
# Open data for food quality and food safety: a case study of the Czech Republic

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***Abstract.*** *Food quality and food security is of a high public interest in the European Union. In the Czech Republic, food quality and food security is under control of three different public authorities: the Czech Trade Inspection Authority (CTIA) that is affiliated with the Ministry of Industry and Trade of the Czech Republic, the Czech Agriculture and Food Inspection Authority (CAFIA) that is affiliated with the Ministry of Agriculture of the Czech Republic and the regional network of hygienic stations that are affiliated with the Ministry of Health of the Czech Republic. The competences of control bodies are divided such as following. CAFIA can control all public catering in terms of food production, HACCP compliance, food storage, distribution and sale. Czech hygienic stations operate on regional level and they can collect food samples and conduct microbiological analysis, chemical substances assessment, and can reveal an intentional replacement of food ingredients. CTIA's interest is in control of compliance with food quality and health conditions and it checks also amounts of served food and beverages, advertising and financial issues.*

*The main goal of the paper is to contribute to understanding of open data leveraging for better food quality and food safety. Results presented in the article are twofold. Firstly, we build a comprehensive overview of available data sources in domains of food quality and food safety in restaurants in the Czech Republic. Secondly, we conduct an evaluation of data sources and existing applications.*

*Technical issues such as data availability, format and merge seem to be main technical issues for better information provision. However, much larger issues are language conversions and legal compliance of published data. Food safety and food quality, in general, are topic on a high stake not only in developing countries, but also in developed regions of the world. New concepts of data provision and reuse should be analyzed, explored and implemented to bring better, more accurate and quality information to citizens, public authorities and all other relevant stakeholders.*

***Keywords.*** *Food safety, food quality, control, public authority, open data, Czech Republic.*

## Introduction

Terms food safety and food quality might appear to be synonymous or interchangeable. According to (Fao et al., 2003), food safety refers to all those hazards, whether chronic or acute, that may make food injurious to the health of the consumer. While food quality includes all other attributes that influence a product's value to the consumer. This includes negative attributes such as spoilage, contamination with filth, discoloration, off-odours and positive attributes such as the origin, colour, flavour, texture and processing method of the food.

Vast pools of data spill over digital communication channels on daily basis. However, the ability to find, harvest and obtain valuable information from data is a tedious process. Expectations in utilizing open data for better, faster and transparent decision making in many domains has been high (Ubaldi, 2013).

Food quality and food safety is of a high public interest in the European Union (Füzesi et al., 2010). In the Czech Republic, food quality and food safety is under control of three different public authorities: the Czech Trade Inspection Authority (CTIA) that is affiliated with the Ministry of Industry and Trade of the Czech Republic, the Czech Agriculture and Food Inspection Authority (CAFIA) that is affiliated with the Ministry of Agriculture of the Czech Republic and the regional network of hygienic stations that are affiliated with the Ministry of Health of the Czech Republic.

The competences of control bodies are divided such as following. CAFIA can control all public catering in terms of food production, HACCP compliance, food storage, distribution and sale. Czech hygienic stations operate on regional level and they can collect food samples and conduct microbiological analysis, chemical substances assessment, and can reveal an intentional replacement of food ingredients (CAFIA, 2016). CTIA's interest is in control of compliance with food quality and health conditions and it checks also amounts of served food and beverages, advertising and financial issues. However, CTIA does not control quality and labelling of purchased products and quality of served food and beverages in restaurants (CTIA, 2016).

While CTIA already provides results of quality controls in open data format (XLSX, CSV, ODS and RDF), CAFIA launched and maintains both web and mobile application called the Food Pillory. The application combines CAFIA's control data and refers to shops and restaurants where food of a poor quality or unsatisfactory conditions were detected. On the contrary, regional hygienic stations publish their food controls data only as a part of annual reports for a particular region in a Word document.

We selected the case of food quality in restaurants that is in focus of many commercial applications such as Yelp.com or TripAdvisor.com that are targeted for tourists and foreign visitors. However, many of applications lack trustful and state-guaranteed information about food quality and safety. Customers cannot enter food storage area and kitchen; therefore, their reviews are only subjective. Currently, there is no similar application that concentrates all state control authorities' data and private reviews related to food quality.

The main goal of the paper is to contribute to understanding of open data leveraging for better food quality and food safety. Results presented in the article are twofold. Firstly, we build a comprehensive overview of available data sources in domains of food quality and food safety in restaurants in the Czech Republic. Secondly, we conduct an evaluation of data sources and existing applications.

## Materials and Methods

Research presented in this is based on the literature review of current scientific papers and related professional articles. Official online sources and websites of public authorities in areas such as agriculture, health, food and trade inspection were examined to explore the availability of data

sources.

Regarding the literature review a comparative analysis of available open data sources and applications is conducted and a comparison between the Czech Republic several other countries is done.

## Results and Discussion

Upon the review of available online source, the list of data sources related to food safety and quality was built. The list is divided to international sources and national sources (see Table 1 and Table 2 )

**Table 1 List of European data sources - food safety and quality**

| Data source | Provider | Format | Language | URL |
|---|---|---|---|---|
| DOOR - Designations of origin register | EC | HTML/ PDF | EN | http://ec.europa.eu/agriculture/quality/door/list.html |
| E-Bacchus - Register of designations of origin and geographical indications of wine | EC | PDF | EN | http://ec.europa.eu/agriculture/markets/wine/e-bacchus/index.cfm?event=pwelcome&language=EN |
| EU Register of authorised GMOs | EFSA | HTML | EN | http://ec.europa.eu/food/dyna/gm_register/index_en.cfm |
| JECFA Compendium of Food Additive Specifications | FAO | HTML/ PDF | EN | http://www.fao.org/ag/agn/jecfa-additives/index.html |
| RASFF | EFSA | HTML | EN | http://ec.europa.eu/food/safety/rasff/portal/index_en.htm |

Legend:

EC=European Commission; EFSA=European Food Safety Authority; JECFA=Joint FAO/WHO Expert Committee on Food Additives; RASFF=Rapid Alert System for Food and Feed

Source: self-authored.

We can see from the Table 1 that the major authorities and information providers on food safety at European level is the European Commission (EC) and European Food Safety Authority (EFSA). A significant resource provides also the Food and Agriculture Organization (FAO). In total, there are 5 various web sites or databases that can be publicly used to collect, store and publish food safety or food quality information in EU member states. However, none of these sources provides open data by default.

Table 2 List of national data sources in the Czech Republic - food safety and quality

| Data source | Provider | Format | Language | URL |
|---|---|---|---|---|
| Food controls in restaurants | HSCP | HTML/DOCX | CZ | http://kontrolystravovani.hygpraha.cz/mesicni-prehledy |
| Food safety A - Z | MA | HTML | CZ | http://www.bezpecnostpotravin.cz/az/default.aspx |
| Food, business premises, controls by commodities | CAFIA | HTML | CZ | http://www.potravinynapranyri.cz/ |
| Information Centre of Food Safety (newsletter) | MA | HTML | CZ | http://www.bezpecnostpotravin.cz |
| Open data - controls, sanctions, bans | CTIA | CSV, XML, RDF | CZ | http://www.coi.cz |
| Organic farming - register of enterprises | MA | XLS | CZ | http://eagri.cz/public/web/mze/zemedelstvi/ekologicke-zemedelstvi/seznamy-podnikatelu/celkovy-seznam-podnikatelu/ |
| RASFF - weekly overview | CAFIA | HTML | CZ | http://www.bezpecnostpotravin.cz/kategorie/hlaseni-v-systemu-rasff.aspx |

Legend:

CAFIA=Czech Agriculture and Food Inspection Authority; CTIA=Czech Trade Inspection Authority; HSCP=Hygienic station of the capital Prague; MA=Ministry of Agriculture;

Source: self-authored.

The main data sources related to food safety and quality come from the Ministry of Agriculture and three authorities with control competence - the Czech Agriculture and Food Inspection Authority, the Czech Trade Inspection Authority and a network of regional hygienic stations linked to the Ministry of Health. Currently, the Czech Trade Inspection Authority is the only provider of relevant data in machine readable formats. In total, there are 7 different national data sources that could be publicly used and consulted in relation with food safety and quality. All detected data sources are provided only in Czech language, which limits its use for potential international audience.

**Table 3 List of available applications in the Czech Republic - food quality and safety**

| Application | Developer | Platform | Target users | Language | URL |
|---|---|---|---|---|---|
| Vis co jis? ("Do you know what you eat?") | MA | Mobile - Android | Public | CZ | https://play.google.com/store/apps/details?id=cz.viscojis |
| Interactive board application ("Eat healthy and tasty") | MA | Smart Board | Public | CZ | http://www.bezpecnostpotravin.cz/ShopRegistration.aspx |
| Nutrition database | MA | Web application | Public | CZ | http://www.nutridatabaze.cz |
| Food pillory | CAFIA | Web application / Mobile - Android, iOS, Windows | Public | CZ/EN | http://www.potravinynapranyri.cz |
| Czech restaurant inspections | Spinque | Web application | Public | EN | http://devel.spinque.com/comsode/coi/ |

Legend:

CAFIA=Czech Agriculture and Food Inspection Authority; MA=Ministry of Agriculture; Spinque=private company.

Source: self-authored.

Upon the review of currently existing applications in the food safety and quality domain, only 5 applications were found in the Czech Republic and only 2 of them provide an English version of the user interface.

### The case of the web application Czech Restaurant Inspections

Czech Restaurant Inspections is a web application developed by Spinque within the EU-funded COMSODE project. The application is the first attempt to bring together various datasets related to food quality in restaurants and other food establishments such as supermarkets, catering services and any shops selling food in the Czech Republic.

The main capability of the application is to search for restaurants by name, or search for restaurants in a street, city or area. The displayed results provide a colour based information about the quality of the restaurant based on the control results by the Czech Trade Inspection Authority. Green means a satisfactory result, orange detects certain issues and grey stands for unknown status due to no inspection conducted. In fact, without artificial colour based categorization of food establishments it would be difficult to provide relevant information to the international audience.

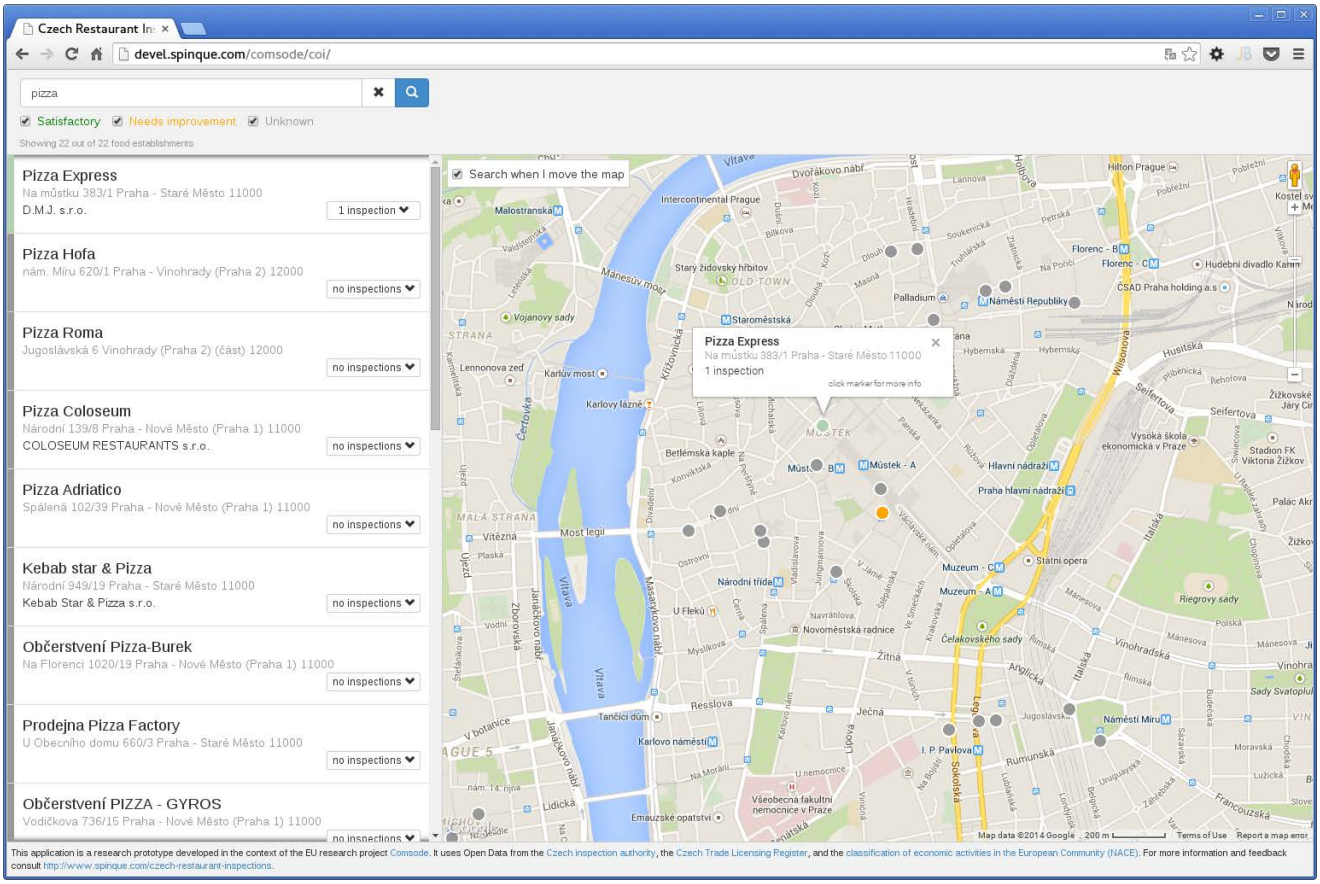


**Figure 1 Screenshot of Czech Restaurant Inspections application**

Source: (Spinque, 2015)

As to the database, there are three datasets used in the application: Czech Trade Inspection Authority's dataset with control results; the Czech Trade Licensing Register with identification of the business and the Ministry of Health that maintains the registry of food related entities. In practice, only the first dataset is published in open data formats by default, while the other two are not. The Czech Trade Inspection Authority is a web-based database that provides XML API to extract data, but applies daily limits to every user. The Ministry of Health publishes only an Excel file with the list of all registered food establishments on annual basis. The challenge that had to be solved was the extraction, conversion and publishing of all three respective datasets in the format of linked open data. The application front-end was developed with less than 500 lines of code in Javascript which is a standard size (Spinque, 2015). Common web technologies are viable for map based applications where spatial data are visualized (Jarolimek et al., 2015).

The integration is done via a proprietary tool Spinque Linked Data that enables to link data sources without any coding. An important aspect of the integration is the alignment of datasets by linking entities from one dataset with appropriate entities from another dataset (Hildebrand, 2015).

## Open data for food safety and quality

The level of open data among countries can be compared by Open Data Index (http://index.okfn.org) or Open Data Barometer (http://opendatabarometer.org). The Czech Republic ranked 21$^{st}$ out of 134 countries according to the Global Open Data Index (OKNF, 2015), and 17$^{th}$ out of 88 countries according to the (Foundation, 2014). It should be noted that the first index is built on observations of 15 various open datasets provided by volunteers. While the latter collected data about 10 different

datasets through the questionnaire survey among experts. We chose the United Kingdom (1st), France (3rd), Finland (4th) and the Czech Republic (13th) (Foundation, 2014). The numbers of datasets related to food safety and food quality that are available through national open data portals are presented in Table 4. Datasets were searched by phrases in local languages “food safety” and “food quality” at respective national open data portals.

**Table 4 Survey of open datasets for food safety and quality**

| | Czech Republic | EU | France | Finland | United Kingdom |
|---|---|---|---|---|---|
| Ranking in 2014 | 13th | - | 3rd | 4th | 1st |
| National open data portal | portal.gov.cz | europeandataportal.eu | www.data.gouv.fr | | data.gov.uk |
| Food safety datasets | 1 | 39 | 8 | 20 | 11 |
| Food quality datasets | 0 | 19 | 5 | 1 | 1 |
| Total | 1 | 58 | 82 | 21 | 12 |

Source: self-authored, ranking based on (Foundation, 2014)

Even if the food category is not represented in the Open Data Barometer, the ranking of compared countries follows the number of relevant published datasets in the food domain. On the other hand, European open data portal concentrates much more relevant open datasets than some national portals.

## Conclusion

The main aim of the paper was to explore and compare available open datasets related to the food safety and quality. In the Czech Republic, there is a major lack of suitable datasets in the explored domain, which is an obstacle to development of suitable applications.

Technical issues such as data availability, format and merge seem to be main technical issues for better information provision. However, much larger issues are language conversions and legal compliance of published data.

Food safety and food quality, in general, are topic on a high stake not only in developing countries, but also in developed regions of the world. New concepts of data provision and reuse should be analyzed, explored and implemented to bring better, more accurate and quality information to citizens, public authorities and all other relevant stakeholders.

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