I-KNOW-FOO: Interlinking and creating KNOWledge graphs for near-zero CO2 emission diets and climate-change robust FOOd production

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Introduction

The diet of the world's population has a huge impact on climate change. However, it is not straightforward to see the impact of consumed products, both for end users and within the supply chain. For example, it may be unknown to consumers that the production of mineral water - due to the packaging materials used - can be more harmful to the climate than the production of rice as data and knowledge within the supply chain is often not easily reachable or linkable.

Objective

The aim of the project is to be able to unlock the available data and derived information via (automated) semantic web services. We would like to show the feasibility of connecting data from various sources to evaluate the impact of diets on climate change and how to suggest alternatives to the commonly consumed products to support climate adaptation.

Methodology

We will link different scattered data sources and suggest alternatives to the mostly consumed products.This process will be partly manual in the beginning and will be increasingly automated during the project.
For this purpose, first an inventory has been made of relevant databases, ontologies, and knowledge graphs in the areas of nutritional values, and sustainability and food. We will apply the steps to three top products in terms of import to the Netherlands, selected on the basis of FAOSTAT statistics from the past five years.

Results

- Soybean, potato and wheat crops were found to be the main imported and consumed crops using FAOSTAT database (Table 1). As a start, we use this information to find alternatives in diets for these food products in order to make diets more robust against climate change .

Imported Quantity (2020)	Imported Value (2020)	DFSQ (2019)	FSQ (2019)
Maize	Cocoa Beans	Milk - Excluding Butter	Milk - Excluding Butter
Soybeans*	Palm oil	Sugar beet	Potatoes and products*
Wheat*	Soybeans*	Wheat and products*	Wheat and products*
Rapeseed	Wine	Maize and products	Vegetables, other
Barley	Chocolate products	Potatoes and products*	Beer
Potatoes*	Maize	Soybeans*	Sugar (Raw Equivalent)
	Cheese	Barley and products	Apples and products

DFSQ: Domestic Food Supply Quantity (1000 tonnes/yr)
FSQ: Food Supply Quantity (kg/capita/yr)
* Selected crops for being replaced by alternatives

Table 1. Most Imported Food Groups and Food Supply Data in Netherlands (FAOSTAT)

- At first, the nutritional values and environmental impacts of the selected crops were looked up using the PDA web services (Fig. 1). These services are linked to NEVO database from RIVM. The original goal was to find alternative cropps/products with similar nutritional values using the Food Item Ontology (FIO). However, finding alternatives using FIO data will be computationally expensive. Alternatively, the 'Alternatief' application has been used to find alternatives (Fig. 2).
- In parallel, the FAO Land & Water Crop Information was also used in the semi-manual process of finding other alternative food item considering growth conditions. This process will be automated step by step, incorporating more and more aspects of climate change: first only temperature, later also drought, water needs, etc.

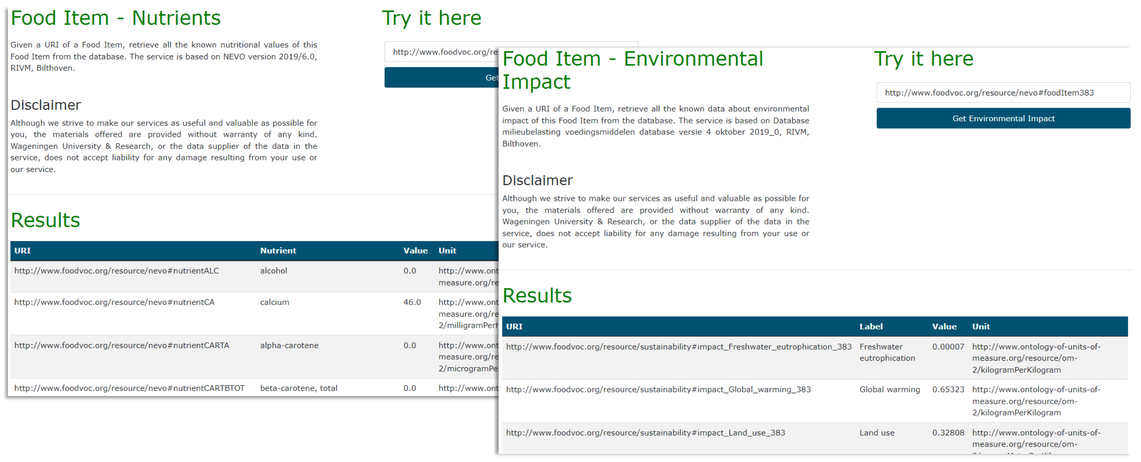

Figure 1. PDA services on nutritional composition and environmental impact of crops

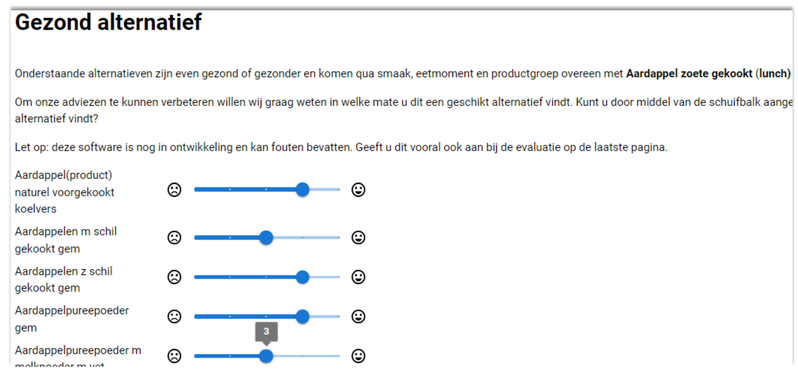

Figure 2. Alternative products to 'potato' generated using 'Alternatief' App. (alternatief.wur.nl)

- To make steps towards automation, an inventory of existing databases, ontologies and knowledge graphs on sustainability, climate change, and growing conditions has been made. This inventory will then be used to annotate and link various data.

Conclusions and Future Work

Alternative food products are mapped out with software tools. Then, based on the climatic conditions for their possible growth in the Netherlands and other regions, the best alternative is determined. The final step is to evaluate the sustainability impact once the food item has been replaced in a diet in the Netherlands. For this, a linked data model approach will be developed which can then be used to automate generating alternatives for diets in a changing climate.

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