

Household Budget Survey - Online reporting tool

Final Report

December 2019

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1. Introduction

Statistics Denmark has, with this grant, aimed at developing a free online reporting tool, to replace an old outdated reporting tool for the households who report to the household budget survey (HBS). This tool has been developed with both a local language version and an English version. The online tool will support the reporting of daily consumption over a 14-days period. Three goals have been set up in this project:

1. Development of a user-friendly and reliable online tool for the reporting household in the household budget survey
2. Online validation and commodity-word (hereafter, Lib-words) recognition linked to ECOICOP-codes to secure high quality of the reporting data and therefore also for the statistics based on this data. The tool will also reduce the workload at the statistical office
3. Development of a generic online tool for reporting with the potential of sharing with other European statistical institutions - that is the tool will be developed in a cross-country known it-language

The modernization of the reporting tool should result in an improved quality of the reported data and the reporting households should experience a more user-friendly and robust tool for reporting their household expenditures.

2. Overview of the project

The project has several important work streams. The following three headlines covers the activities carried out under this project.

1. Evaluation of reporting tools
2. Specification of needs for the IT development
3. Developing the tool

Evaluation of reporting tools

During the spring of 2019 a usability test of the existing accounting reporting schedule was completed by colleagues from DST Survey This work concluded that the existing solution needed to be improved. Furthermore, there were many suggestions from the users on how to improve the application, and these have been implemented in the development of the application.

There was also completed a small volunteer study among the participating households in the period of November 2018 to mid-February 2019. The result of the enquiry was that the respondents, on average found, it difficult to get access to the accounting booklet, to understand questions and guidance, to provide the necessary information and to enter information and find infor-

mation in the accounting booklet. The conclusions were that the existing application absolutely needed a modernization. The recommendations from the households were all in line with the improvements we have suggested.

Specification of needs for the IT development

In June the first specification draft of needs for the IT-development of the application was finished, and many of the recommendations from both the usability test and the voluntary study were implemented. The specification resulted in the following requirements:

1. Development of a library containing words (Lib-words) for the most common expenditure items
2. Linking of ECOICOP with Lib-words
3. Price boundaries for each expenditure group to be integrated in the online tool as a front-end validation tool where the reporting person will be met by a warning if reported prices of the given amount on the expenditures are outside the boundaries stated

This resulted in the development of four databases.

The LIB-word library

The LIB-word library is the database which is full adaptable to the national requirements that every country may have to the HBS.

ECOICOP database

This database contains the ECOICOP at the 8-digit level and this is the most essential database in matter of uniform methods for cross-border data collection. The linking between the LIB-word database and the ECOICOP database is crucial.

Boundaries

This database contains the boundaries set up for prices with regards to quantities. It is necessary to make the simultaneous test of quantities and price while the respondent enters their purchases. This database integrated the feature of the application that it will be the single households that at an early stage validate the data they send in.

Statistical figures

This database provides the single household with a status of their own consumption based on the information we have from similar household types from the previous year.

Developing the tool

To begin with, there was a very clear idea of what the new application has to fulfil. The difficulties appeared when the ideas were to be realized. The development and design of the library of LIB-words was the most complex part of the project. The design had implications for the further process and it took several iterations to find the right design. In the beginning of the project, we thought that the application would be developed in Blaise5, but the many iteration between the IT-and Statistical personnel actually resulted in using a costumer web solution instead. The argument for changing from the Blaise5 based solutions to a costumer web solution was, that the web solution would make it easier to further develop the application later on. The other argument was that it would be relatively simple to apply the online version in other countries. The last argument was that the web solution to a greater extent would lead to a faster application. However, the decision to change platform also meant that more time would be spent by the IT-experts than initially anticipated, making it necessary to rearrange the detailed budget. In spite of this, it was managed to stay within the budget.

The next step was to make the link to the ECOICOP library. Which resulted in many iterations between the IT-personal and the statistical personnel. Because it has to be code correctly but it at the same time, it should be easy to use for the reporting household. The balance between what was nice to do in manner of statistical practice and design considerations was sometimes troublesome.

A crucial requirement to the new online tool was that the linking actually took place while the respondent was typing their information in the online application. Therefore, it was a requested that the price boundaries for each expenditure group had to be integrated in the application as a front-end validation tool where the reporting person will be met by a warning if reported prices of the given amount on the expenditures are outside the boundaries stated.

This requirement has only been partially fulfilled. It was concluded that asking the respondents to state the amount would lead to many errors Therefore only the price boundaries are integrated. Another request was to give the reporting households important information about their consumptions patterns according to a similar household from the year before. Finally, it was an important requirement for the application to be fast and stable. The application is designed to contain both a local language and an English version. The English version in the Danish case is only a translation of the original languages.

The original solution contained a requirement about that the solution would have incorporated video tutorials in both the original languages and English but for now only written tutorials are available

Furthermore it was plan that the solution would have mouse-over guidance. After many iterations it was concluded that these ideas wasn't suitable with the other requirement of an easy web solution to use by the reporting households and should have a well-understandable design.

The most important requirement is of course the data security and the safety of the data. All requirements to security is of course respected.

The web application has been subject ongoing testing and finally so-called bughunt. The bughunt is a way to detect errors. 12 persons validated the application and a lots of defects were detected and corrected.

3. The work carried out

The result is a web application that is easy to use by the reporting households and which has a well understandable design, the solution is accessible on <https://rsh.dst.dk/>.

Every household who has been asked to participate in the HBS will receive a letter with a password to participate in the survey if they choose to do so. Each household is randomly selected by address each quarter and have to enter their expenditure for a two weeks period. To enter the web solution, the participant households' respondents have to type their password, which is unique for each household.

When the participant households enter the web application, they have to state what kind of household they considerate them self to be. This information is stored for later on in the process. After the respondent is finish to type their consumptions in the application this information is used to show the respondents if they use more or less than a similar households on average.

Hereafter the respondent can start to type their expenditure. The Lib-word database is designed to use the most common used word. If e.g. the respondent has bought 1 l. of fat milk. When the respondent type fat milk, the lib-word library finds all the relevant ECOICOP variables and shows them in a drop down menu. The respondent chooses the most appropriate text for their purchase. The respondent has to fill out if the item purchased is fresh, canned or frozen. The respondent has to inform if the item is organic, or if the item is bought abroad, or if it is second hand, or purchased as a present. If the item is clothing then the respondent has to state if the clothing is for a woman, man or child. Even if the respondent has made many choices during the reporting, it is our opinion that the web solution is designed so well that the household will not be irritated. For the ECOICOP categories for which it is relevant, the respondent also may report quantity, unit and price.

When the respondent is finished with typing their consumption, the respondent has to finish each day in the two weeks period. When the two weeks periods have been filled out, the web application calculates statistics based on

the data from the statistical database, and create a graphical comparison between the reported consumption and a similar households' consumption the year before.

4. Closing remarks

In order to implement the web application there are some technical specifications that must be met. These specifications can be read in appendix A.

The web application runs best in Chrome, Firefox or Safari.

Appendix A:

RSH web application technical overview

The RSH web application is an online tool used to collect data for the household budget survey.

This document describes the technical aspect which is required, in order to be able to make local changes to the application, and get it up and running.

Skills required

In order to adopt and use the RSH web application the skills listed below are required:

- Understanding of asp .net core (v2.2)
- Setting up a Database supported by Entity Framework core 2.2.4 (code first)
- Understanding of HTML and javascript

Since this is an asp.net core application any webserver can be used to host the application. We are currently using a Microsoft IIS 10.

Technology used

This project uses the following technologies:

- Microsoft asp .net core (v2.2)
- Knockout.js (MVVM binding library)
- PostgreSQL(any database supported by EF core is viable)
- Entity Framework core 2.2.4
- Visual studio 2019

Furthermore, a smaller number of libraries inconsequential of the architecture have been used.

Prerequisites

The following requirements must be met before the website will work as intended:

- The database must be created
- All tables must be created (defined in the description section)
- The tables Coicops, CoicopGroups, Bips, HistoricalData, Gifts, and Users must be filled with relevant data

Localization

This web application (Dst.Rsh.WebUi) supports two languages out of the box, namely English and Danish. If a language must be removed or added the following description will help locate the relevant key points in the project.

VIEW LOCALIZING

Localizing all text is done in a standardized way following best practice recommended by Microsoft. It is done via a folder structure¹ as shown in Figure 1. The language resource file must be placed in a folder with the same name as the controller and the file must be called the same as the view itself, post fixed with a country code.

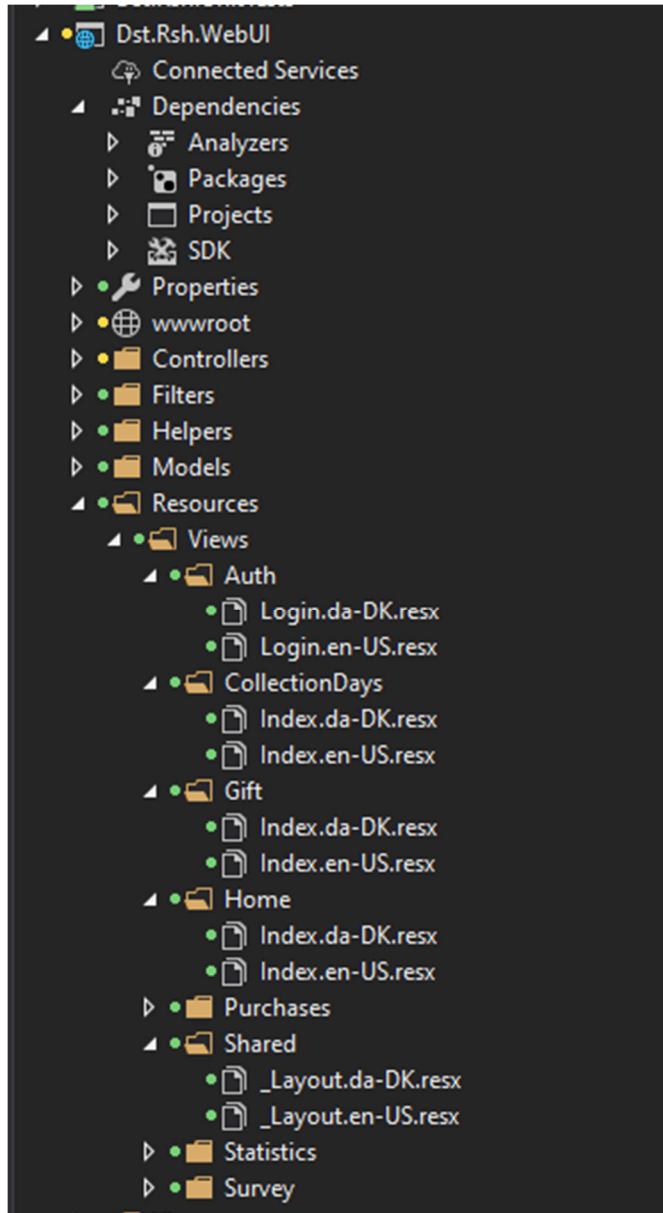


Figure 1 Each language is postfixed with a country code

To add a new language, add a new resource file and postfix with a country code. Furthermore add a new CultureInfo object in the startup.cs as depicted in Figure 2

¹ <https://docs.microsoft.com/en-us/aspnet/core/fundamentals/localization?view=aspnetcore-3.0#resource-files>

```

services.Configure<RequestLocalizationOptions>(
    opts =>
    {
        var supportedCultures = new List<CultureInfo>
        {
            new CultureInfo(name: "da-DK"),
            new CultureInfo(name: "en-US"),
        };

        opts.DefaultRequestCulture = new RequestCulture("da-DK");
        // Formatting numbers, dates, etc.
        opts.SupportedCultures = supportedCultures;
        // UI strings that we have localized.
        opts.SupportedUICultures = supportedCultures;
    });

```

Figure 2 Add a new CultureInfo with a country code after the red line

Language selection

The user can change language in the top right corner as depicted in Figure 3.

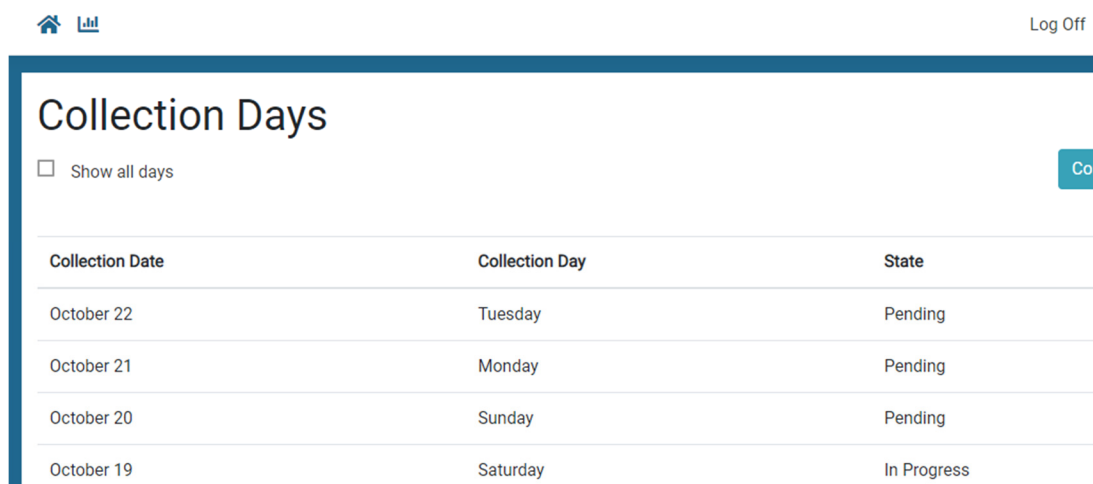


Figure 3 Change language in the top right corner

In order to add or remove a language make the appropriate changes to the file `_CulturePartial.cshtml` placed in Views/Shared.

Javascript files

The following javascript files needs to be changed in order to be localized.

File	Description
wwroot/js/Shared/textfieldTo-Decimal.js	Restricts input to either use a comma or dot for decimals depending on selected language
wwroot/js/ViewModels/Statistics/index.js	Localizing currency.
wwroot/js/ViewModels/Survey/index.js	Localizing calendar

Administration data

To support a given language bips words, coicop codes, coicop groups, and gifts must be added to the database with the language property string set to the given cultureInfo eg. "da-DK" or "en-US".

DataTables

The following section contains a description of the data tables in the project. All tables are created using Microsoft Entity Framework core code first migrations.

Bip

This table contains all the predefined search words, which in turn will correspond to a coicop code, it is furthermore used to autocomplete a user's input for a product. A bip word can act as a category with a collection of other bip words attached or have a collection of coicop codes attached.

Id	Unique identifier
BipText	Search text
ParentBipId	Used if bip word is part of a bip category, note each bip can only be part of one bip category.
NotSearchable	Is it searchable in the autocomplete list
IsCategory	Is it a category (does it have a list of bip words instead of a list of coicop codes)
Language	Language code (eg. da-DK or en-US)

Coicops

This table contains the items that a purchase ultimately needs to be mapped to

Id	Unique identifier
Code	Identifier coicop code
Name	Name of the coicop item
CoicopGroupId	Id of the group the item is part of
MinimumPrice	Minimum price for validation
MaximumPrice	Maximum price for validation
ConservationFresh	Metadata that controls which questions the user is asked
ConservationFozen	
ConservationCanned	
ConservationOther	
Ecological	
ConsumptionRestaurant	
ConsumptionCanteen	
ConsumptionTakeAway	
GenderMale	
GenderFemale	
AgeBaby	
AgeChild	
AgeAdult	
Ecommerce	
SecondHand	
FoodWaste	
Gift	
ForeignPurchase	
Quantity	

Amount	
UnitOfMessure	Comma separated definition ie.: KG,G
Language	Language code (ie. da-DK or en-US)
HelpText	Text to help a user understand the product

BipCoicop

A relational table which binds a bip with a Coicop.

BipId	Bip id
CoicopId	Coicop id

CoicopGroups

Each coicop belongs to a group defining an area

Id	Unique identifier
GroupNumber	The group number
Name	Name of the coicop group
Description	A description of the group
Language	Language code (ie. da-DK or en-US)

CollectionDays

A survey is a period of 14 collection days

Id	Unique identifier
SurveyId	The id of the survey
CollectionDate	Collection day date
Status	Defines whether the day is finished or still in progress

Gifts

When a user completes a survey they are awarded with a gift of their choice

Id	Unique identifier
Image	Image of the gift
Name	Name of the gift
Description	Description of the gift
InUse	Defines if the gift is selectable for the user
Language	Language code (eg. da-DK or en-US)

HistoricalData

This table is used for statistical purpose, i.e. show how the expenditures is distributed on a national level.

Id	Unique identifier
HouseholdType	Defines the type of household (eg. Single, Single with children etc.)
CoicopGroupNumber	The coicop group number
AverageExpenditure	Average expenditure

Purchases

This table is where data is gathered for all the products which is bought.

Id	Unique identifier
CollectionDayId	Reference to the collection day id
ConsumptionVenue	Defines where the product is bought
SearchTerm	The input the user has typed to search for a product
SelectedName	The selected coicop name
CoicopCode	The code corresponding to the selected coicop name
IsForeignPurchase	Is it a non domestic purchase
IsEcological	Is it ecological
Gender	Male or female
AgeCategory	3 different age categories
IsSecondHand	Is it bought second hand
IsGift	Is it a gift
IsEcommerce	Is it bought online
IsFoodWaste	Is it bought as a food waste product
Conservation	Which kind of conservation (eg. Frozen, canned)
Price	Price of the product
Quantity	Quantity of purchase
Amount	Purchase amount
UnitOfMeasure	Unit of measure of the quantity
CollectorComment	User input field eg. to explain something
AdminComment	Admin comment field

Surveys

A survey is the period for which a user records all of his/her purchases.

Id	Unique identifier
PeriodBegin	The start date of the collection period
UserId	The unique user id
TypeOfHousehold	Type of household
GiftId	Id of the selected gift
Status	Defines whether the survey is ongoing or ended

Users

Id	Unique identifier
CreateDate	Date the user was created
IpNo	Works like a username
Password	Hashed password
ExpirationDate	Date when user is voided

_RshMigrationHistory

This table is created by Entity framework and describes the migrations.