with 10 times cost reduction. The activities of the thesis will consist on:

- Applying method and tools for product development as studied during the program (e.g. needs identification, tech watching, etc...)
- Develop a working prototype of the new communication device
- Test the prototype in real football training matches in more than one occasion
- Improve the prototype based on the testing

Expected results

- A full and consistent description of the development process followed
- A working prototype with the estimation of its production cost
- Based on the thesis project results, and on the students' wishes, the possibility to bring the product forward to commercialization through a start-up would eventually be considered in collaboration with BTH and Blue Science Park.



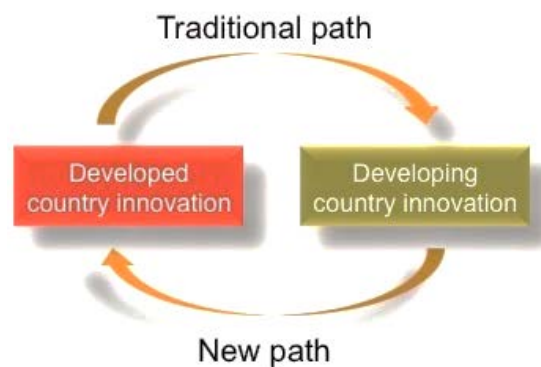
The thesis work is fitted for potentially 2 students, not limited to mechanical engineering, most likely with at least one of those having skills in product development processes and methods.

#PDRL-1: Reverse Innovation: Attitudes and practices of Swedish companies

Reverse innovation is about adapting products and services, originally designed for developing countries, for markets in developed countries.

https://en.wikipedia.org/wiki/Reverse_innovation

Reverse innovation can also be about seeking inspiration from products and services, originally designed for developing countries, in designing solutions for developed countries. For example, any company or organisation can seek inspiration from innovations in developing countries in designing solutions for developed countries to reduce cost and resources, for instance.



One opportunity to undertake masters thesis work in this area is to explore awareness, practices, and perceptions of Swedish companies about reverse innovation. There are many other avenues to undertake thesis project work in the area of reverse innovations.

Prerequisite: It is desirable to have knowledge of product or engineering design processes.

For further information, please contact:
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#PDRL-2: Product design for emerging markets: Opportunities and challenges

Companies such as IKEA are expanding their business in emerging markets and offer products specifically tailored to the social, cultural and economic aspects in such markets. However, while emerging markets present big opportunities for companies, they often face daunting challenges in designing products for such markets.

This project will be undertaken with product designers and design managers from companies such as IKEA to understand barriers and enablers in designing products for emerging markets such as Brazil, China, India, etc.



Prerequisite: It is desirable to have knowledge of product or engineering design processes.

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#PDRL-3: A design or research project in low-resource settings

Design project: This project will involve undertaking fieldwork in a low-income country to understand local context and to identify some needs of local communities. Conceptual design, prototyping and analysis will be undertaken to satisfy the identified needs.



Some examples of projects for low-resource settings

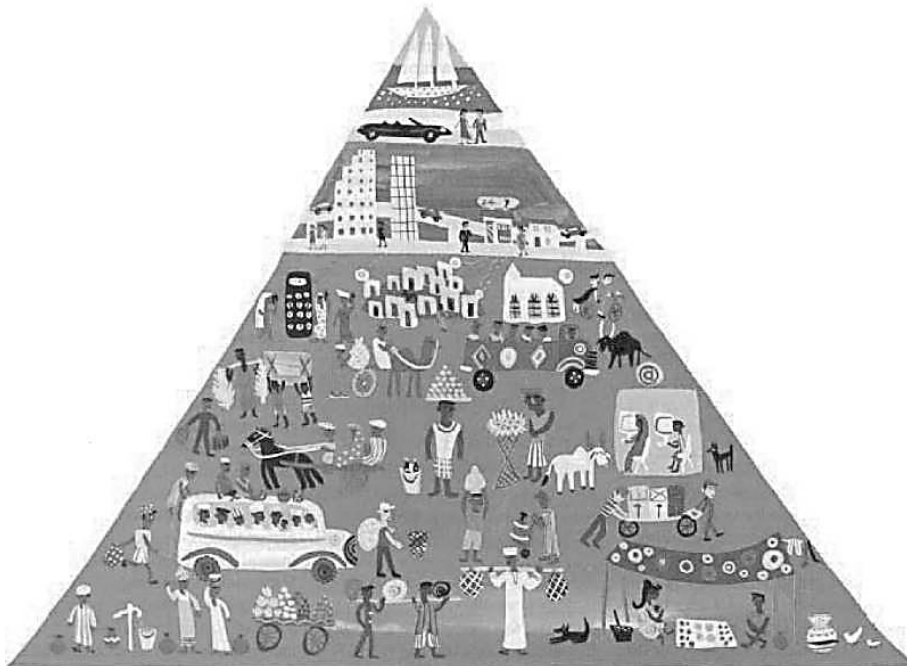
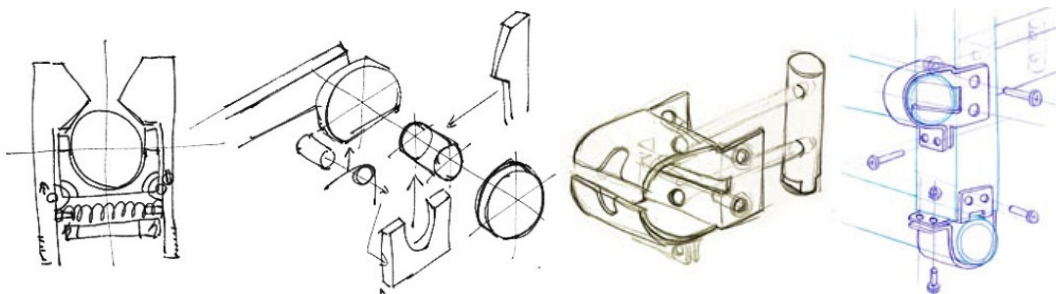
Research project: This is a research project in the context of low-resource settings. Areas of research can include, among others, product design, engineering design, sustainability, product service systems, etc.

Prerequisite: It is desirable to have knowledge of product or engineering design processes.

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#PDRL-4: Effect of market context on idea generation in engineering design

There is a sharp contrast between markets in developed countries and markets of marginalised people in developing countries. This project will generate knowledge about how ideas generated by engineers differ depending on the type of market. This knowledge is crucial for companies and NGOs to design products for different kinds of markets.



People in developed countries vs. marginalised people in developing countries

Prerequisite: It is desirable to have knowledge of product or engineering design processes.

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