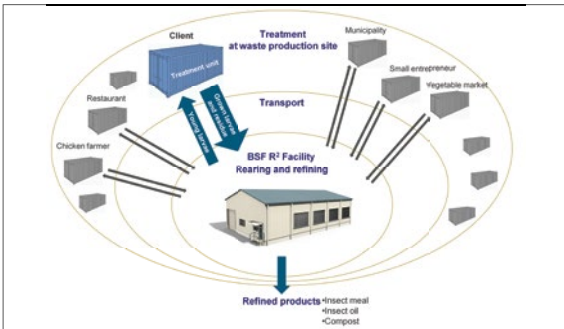


Imre Antalffy

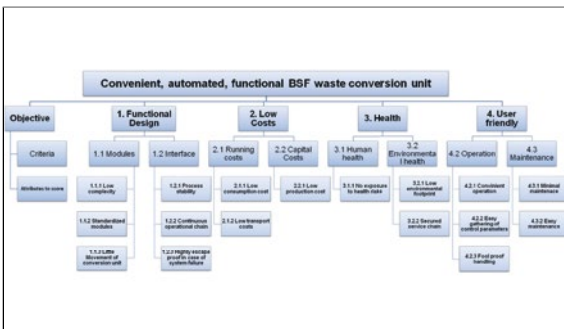
Graduate Candidate	Imre Antalffy
Examiner	Prof. Dr. Michael Burkhardt
Co-Examiner	Dr. Christian Zurbrügg, Eawag, Dübendorf, ZH
Subject Area	Abfallwirtschaft und Technologien

## Bugs in a Box

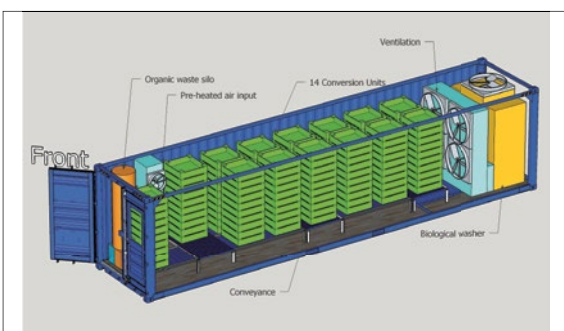
### Automated Organic Waste Treatment Unit with Fly Larvae Composting



Schematic organic waste treatment plan with the main facility in the center, while outsourcing organic waste treatment into decentralized units



Full multi-criteria analysis, used for evaluating various concepts



Final CAD sketch of the treatment unit with all modules built in

**Introduction:** In our society, waste is reused in different ways. The recycling of organic waste is linked with difficulties in certain tasks, such as collection, transportation, separation and transformation. This lowers the economic benefit. The SPROUT project (SafePROtein from Unused waste) develops an insect-based treatment system converting food waste and animal manure into valuable end products such as animal protein feed and high-quality fertilisers. Current solutions aim either for small scale waste conversion or industrial scale protein production. Combining both is not possible, as the logistics for the waste conversion lower the profit for a protein-based operation. Instead of using centralized facilities, the project aims to outsource waste handling, as decentralized treatment units are used in conversion-based operations. This lowers transportation costs while tapping new sources of waste. The objective of this thesis was to design a treatment unit for organic waste conversion able to handle 500 kg per day. The treatment unit resembles a 40 foot container, in which larvae of the black soldier fly (*Hermetia illucens*) are fed with organic waste.

**Approach/Technologies:** The thesis started off with a focus group discussion to find ideas and comparable elements of the treatment unit in current industrial applications. Following up with literature research about project design, different systems have been compared regarding parameters like size, energy demand, etc. The data were used in a multi-criteria decision analysis in order to pinpoint the best solution for the following CAD design.

**Result:** The designed fully automated system makes the operation convenient and needs no manpower, but is expensive. Further potential is seen in evaluating the analysis including a group of experts. To optimize the costs, a market analysis needs to be done to fully understand the monetary profit of outsourcing the waste conversion from the main operation facilities. Backed up with solid numbers to calculate with, the system needs to be looked at as a whole, including the processing facility, not only looking at the waste treatment unit. Such a re-evaluation will lead to an economically advantageous system.