

enercoast



Extended abstract

**Improving Sustainable Supply Chains by
including geographical information
in the management processes**

Daniel Meyerholt

*Business Information Systems / Very Large Business Applications (VLBA),
Carl von Ossietzky University of Oldenburg,
Ammerländer Heerstr. 114-118,
26129 Oldenburg, Germany*

While the modeling of Sustainable Supply Chains in appropriate information systems or Corporate Environmental Management Information Systems (CEMIS) is one important research aspect when it comes to supporting Sustainable Supply Chain Management (SSCM) using ICT tools, the application domains of such models have to be regarded as well. The model solely lays the basic ground to build sophisticated tools upon.

One research aspect that deserves attention is the inclusion of Geographical Information Systems (GIS) into the SSCM methodology. While traditional indicator based approaches tend to represent high level information that is suitable for some domains, the extension of the metadata provided offers significant potentials of improvement. The software prototype SSCManager that was developed during the enercoast project supports the modeling of Sustainable Supply Chains which can be supplemented by indicators and respective values. The current state of indicator design can be seen in Fig. 1.

Figure 1: Indicator Types and Metadata

These indicators alongside other descriptive metadata currently form the basis for the supply chain design in enercoast. Current use cases implemented in the software utilizing these indicators include:

- Several visualizations of indicators and the supply chain as such based on different supply chain variations and
- Multiple criteria decision analysis (MCDA) based on the Promethee method.

In this abstract the extension of indicator and supply chain meta data by the means of geographic information is proposed.

Inclusion of geographical information means the implementation of additional software components enhancing the indicator metadata of the current data model. Two basic extensions to the SSCM software have to be made:

- Using a web-based mapping service like Google Maps or Open Streetmap as raw map material, that will be used to display metadata and background maps in the Web Browser. This is feasible using e.g. the OpenLayers (<http://www.openlayers.org/>) JavaScript library.
- Add new data types to the data model by defining several spatial types like
 - Points
 - Lines
 - Rectangles
 - Polygons

Basic integration of the OpenStreetMap mapping services for the overall Supply Chain has already been implemented in the SSCManager software and is shown in figure 2.

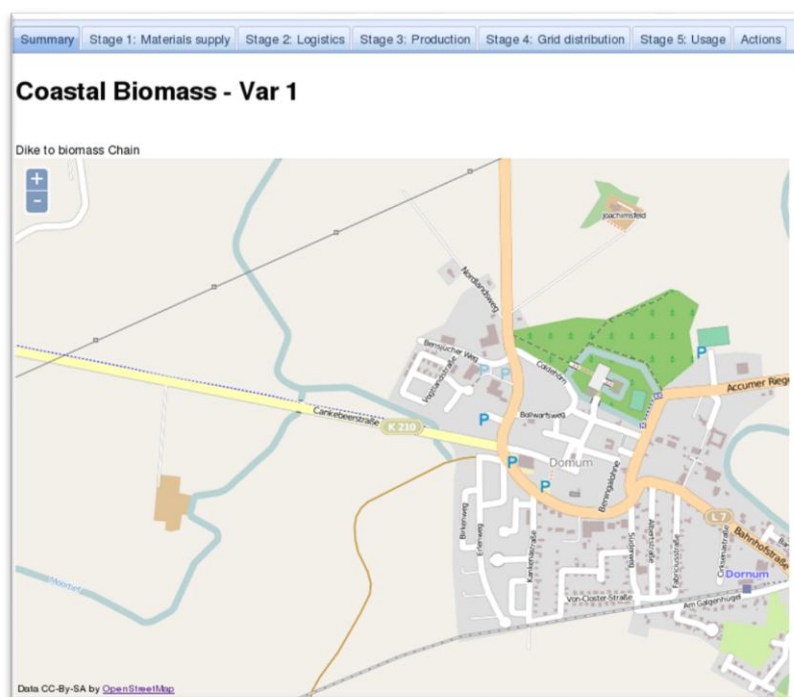


Figure 2: Basic OpenStreetMap integration in SSCManager

The definition of these spatial types can be done best using a spatial extension to the used Database System. In the case of the SSCManager Software the DBMS used is Postgres (<http://www.postgres.org/>) so the usage of PostGIS would be a pragmatic approach here.

Spatial data types can be used for the calculation of indicators. E.g. the area used to describe a biogas power plant can be drawn directly on a map and the resulting shape is then used to calculate the exact area that the plant needs. This information can then be used then in the respective indicator instead of specifying it by hand. Drawing a polygon using openlayers is shown in figure 3.

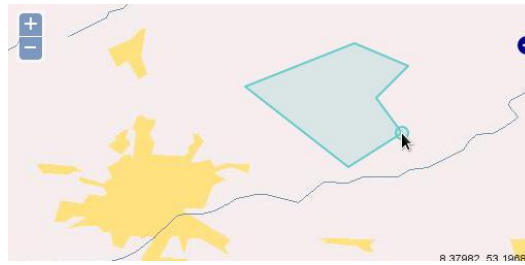


Figure 3: OpenLayers drawing example

Annotating existing indicators with geographical information allows to draw an overall map of a supply chain. This is a very powerful visual tool for the presentation of a Supply Chain Project for example to stakeholders (“Where are the power plants?”, “Where does the raw material come from?”, etc.). It makes the planning of Supply Chains more easy and understandable for non-project planners.

Furthermore the inclusion of information systems and applications on top of the geographical information capabilities allows advanced functionalities. A very good example would be the inclusion of a routing service that describes the best route between the place where the raw material is produced and the production site. That information can then be used to furthermore create a new indicator (“Distance to production site”). And on top of that a guess of the related CO₂ emission can be made. Including different other routing services might be an option here, too.

The geographical meta data could also be assigned to other elements of the Sustainable Supply Chains like “Targets”, “Enablers” or the whole chain as such. Example use of this could be drawing a shape on a map that describes the total dimensions of the supply chain or spatial implications of certain aspects. Shapes of one chains’ could then be merged with the dimensions of project/supply chain alternatives and the different geographical implications of a specific project are visualized more feasible.