University of Applied Sciences Northwestern Switzerland
School of Life Sciences

Life Cycle Assessment (LCA) on economic sectors of Jordan

Master's thesis - MAS Environmental Technology and Management

Background

Freshwater is one of the most valuable resources. In countries like Jordan where water is scarce, the expanding demand causes increasing problems. This situation formed the background for this study.

Goal

The study should indicate whether a Life Cycle Assessment (LCA) is a practicable instrument to model the special circumstances of semiarid or arid areas adequately. A further objective of this study was to give a basis for political decision makers that can help to find out which economic sector is seen most eco-efficient for Jordan and should therefore be developed.

Method

An LCA should give an overall view of the environmental impacts of Jordan's economic sectors with a special focus on water demand and supply. The process of data collecting turned out to be rather difficult. Although a lot of information was available it was not always possible to get the figures needed in a qualitatively sufficient manner. Finally, an input-output matrix could be compiled by using data about gross output, intermediate consumption, imports and gross domestic product.

supplier (outputs) \ *customer (inputs)*	*inputs to sector 1*	*inputs to sector 2*	*inputs to sector 3*	*total to other sectors*	*final demand*	***total gross output***
sector 1 (agriculture)	26'581	271'180	8'924	306'685	516'361	**823'046**
sector 2 (industry)	176'097	1'703'599	624'816	2'504'512	7'462'670	**9'967'182**
sector 3 (services)	54'720	734'598	2'276'331	3'065'649	6'887'928	**9'953'577**
imports (from foreign suppliers)	319'802	3'625'389	632'243	4'577'434		
total intermediate consumption	577'200	6'334'766	3'542'314	10'454'280		
value added	245'846	3'632'416	6'411'263			
total gross output	**823'046**	**9'967'182**	**9'953'577**			**20'743'805**

Input-output matrix of Jordan 2006 (in 1'000 JD)

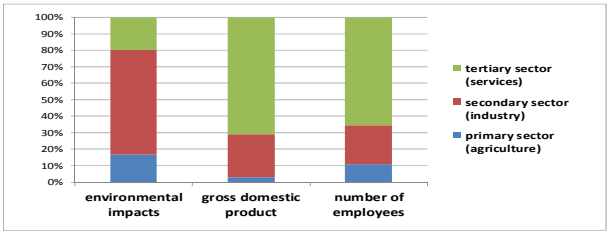
The so-called input-output matrix can help to identify interrelations between economic sectors and to predict the effect of changes in one industry on others. Linking the matrix with environmental data by using the LCA software SimaPro enables to express the environmental impacts of an economic sector per unit value added.

Most LCA methods consider freshwater resources to be non-depletable and therefore neglect the importance of water demand which is especially in water scarce countries a relevant issue. The method of Swiss Ecological Scarcity 2006 features spatially differentiated eco-factors for freshwater use, assigning higher relative weights to regions of elevated water stress. This improvement of the existing method enables to take into account Jordan's limited water resources appropriately.

Results

Based on the input-output matrix reflecting all the economic data and the environmental figures about water and energy consumption, the LCA was generated. The results especially indicate the numerous inter-industry relations and the significant influence of water.

A concentration on the secondary and, particularly, tertiary sector of the economy should be considered. The tremendous water consumption of the primary sector causes major problems in a water scarce country like Jordan. Certainly, strategic decisions must include all three pillars of sustainability: environmental, economic and social dimension.



Comparison between the sectors with regard to the dimensions of sustainability

Conclusion and recommendation

The study provides a good initial position and gives first insights about which economic sectors are more eco-efficient than others. However, existing results are not substantiated enough, therefore further research is recommended. Nevertheless, the study can clearly state that LCA is an appropriate instrument for arid areas too. Recently introduced assessments of freshwater resources allow to consider adequately the significance of water.

The water footprint is essential for Jordan but it is also important to take into account other environmental impacts. In future economic strategies particular attention should be paid to external trade. Shifting production of goods with high water consumption to countries with a lower water stress index and the development of economic sectors or single products with moderate water consumption should be debated.

Further research should focus on the improvement of the input-output matrix by collecting more reliable and detailed data as well as on the inclusion of complete mass flows (raw material, waste, etc.) and emissions. Moreover social aspects should be considered too. As a further step, detailed analyses of single sectors are recommended.

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