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**Deliverable D5.1**

**Inventory of types of purchase data and data collection methodologies for consumer-generated food purchase data**

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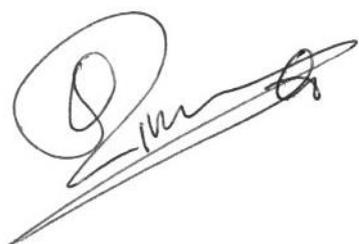
**Author:**

Susanne Ekman, Anne Normann, Erik Baderstedt, Naomi Klepacz, Marcus Maringer, Anouk Geelen, Muriel Verain, Monique Raats

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**Karin Zimmermann**  
**Project Coordinator**



**prof. dr. ir. Pieter van't Veer**  
**Scientific Coordinator**

## Summary

The overall aim of Phase 1 within the RICHFIELDS project is to design a Research Infrastructure (RI) for the collection, integration, processing and sharing of consumer-generated data as related to food intake activities and thereby including food behaviour and lifestyle determinants. The Deliverables 5.1, 6.1 and 7.1 share a common framework and tool for the data collection method, where the labels for scientific data collected in the inventory are specific for the domains purchase (D5.1), preparation (D6.1) and consumption (D7.1). 5.1 made an inventory of available mobile applications (apps) for consumer-generated purchase data based on the quality framework developed in task 5.3. The inventory provides a list of available consumer purchase apps with data collection methods that generate data on consumer food intake activities in relation to key questions relating to food purchase behaviour (i.e., What/Who/Why/How/Where). The inventory was made in Mobile application stores; iTunes and Google Play, and by using search engines Google and fnd.io. In addition, apps for inclusion were found in reference lists of searched articles, links found on the internet, etc. Fifty-four mobile applications were identified for inclusion into the RICHFIELDS Inventory Management System (RIMS), an online management system created in response to Task 5.1, 6.1 and 7.1. These apps were assessed in terms of their descriptive, scientific, legal and technical characteristics. This report contains an outline of the methodology used for the identification of the apps and a discussion of the application of the quality criteria. Aggregations, analyses and evaluations of the collected information related to the quality criteria developed in Deliverable 5.3 will be part of Deliverable 5.4 and 5.5.

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# 1. Introduction

## 1.1 BACKGROUND

The overall aim of RICHFIELDS is to design a Research Infrastructure (RI) for the collection, integration, processing and sharing of consumer-generated, research-generated and business-to-business data as related to food intake activities, food behaviour and lifestyle determinants. The current growth in ICT technologies available for consumers bring opportunities for researchers to monitor and collect information on these behaviours, which have often been recorded within the behavioural context and close in time to the users' experiences. But what kind of data does this increased use of mobile-services generate? How does the generated data describe actual food related activities and consumer behaviour? Does this great amount of real time purchase data have any relevance for a deeper and more reliable understanding about consumer behaviour? And could this data be used in the formation of a data platform to be used by researchers?

Technological advances and customer mobility have created opportunities for serving customers in ways that go beyond the traditional exchange of products/goods and services. Companies are provided with tools to extend their focus from goods to providing customers with additional support for their own processes. Focus is not only selling goods but providing services and increase consumer knowledge. For example, the mobile application Whole Foods Market, allows customers to check whether or not their preferred groceries are available or even on offer in their nearest store. Moreover, the app called Shop Savvy, allow customers to scan product tags within the store and get price comparison information. Pizza Hut has developed a mobile application that helps customers design their own pizzas (Saarijärvi, et al 2014).

So m-services support customers both during pre-purchase, in-store purchase and post-purchase processes; to decide what to buy, ease the comparison of products, present service- and store-related information, learn about nutritional information, be a store locator and manage shopping lists, self-scanning, pay for purchase at the checkout, (Saarijärvi et al, 2014, Shankar et al, 2010, Kroski, 2008). According to Shankar et al (2010); create shopping lists, search, compare, purchase and post-purchase activities were

identified as mobile consumer attitudes and behaviours. Local search, shopping search, visual/camera phone search, voice search, mapping are added as activities by Kroski (2008), and of course also make an actual purchase.

There are different ways of collecting user generated data; consumers can voluntarily hand over information about themselves for example when registering for services (for instance to use a mobile app), buying products, or participating in surveys. Consumers often have to supply some data, such as delivery address, contact and payment details as part of a transaction. Consumers also generate data that is observed by businesses and collected in the background as they undertake actions. For example, the location data generated by mobiles and the search histories they leave as they browse the internet. The consumer-generated real time data from m-services could provide researchers with valuable information on the association between determinants and dietary intake which is of high societal and scientific relevance.

This report relates to the work of Work package 5 (WP5), which is a WP within Phase 1 of the RICHIELDS project. The overall aim of Phase 1 (WP5, WP6 and WP7) is to explore the available consumer-related data on food purchase, preparation and consumption, in terms of its type and quality. WP5 is tasked with exploring consumer-related data relating to food purchase, WP6 to food preparation data and WP7 to food consumption data.

## 1.2 AIMS

This document reports on the outcome of Task 5.1, an inventory of types of available food purchase applications (apps) that collect consumer-generated data. The inventory aims to characterise the available food purchase applications according to key research questions (i.e., What/Who/Why/How/Where). The characterisation of these apps is centred on a framework of quality criteria listed in deliverable D5.3. The apps in this inventory are therefore also assessed in terms of their descriptive, scientific, legal and technical characteristics.

This deliverable is not to be seen as a quantitative study, meaning that the list of collected tools should not be seen as a complete list of all tools available on the market. This

deliverable aims to describe the range of available tools that is of potential interest to the design of the future RI. The challenge of the inventory is to form a list which is representative for the variety of data collection tools, the methodologies they implement and what food purchase data they generate.

## 2. Methodology

The methodology related to the generation of the inventory will be presented in the following chapter. It is important to note that the method is to be seen as a preliminary assessment to capture the scope of available tools out there and to what extent the quality criteria set down in deliverable D5.3 is feasible as characterisation of the tools. These criteria cover descriptive quality criteria, scientific quality criteria, technical governance quality criteria and legal governance quality criteria. Besides the inventory of tools, an online management system RIMS (The RICHFIELDS Inventory Management System) was created in WP7; see more about RIMS in section 2.4.

### 2.1 TOOL TYPES

An initial search through relevant literature and search of tools online was conducted. As a result of this activity, the decision was made to restrict the identification of tools to mobile apps. An app is a software program developed specifically for use on small, wireless computing devices such as smartphones or tablets. From the initial search, it was found that the main area of innovation and relevance regarding real-time consumer-generated data collection is the mobile app market. Mobile devices for Apple's IOS and Google's Android have a market share of almost 99% (International Data Corporation, 2016). The inventory in this task was therefore restricted to apps available on the IOS and/or Android platforms. In the Phase 1 inventory for RICHFIELDS (Deliverable 5.1-7.1) the following tool types were searched for: 1) Food purchase apps, 2) Food preparation apps, 3) Food consumption apps, 4) Activity, health and fitness trackers and 5) Health and wellness data aggregators. In this Deliverable 5.1 data related to 1) Food purchase apps was conducted. The search strategies and data collection method for the relevant tool types are described in more detail in section 2.5.

## 2.2 DEFINITION OF FOOD PURCHASE

The intention of RICHFIELDS Phase 1 is to cover the area of food intake activities and consumer behaviour. WP5 only covers consumer generated food purchase data. It is of course well known that not all food we eat is purchased, it might originate from home gardening or meals at school, but food intake includes purchasing behaviour. And the other way around; the one who purchases the food does not necessarily consume it.

The term “purchase” could easily be seen as only the decision made at the actual point-of-sale. However, purchase behaviour can instead be defined as a process that goes beyond the act of purchase at the product shelf. Rather, it includes different factors which can influence the consumer before, during and/or after a purchase decision (e.g. Solomon et al. 2013). Levy, Weitz and Grewal (2014, p.91) defined the process in 5 steps/phases. The steps are described in a linear way but are presumed to interactively influence the purchase process. It begins with the pre-purchase phase, which includes the recognition of a need/motive, a more or less intensive information search determined by the current type of buying decision, and an evaluation of different options (e.g. Howard & Sheth 1969, p. 25f). The pre-purchase phase includes processes where consumers compare prices-, groceries-, product-, service- and store-related information, plan and decide what to buy or cook (Saarijärvi et al., 2014). After the pre-purchase phase, the purchase decision at the point-of-sale is made. This step includes a monetary exchange. Finally, the consumer evaluates the buying decision in the post-purchase phase (e.g. Levy et al. 2014, p. 91). Regarding purchase within the scope of WP5, the primary focus is on the phases of pre-purchase, as well as the actual point-of-sale. The post purchase phase of WP5 includes financial evaluations of purchases but it is also assumed that post-purchase is the base for another (pre-)purchase phase, which means that consumers use their memories and experiences as an information source. This definition of purchase was the basis for the typology. The typology was done in order to be able to categorise the tools and order the (meta) data, not to describe the mechanisms of the purchase process

### 2.3 TYPOLOGY OF FOOD PURCHASE

The typology is a framework that categorizes the tools and used to order the (meta) data in different categories and sub-categories. The collected tools were initially categorised into three phases as an ordering system; pre-purchase, actual point of sale and post-purchase, as connected to the definition of purchase used in WP5. The structure is used as a categorization method and do not reflect on purchase as a mechanism or fixed process. Those phases were set as a starting point for making the inventory in RIMS possible. As the inventory /data collection continued and more tools were logged in RIMS – new kinds of functions and new kinds of potential consumer-generated data were found. And moreover, tools with similar functions were grouped together in the same category. The process of formulating a typology was as dynamic as the search for tools. Therefore newer versions of the typology were set continuously, where some subcategories were merged together and some categories were renamed in order to present the selected tools. The final version is shown in Figure 1.

The typology consists of four levels. Level 1 is based on the definition of purchase (see section 2.2) and the categories (Level 2) describe the purpose of the data collected (the motivation underlying the behaviour captured by the app) for example to gain knowledge and/or understanding. The third level (Level 3) reflects what recordable food related activities that are captured (the specific behaviours captured by the app) for example searching for information. The final level (Level 4) indicates the potential consumer data it generates (the recorded behaviour). The separation of the definition into the different categories is based on McGowan et al, 2015. The categories are described below.

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#### KNOWLEDGE AND UNDERSTANDING

A motivator in the pre-purchase phase is to seek for knowledge and increased understanding, which includes searching for experiences/reviews made by fellow consumers, searching for offers/deals, “best price” and specific restaurants and/or grocery stores. If or when the consumer has sufficient knowledge or when that need is met from a knowledge search, the planning and organisational part of the decision process may start.

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#### PLANNING AND ORGANISATION

During the phase of planning and organisation, the consumers create their own shopping lists, make a budget and use different booking services. The consumer has enough knowledge for making a purchase, however still need to plan the actual purchase.

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#### MAKING A PURCHASE

After planning and organisation the actual point of sale is performed, meaning the purchase action is made. Placing an order is a service which many purchase apps provide.

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#### FINANCIAL UNDERSTANDING

The financial part of a purchase is included in the category named financial understanding and considers both an evaluation of a purchase but likewise a basis for future purchases. It is important to note that the purchase process is not linear or rational even though the typology might explain the process in a linear and rational design. The different stages might also vary both due to time but also considered that a consumer might seek for knowledge and understanding, however not use a tool to proceed with the purchase. Likewise could a consumer search for increased knowledge among friends, family or visit a store, but use a tool to place an order. Especially the pre-purchase phase has to be seen as a stage where a consumer might (un)consciously search for much more information than what is used to continue with the planning of the purchase in the end.

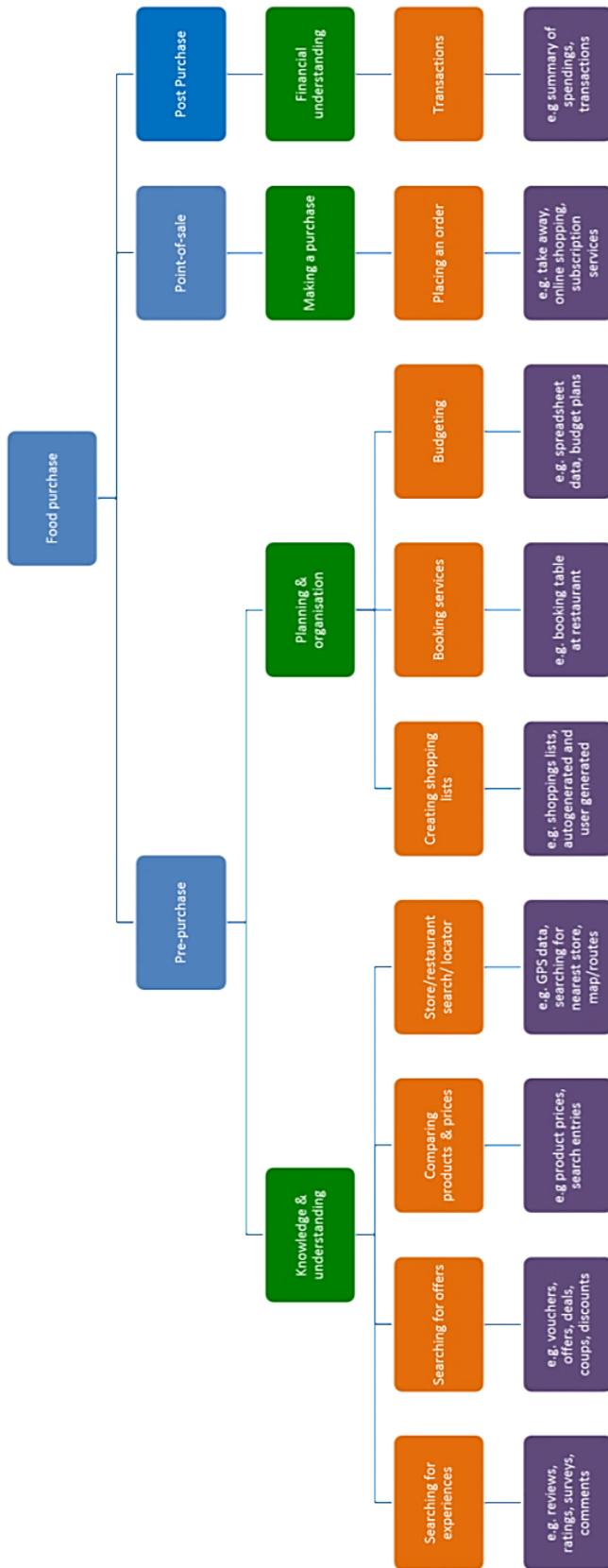


Figure 1. Typology of food purchase which is the base for categorising the apps and used to order the (meta) data in RIMS

## 2.4 RICHFIELDS INVENTORY MANAGEMENT SYSTEMS (RIMS)

The RICHFIELDS Inventory Management System (RIMS) was created by WP7 in response to Task 5.1, 6.1 and 7.1 which required the creation of an inventory of types of purchase, preparation, consumption and lifestyle associated data, and data collection methodologies. In brief, RIMS is an online management system for the storage and assessment of tools that produce data on consumer food intake activities and consumer behaviour, with a potential use to researchers. RIMS comprises two parts; 1.) a typology and categorisation of the tools stored within the inventory, described above, and 2.) a list of quality criteria against which each tool can be evaluated. The second part is covered in deliverable D5.3. Further description of RIMS, see D7.1.

## 2.5 DATA COLLECTION METHOD

The results from phase 1 (WP5, WP6 and WP7) are presented separately due to the division of the activities purchase, preparation, consumption and lifestyle, thereby further categorised and sub-categorised into groups defined by each WP. For WP5 and based on the definition of food purchase, a protocol was devised for the identification of relevant apps. Our focus was to find applications related to retail/supermarket purchases for household consumption by individual/family and restaurant/cafés purchases. Apps developed and launched both by food retailers and third party actors were included.

The data collection process was conducted from April to September 2016 and consisted of two steps. In the first step, an internet based search of the following sources was conducted; the mobile application stores Google Play and iTunes Store, the search engines Google and fnd.io. In addition, possible tools for inclusion were found in reference lists of searched articles, information and/or links to apps in articles/newsletters, or notifications and mentions provided by colleagues. For transparency reasons the reference and search procedure was documented in RIMS for each tool that was included in the inventory. All searches were conducted on desktop personal computers (PC). The search task in WP5 was undertaken by three researchers at SP in Sweden (the co-authors SE, EB and AN).

The initial search was executed using iTunes Store, Google Play, Google and fnd.io on the Internet Explorer browser in a private mode, logged off from any Google account, using the following keywords and synonyms in different combination; “food & drink”, “groceries”, “finance”, “shopping list”, “shopping”, “retail food”, “purchase food”, “food coupons”, “survey food”, “food scores”, “expenses”, “food box UK”, “dinner kit”, “eating out”, “food products UK”, “food product comparison UK”. Google searches were made with search terms added with the words “app” and/or “online”. It was decided in WP5, WP6 and WP7 to only include tools available in the United Kingdom (UK) since the legal and privacy documents for each tool should be interpretable by any researcher in the RICHFIELDS consortium. Another reason was to find a possible limitation to the huge amount of tools available on the European market for mobile apps.

In the first step, the researchers assessed and compared the apps by the information given in iTunes Store, Google Play, Google or fnd.io. The objective was to identify the scope of available food purchase apps, and thus record the variety of apps available rather than only the most used or most popular. To this end, the search objective was to identify approximately 50 prototypical apps that collected consumer-generated food purchase data according to the definition set out in section 2.2. Parallel and too similar apps with very comparable functions, based on the information given in iTunes Store, Google Play, Google or fnd.io were not included.

The second step of the work consisted of collecting additional data/information about the selected apps via both iTunes/Google Play and the website of the app. The types of data collected in RIMS were grouped into descriptive, scientific, legal and technical criteria. The complete description of these criteria, also described as “quality criteria” are presented in Deliverable 5.3 and therefore not further explained in this deliverable. However, the specific inputs for purchase (the scientific profile) were dynamic as long as the inventory of tools was conducted. Inputs were added, changed and reduced in order to describe the functions of the app /generated data in the best possible way, and not resulting in too comprehensive inputs lists. And as the inputs changed the already logged tools in RIMS were re-analysed in order to follow the updated protocol.

Some apps had an optional in-app purchase, for example that more functions could be available through an upgraded version. This purchase function was logged in RIMS (input: paid services). However the functions were not analysed and logged in RIMS.

Collected tools in WP5-7 could also generate data related to more than one domain (functions related to purchase, preparation, consumption or lifestyle). The scientific profiles of those apps were analysed by the appropriate WP for each domain. The other profile (legal and technical) were analysed by the WP that collected the tool.

In response to the volume of data collection tools available in the market place for apps, criteria were established in order to limit inclusion of apps, while maintaining the aim to address a wide range of apps. Thus, the following inclusion criteria had to be satisfied:

- Currently available to users, due to be released in the near future, or in an advanced stage of development (i.e. information available in the public domain). For searches in iTunes the first 200 apps in the categories Food & Drink and Finance were assessed for possible inclusion.
- Search engine ranking. For searches in Google, with predefined search queries, the first 30 hits of each search query were assessed for possible inclusion.
- Meet the definition of purchase (see page 8)
- Able to collect consumer generated data on purchase at a personal, household and/or population level.

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#### 2.3.1 DESCRIPTIVE PROFILE

Data for the descriptive profile of the app was collected from the descriptions and screenshots provided on iTunes or Google Play and from information on the website of the app.

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#### 2.3.2 SCIENTIFIC PROFILE

Data for the scientific profile was collected as described below:

- Lifestyle and situational data was interpreted as; data where the consumer's actual location was logged (GPS data or venue name), if a product or a restaurant was preferred (e.g. a favourite function in the tool), if a food product was preferred (e.g.

favourite products on a shopping list), if the consumer could make an evaluation or comment (e.g. rating/reviewing a product or a restaurant), write notes (e.g. write own notes in a shopping list) or post (e.g. share a shopping list). Moreover, if the user could write notifications (e.g. push notifications) and/or connect to users (e.g. users which follow each other's posts, comments or other sorts of shared information like shopping lists) that was also logged as situational/lifestyle data

- Product characteristics of purchased products were collected based on information in the iTunes/Google Play description and screenshots as well as on the website of the app.
- Information about data integration with partner tool was searched for in privacy policy document. If the privacy policy mentioned specific partner tools (e.g. Facebook and Twitter) this information was collected. If no specific partner tools were mentioned "no information" was given.

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#### 2.3.3 SCIENTIFIC PROFILE: PURCHASE

Data for the purchase specific part of the scientific profile was collected from the iTunes/Google Play description, screenshots and from information on the website of the app. If no information could be found in the iTunes/Google Play description or on the website of the app in order to answer the questions What/Who/Why/How/Where – "no information" was given.

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#### 2.3.4 LEGAL PROFILE

Legal information was collected from the terms of use document and the privacy policy document. If no information could be found in the documents in order to answer the legal questions "no information" was given. "Yes" or "no" was only given when the information was clearly stated. This procedure was also applied for the technical profile.

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#### 2.3.5 TECHNICAL PROFILE

For the technical criteria Programmable web (<http://www.programmableweb.com/>) and Google search engine were used in order to answer the question if and how data from the tool was available via an API (Application Programming Interface).

## 5. Results - characterisation of apps according to typology

This section includes a description of the typology and the different categories as well as a general description of the (meta) data generated by the tools in each category. The search resulted in a list of 54 apps that represent those available in the current marketplace for apps. These apps can be said to fulfil at least one of the four categories mentioned in the typology which refers to what motivation it might be for the users; to gain “knowledge and understanding”, gain assistance with “planning and organisation”, “making a purchase” and/ or to gain “financial understanding” of a food purchase.

### 5.1 CHARACTERISATION OF APPS ACCORDING TO TYPOLOGY

Table 1 describes the final typology in more detail as it evolved and was finalized during the inventory process. The process started from a structure based on the definition of purchase and from the phases or steps which follow a purchase situation; meaning a pre-purchase phase, a point-of-sale action and also the evaluative part which is done after a purchase. Since the process of a purchase does not have to follow a linear structure, the typology was formed from a user perspective, driven by potential motivations where the consumer uses a tool to ease one or several steps in the process, e.g. a consumer could search for information and plan a purchase more than once before making a purchase (point-of sale). Examples of generated data and whether it was mainly actual or intentional are also described in table 1. For the phases of pre-purchase, data generated from consumers searching for prices, offers, reviews or specific products or creating shopping lists can be of interest even though no actual purchase was made.

Table 1. Typology description for food purchase and description of type of generated data of the collected tools in RIMS

Category: name and description	Sub category: name	Subcategory: function/s	Generated data
<p><b>Knowledge &amp; Understanding-</b></p> <p>Refers to the very first and initial phase of the purchase behaviour. The consumer searches for information before starting the next, more organisational step of the purchase planning activities. The information search is likely to include more information about purchase than what ends up in an actual point of sale.</p>	Searching for experiences	Tools showing consumers' ratings and/or reviews including scores and/or comments about food products and/or restaurant experiences. Some tools provide survey questions after a food purchase or a restaurant visit.	This data is generated by the individual consumer and also available to read by other consumers. Qualitative and quantitative data are generated.
	Searching for offers	Tools with deals, offers, vouchers and/or coupons which can be used in specific stores or restaurants or in stores by own choice.	Intentional purchase data, such as product, price and venue name. Data can also be generated about offers that are frequently searched for during specific times of the year, in different geographical areas etc.
	Comparing products & prices	Tools that provide the consumer with prices and product information from different stores/retails	Intentional purchase information, such as product name and price, product characteristics and venue name (stores and restaurants).
	Store & restaurant search/ locator	Tools with a search function in which the consumer can search for location of specific stores or restaurants via GPS function. Filters can often be used in order to tailor the search for different cuisines or find unique stores with specific products.	Intentional purchase data. Searching for retails and restaurants generate geographic mapping of where or what the consumer are interested to know more about. The data does not say if the information is for own use or someone else's.
<b>Planning &amp; Organisation</b>	Creating shopping lists	Food products/ items can be added on lists	Intentional purchase data. Generated data may vary in

<p>Refers to the phase when the plans for a purchase is decided but there is still a need for a bit more planning and organisation before the actual purchase and point of sale is made. The consumer has decided what to have for dinner, what restaurant to visit and/or how much money to spend on a dinner.</p>		<p>by manual input, by voice recording, by adding a photo, by scanning a barcode and/or directly from selected recipes. There are possibilities to comment, send and share lists, make a budget, count calories and estimate prices.</p>	<p>level of details, e.g. “milk”, “a package of milk” and “a litre of [brand name] milk”. For those tools where consumers can use the tools as a budget planner, count calories and estimate prices, intentional data about these aspects are also generated.</p>
	<p>Booking services</p>	<p>Tools for booking a table at a certain restaurant at a specific date and time</p>	<p>Intentional purchase data from a perspective of a potential restaurant visit. Generate the frequency of how often a consumer intends to eat out and plans to visit a specific restaurant or cuisines.</p>
	<p>Budgeting</p>	<p>Tools tracking the consumers’ expenses and income. A budget plan can be made. Expense data can be added by transactions, scanned receipts or by manual input. Some tools allow the user to share the budget. Purchases with cash money can either be included (e.g. by manual input or by scanning a receipt) or excluded for some tools</p>	<p>Generated data about consumer buying behaviour, when, where and how much money that is spent during a time period. It also reflects on how much money consumers intend and/or intended to spend on food purchases. From a RICHFIELDS perspective these data shows an intentionally and actual price tag on food purchases both on an individual and sometimes household level. The data can show buying behaviours over time.</p>
<p><b>Making a purchase-</b></p> <p>Refers to the actual point of sale. This includes the time where a purchase activity</p>	<p>Placing an order</p>	<p>Tools are often connected to a retail/grocery store and allow consumers to directly buy foods from groceries/stores/retails over the Internet.</p>	<p>Actual point of sale by online shopping or by a physical place i.e. restaurant/café or retail where you use the tool to spend money and pay your purchase. The generated data is an act and shows</p>

is taking place and the planned decision gets its consequences.		Some tools have functions such as shopping lists, special deals and vouchers to use when ordering. Ordering food online from a restaurant is also included in this group.	the financial effect and what, how much and when it has been purchased. However, the data says nothing about for whom the purchase was made for.
<b>Financial understanding-</b>  Refers to the follow-up after the purchase has been made. The amount of money that has been spent is tracked/logged.	Transactions	Tools which collect and show transactions conducted on banking account/s. It differs between the tools regarding the number of banking accounts that can be included. The tools collect transactions which have been conducted with credit and/or debit cards and in some tools the user is able to see how much credit that is used/left on the credit cards.	Generated data about consumer buying behaviour, when, where and how much money that is spent during a time period. From a RICHFIELDS perspective these data can reflect on buying behaviour over time, for instance potential differences between weekdays/weekends. The tools also generate data about where the purchases were made (geographically as well as what venue location).

A complete list and overview of apps in the inventory, together with their categorisations can be seen in Table 2. The apps are presented in alphabetic order and are marked with “X” in those categories where the tool has a function (and generate data).

The table is a schematic picture of the apps and what tools that has several or just one function. For instance making a purchase and financial understanding are either not presents, or they are mutually exclusive. Financial understanding is sometimes connected to budgeting, but not to any other columns of the typology such as in the categorization of increasing knowledge and understanding.

Four apps with purchase features were logged in RIMS by WP6 or WP7 as cross-linked to WP5. These apps were; Fat Flush Diet Plan & Meal Tracker Program, Reboot with Joe Juice Diet, The Monash University Low FODMAP Diet and Yummly recipes.

Finding gaps and connections between purchase apps as well as between the domains (purchase, preparation, consumption and life style) is useful information in the creation of the Richfields platform and will be a part of deliverable 5.5

Table 2. The collected food purchase apps and their classification according to typology, the table also show functions of each app.

Tool name in alphabetical order	Category		Knowledge & understanding				Planning & organisation			Making a purchase	Financial understanding
	Sub category		Searching for experiences	Searching for offers	Comparing products & prices	Store/restaurant search/ locator	Creating shopping lists	Booking services	Budgeting	Placing an order	Transactions
AnyList							X				
ASDA				X		X				X	
Avocadolist							X		X		
BritishSt.Food	X		X			X					
Checkbook											X
Coeliac UK					X	X					
Costa Coffee Club			X			X				X	
Domino's Pizza			X							X	
EWG's Healthy Living	X				X						
Fat Flush Diet Plan & Meal Tracker Program							X				
Find Me Coffee App	X					X					
Frankie and Benny's			X			X		X			
Frugl			X			X				X	
Goodbudget								X			X
Gousto	X									X	
Grain or No Grain					X						
Groupon			X			X				X	
Harden's Survey Edition	X					X		X			
HelloFresh										X	
IntelliList							X				
JUST EAT	X		X			X				X	

Lidl		X		X	X				
Lloyds Bank Mobile Banking									X
Michelin Restaurants	X			X		X			
Money Manager Pro							X		X
Morrisons Groceries								X	
mySupermarket		X	X		X			X	
Nespresso				X				X	
Ocado	X	X						X	
OnTrees							X		X
OpenTable		X		X		X			
Personal Banking							X		X
PizzaExpress		X		X				X	
Pocket Expense Personal Finance							X		X
Price It					X				
Quick Scan			X	X				X	
Reboot with Joe Juice Diet					X				
Shopmium		X							
ShoppingList 3					X				
SnipSnap Coupon App		X	X						
Spending Tracker							X		
Starbucks		X		X				X	
SurveyMini	X	X							
Tastecard	X	X		X		X			
TellSpec	X		X						
Tesco Groceries		X			X			X	
The Coupons App		X	X	X					
The Monash University Low FODMAP Diet					X				
UK Food Hygiene	X			X					
Untappd - Discover Beer	X			X					
Whole Foods Market		X		X	X				
Vivino Wine Scanner	X		X	X				X	
VoucherCodes.co.uk		X		X					
Yummly Recipes	X				X				

## 6. Discussion

The overall aim of RICHFIELDS is to design a Research Infrastructure for the collection, integration, processing and sharing of consumer-generated data as related to food behaviour and lifestyle determinants. It is crucial to give a structure of what kind of data is

available regarding food intake activities and consumer behaviour. The aim of this deliverable (D5.1) was to create an inventory of food purchase tools and to describe the methodologies based on the quality framework described in Deliverable 5.3.

The quality of the data generated by the collected apps in task 5.1 with respect to scientific relevance, legal governance and data management needs to be further investigated and will be more described in Deliverable 5.4 and 5.5 respectively.

What was found in this inventory was that most apps had functions that covered several phases in the purchase process. For example apps where the consumer was able to search for offers, search for a store (knowledge & understanding) and also create a shopping list (planning & organisation). Similar results are presented by Saarijärvi et al, 2014; where technological advances and customer mobility have created opportunities for serving customers in ways that go beyond the traditional exchange. Companies are provided with tools to extend their focus from goods to providing customers with additional support for their own processes.

For many apps the consumer-generated data could be classified as intentional and/or actual. For the phases of pre-purchase, data generated from consumers searching for prices, offers, specific products or creating shopping lists can be of interest even though no actual purchase was made. Moreover, a consumer books a table at an Italian restaurant, but that does not mean that he or she decide to visit the restaurant and purchase anything there. According to above, some apps with several functions (for example book a table and order take away food) have both intentional and actual data. The same is true for pictures (of for example a dish, a coffee or a cake) which can be interpreted as both intentional and actual; do I want to buy the pizza I uploaded or did I just buy it, or was it a friend of mine who bought it? Furthermore, data from a shopping lists (intentional data) compared to data from point-of-sales (actual data) could be interesting to combine in order to see the influence of the rational process and the non-rational part of the purchase process; what is actual being purchased from a structured list and what other items are being purchased (made on non-rational decisions).

The strength of using data from real time apps is the potential of more reliable data compared to data generated from questionnaires and traditional market research since consumers use apps in everyday life and avoid reactivity because they are taking part in a survey. However, the limitation is that data generated from apps is not representative consumer generated data with a potential overbalance of more technically interested, younger and higher socioeconomic status consumers. For example, it has been shown that people educated until the age of 20 or beyond were most likely to use home banking compared with respondents who finished education at the age of 15 or younger (Attitudes on Data Protection and Electronic Identity in the European Union, 2011). These attitudes and behaviours also need to be further studied in the next task (5.2).

Due to the number of apps included in this inventory, it was not feasible to download each of them for further inspections. For many apps, it was not possible to provide information on all quality criteria based on the information in iTunes or Google Play and on the website of the tool. Therefore, the content of the inventory might lack important information which has not been provided in the public domain by the vendors of the apps. Furthermore, it could have been that descriptions of all functions of an app have not been provided by the vendors of the tools thereby resulting in that an app was not selected and collected in RIMS during the search task. In our search no aggregators, wearables, or sensors (except a camera function in some apps) related to consumer purchase activities were found. It might be a limitation since the RI should be open to innovations. However we are confident that the type of information we are searching for can provide the RICHFIELDS design process with an overview of existing food purchase data collection tools and methodologies.

According to several research papers there is a requirement that all tools cover data ownership and data privacy in their licensing agreement, which the consumer accepts at the time of initial use (Cummings et al, 2013; Adhikari et al, 2014; Blenner et al., 2016). However, for some of the collected apps no available documents could be found on the associated website. And moreover, the available terms and privacy documents were not presented in a standardised way in either content or vocabulary and were therefore difficult to interpret for non-legal experts. A recent European study showed that almost six out of ten Internet

users usually read privacy statements, and the majority of those who read them adapt their behaviour on the Internet (Attitudes on Data Protection and Electronic Identity in the European Union, 2011). This needs to be taken into consideration when interpreting consumer food related behaviour/activities based on data from real time apps.

An important indicator of data quality is if the data can actually be accessed using a commonly used access protocol and the form of it (e.g. Email export, web feed, web API). For most purchase apps no web API was found by searching either on Programmable Web or on Google. This means that no data collected by the tool is directly accessible via the tools infrastructure (not via integrated aggregators). Whether consumers are willing to share/make their own data accessible for research such as RICHFIELDS RI needs to be further studied in the following task (5.2).

In summary, this inventory highlights the breadth of food purchase apps that collect consumer-generated data and a range of data collected by these apps. Furthermore, the feasibility of the quality framework developed in task 5.3 was tested. The range of the collected food purchase apps and methodologies is of high potential interest to the design of the future research infrastructure.

## 7. References

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