

Project Lab

A virtual international student project on Circular Economy

Introduction

The Emeriti of Excellence at TUM (<https://www.emeriti-of-excellence.tum.de/en/startseite/>) a group of retired but still very active professors plans and organizes workshops and conferences on many timely questions. This year's conference on circular economy (see attached folder) was delayed to the obvious reasons and is hopefully held next year. However, a new format of student lab is planned to prepare the conference. In case of very good results, a limited number of students is invited to the conference to present their results.

Student project labs are now an established learning format. Three or four students form a group, which is working on a common subject. The goal is to develop an experiment, a software tool or a simple methodology to address a question or a problem. Students meet virtually every week and work roughly half a day every week in the semester on the project. A project report and a final presentation finalize the project.

The project lab was done purely virtually in the last semester. Students adapted to the new format and produced quite good results, which is why for the preparation of the circular economy topics, students, and advisors from other universities around the world are invited to participate. Each topic will also be supervised by one member of the Emeriti of Excellence.

Possible Partners

Ahmedabad University, India
Stanford University, USA
University of Texas at Austin, USA
Imperial College London, UK
NUS National University of Singapore, Singapore

Project plan

Application deadline 20.10.2020

- Weekly Meetings
- Hand in of project paper
- Final presentation
- Possible participation of selected members in conference

Research topics

1) Circular Economy an Economic Theory & Practice

The transformation to a circular economy requires a very special regulation and legislation. Efficient regulation is certainly key for all transformation processes. The optimal design of a new policy is certainly the highest art of economy and lawmakers. In the past, we saw the

emergence of “micro”-legislation, which tries to regulate tiny details and is certainly unable to unleash market forces to search for optimal solutions. The problem is even more complex in the international context. Lower standards might attract production. Waste is transported globally. Obviously, rules need to apply globally which is more than unlikely in the current political context. A simple game theoretical context should be used to analyze the possible impact interplay between three world regions. The assumption is that one region advanced with rather strict regulation on energy, emissions and material flows while the other two remain conservative. The challenge is to find solutions which benefit all three regions but do not compromise stricter environmental regulation. The project should develop a very simple model, which just addresses all of the questions.

2) Circular economy and energy efficiency

In an economy with a very strong imperative to reuse and repair products, the overall lifetime of products increases. The question is, will this increase or decrease the overall resource and energy efficiency. The longer lifetime will certainly reduce the energy and resource demand for production. However, the resource and energy demand for operation might stay high, since improvements enter only very slowly the market. In the project, three examples should be analyzed with a simple approach, which describe the technological improvement of appliances and diffusion of new technologies.

3) Resource efficiency through circular economy

The energy sector itself is still quite energy intensive and material flows are not closed. The project should investigate PV and wind in more detail. The focus of PV should be on a silicon cycle and the focus for wind should be on the blade materials. Closing the silicon cycle promises considerable energy savings, while turbine blades pose still a waste problem.

4) Circular economy through digitalization

A way to keep track of all material and energy flows is the implementation of so called digital twins. The project should investigate the possibility to establish digital twins even for complex systems like cities, which are then in the end the source of information to steer energy and material flows and which also keep track of materials which might be reused in hundred years from now. The project should develop a very simple prototype of a digital twin, which describes a very simple model city.

Application

Please write a short email to andrea.cadavid@tum.de until October 20th to organize a short video call and mentioning the subjects you are interested in working on and your study program.

Contact

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