PROYECTOS DE INVESTIGACIÓN 2016

MEMORIA DEL PROYECTO Nº 08

1. DATOS DEL PROYECTO

Título: MEJORA DE LA RELACIÓN ENTRE EL BANCO DE ALIMENTOS DE ASTURIAS Y SUS EMPRESAS DONANTES

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Otros investigadores: Elena Montañés Roces; José Ramón Quevedo Pérez

Empresas o instituciones colaboradoras: Banco de Alimentos de Asturias (BAA), COGERSA, Alimerka, SECOT.

2. MEMORIA DESCRIPTIVA DEL PROYECTO

2.1 Resumen ejecutivo

En el contexto actual llama poderosamente la atención el contraste entre los crecientes problemas de desnutrición y malnutrición y el desperdicio de productos alimenticios en condiciones de ser consumidos.

Esta línea de trabajo, comenzada en 2012 y apoyada por ayudas específicas del IUTA durante 2013, 2014 y 2015, se centra en los bancos de alimentos, entidades sin ánimo de lucro que tratan de solucionar una parte de los problemas anteriormente citados.

En fases anteriores, se había dirigido una encuesta a la totalidad de bancos de alimentos españoles, se estudió con mayor detalle el caso del Banco de Alimentos de Asturias, se investigó a las entidades beneficiarias de dicho banco y a algunas de las unidades de convivencia receptoras de alimentos; asimismo, durante 2014 y 2015 se comenzó a estudiar a las entidades donantes, y a diseñar una herramienta informática para mejorar la gestión del banco.

Para 2016, manteniendo abiertos todos los frentes de investigación mencionados, se pretendía centrar la atención en el "aguas arriba" de la cadena logística, esto es, las entidades donantes de alimentos con relación al resto de agentes involucrados. Con mayor precisión, estos son los objetivos específicos propuestos, de los que solamente se pidió ayuda al IUTA para el número 3, y que no han sido alcanzados en su totalidad debido a que las actividades han comenzado con mucho retraso respecto a años anteriores (noviembre de 2016) por razones burocráticas ajenas al equipo de investigación:

1. Finalización del estudio de la población beneficiaria de las entidades no lucrativas que reparten alimentos procedentes del Banco de Alimentos de Asturias.
2. Estudio de la gestión interna del Banco de Alimentos de Asturias.
3. Ampliación del estudio sobre la potencialidad de donación de productos alimentarios por entidades que ya son donantes o que podrían serlo en mayor medida (industria agroalimentaria, empresas de catering, grandes restaurantes de cadenas hoteleras, etc.).

4. Finalización del desarrollo de las últimas funcionalidades de la aplicación web que gestiona las entradas y salidas del Banco de Alimentos de Asturias.
5. Integración de técnicas de inteligencia artificial para la ayuda a la toma de decisiones en el reparto de alimentos a las entidades beneficiarias.

La metodología ha mantenido el enfoque híbrido cuantitativo-cualitativo y participativo de años anteriores.

Todo ello se concretaba en la siguiente estructura de resultados esperados, de los que, de momento y por lo expresado más arriba, se pueden ofrecer logros parciales aunque mostrando avances considerables:

a) Resultados prácticos de carácter social: mejora de la cadena logística centrada en el Banco de Alimentos de Asturias, lo que se traduciría en la recuperación de más alimentos para más personas necesitadas y más adaptadas a sus necesidades concretas, especialmente en el concejo de Gijón.
b) Resultados académicos: difusión de los resultados del trabajo en congresos y publicaciones periódicas nacionales e/o internacionales consideradas de impacto.
c) Resultados de divulgación: aparte de lo mencionado en el punto anterior, difusión de resultados en la página web del IUTA y así como en las de las entidades colaboradoras (Banco de Alimentos de Asturias y otros bancos de alimentos españoles; espacio RSE de las páginas web de las empresas entrevistadas;…). Además, la propia metodología participativa incluye al menos un seminario, jornada o taller organizado por el IUTA al que se convocará a todos los agentes interesados (empresas donantes de alimentos o de servicios al Banco de Alimentos de Asturias, entidades sin ánimo de lucro beneficiarias del Banco de Alimentos de Asturias, etc.). Todo ello dará lugar a una mayor visibilidad social de todos los agentes implicados y de sus acciones, así como a un reforzamiento de sus relaciones mutuas.

2.2 Objetivos iniciales del proyecto y grado de consecución / 2.3 Tareas realizadas

En la tabla siguiente se han estructurado los objetivos que se indicaban en el epígrafe anterior, añadiendo las actividades propuestas en su día para alcanzarlos e indicando en cada caso el grado de consecución.

Al respecto, deben aclararse varios extremos importantes:

- Dada la relación directa entre objetivos y tareas, se ha decidido unir en un solo epígrafe lo que eran dos en el modelo propuesto por el IUTA, aunque se mantiene la numeración original de dichos epígrafes (2.2, 2.3).
- Como se indica en varias de las casillas de la columna de la derecha de la tabla, la parte subvencionada del proyecto ha comenzado con gran retraso respecto a otros años (noviembre de 2016) por razones burocráticas ajenas al equipo de investigación, lo que ha obligado a retrasar una parte de las tareas previstas.
- En consecuencia, en el epígrafe 2.4 de esta memoria se expresan unos resultados actuales pobres, excepto en lo que corresponde al campo académico. No obstante, el ritmo de trabajo es adecuado, de forma similar a años previos.
- Casi todo lo conseguido respecto a lo planeado (objetivos, tareas y resultados) ha tenido que ser ejecutado con recursos ajenos a la subvención concedida por el IUTA.

	Tareas	Grado de consecución
Objetivo 1	**1.1.** Encuestar a las unidades de convivencia independientes receptoras de entidades de reparto (ER) beneficiarias del Banco de Alimentos de Asturias a las que aun no se había accedido	> 80% (Hasta el momento, se ha encuestado a un número relevante de ER de Avilés, Oviedo, Gijón y otras localidades asturianas; aún falta completar estas poblaciones y abordar otras)
	1.2. Taller participativo para discutir los resultados de dichas encuestas	10% (Mencionados resultados generales en taller habido el 1-12-16 **[ANEXO 5]**; se profundizará en otro taller en 2017 cuando se disponga de más encuestas)
Objetivo 2	**2.1.** Observación directa no participante	100% (Mediante un proyecto fin de carrera específico ya defendido, de cuyos resultados tangibles puede destacarse un manual de procedimientos que está comenzando a ser utilizado en el BAA)
	2.2. Observación participante	
	2.3. Análisis de documentación interna del Banco de Alimentos de Asturias	
	2.4. Taller participativo para discutir resultados provisionales y propuestas de mejoras	100% (2 talleres: 17-6-2016 en la sede del Banco de Alimentos de Asturias; 1-12-2016 en la Escuela Politécnica de Ing. de Gijón, organizado por el IUTA)
Objetivo 3	**3.1.** Analizar el contenido de las memorias de RSE de empresas del sector agroalimentario donantes del BAA no estudiadas en la fase anterior (2015)	100% (Realizado como parte de un TFG en curso)
	3.2. Entrevistas en profundidad a empresas del sector agroalimentario donantes del BAA de Asturias no estudiadas en la fase anterior	20% (Solamente realizada una entrevista de varias previstas dentro de un TFG en curso
	3.3. Entrevistas en profundidad y encuestas en cadenas comerciales potenciales donantes del BAA	50% (Realizado estudio de hipermercados mediante un TFM ya defendido; pendientes otros sectores, como supermercados, restaurantes, farmacias...)
	3.4. Encuestas a potenciales donantes de alimentos cocinados y/o precocinados, como empresas de catering y grandes restaurantes en cadenas hoteleras	100% (Realizado mediante un proyecto fin de carrera ya defendido)
	3.5. Taller participativo para discutir los resultados de las tareas anteriores y cotejarlos con los datos obtenidos en las tareas de los dos objetivos anteriores	100% (Taller dentro de jornada con organizaciones receptoras del BAA y otras entidades, celebrado el 1-12-2016 en la Escuela Politécnica de Ingeniería de Gijón, organizado por el IUTA)
Objetivo 4	**4.1.** Desarrollar las últimas funcionalidades de la aplicación web que gestiona las entradas y salidas del Banco de Alimentos de Asturias que fueron concretadas en las últimas reuniones mantenidas con miembros del Banco de Alimentos de Asturias	100% (Completado y considerablemente mejorado el diseño de la interfaz tras diferentes validaciones por parte de miembros del BAA; perfilados detalles e introducidas modificaciones que permitieron ampliar la capacidad de gestión de los procesos implicados; pruebas exhaustivas de la base de datos y de la aplicación web)
	4.2. Taller participativo para pruebas de la aplicación web en cuanto a su funcionalidad y usabilidad	100% (Varias sesiones, con una central el 17-6-2016 en la sede del Banco de Alimentos de Asturias)
Objetivo 5	**5.1.** Analizar la información introducida en la base de datos para obtener resúmenes, gráficos o tablas que sirvan de ayuda para la toma de decisiones en el BAA	100% (Incluido módulo de búsquedas en las bases de datos configurables en aspectos indicados por los miembros del BAA, para generar informes, y gráficos resumen de barras y de sectores, y guardarlos en formato PDF)
	5.2. Desarrollo de un sistema de recomendación de reparto de alimentos del BAA	100% (Implementado módulo basado en técnicas de IA que establece recomendaciones en la distribución de alimentos en un reparto: qué alimentos y qué cantidades de los mismo resultan adecuadas incluir en un reparto, teniendo en cuenta el stock del BAA y las decisiones de expertos tomadas en repartos anteriores; incorporada así mismo funcionalidad que permite retroalimentar el sistema para que todos los repartos que se vayan realizando y las modificaciones que incorpore el experto en ellos sirvan para mejorar las recomendaciones propuestas por el sistema en repartos posteriores)
	5.3. Taller participativo durante la segunda mitad del año para discutir la información recogida y la propuesta de reparto, y cotejarlas con los datos obtenidos en las tareas del resto de objetivos	100% (Varias sesiones, con una central el 17-6-2016 en la sede del Banco de Alimentos de Asturias)

2.4 Resultados obtenidos

La tabla siguiente resume el grado de consecución de los resultados expresados en el epígrafe 2.1.

<table>
<tr><th>Resultados</th><th colspan="2">Indicadores</th></tr>
<tr><td>a) Resultados prácticos de carácter social</td><td colspan="2">- Algunas recomendaciones propuestas en fases anteriores de esta línea de investigación han sido puestas en práctica por el BAA y una parte de sus entidades receptoras.
- La aplicación web diseñada para mejorar la relación del BAA con sus entidades beneficiarias ha comenzado a ser utilizada.
- El manual de procedimientos redactado para mejorar la gestión logística interna del BAA ha sido incorporado a la institución.
- Una parte de la experiencia de esta línea de investigación ha fundamentado que las empresas COGERSA, SADIM y ABAmobile hayan obtenido financiación del Instituto de Desarrollo Económico del Principado de Asturias (IDEPA) a través del programa para proyectos Tractores o Diferenciales 2015 para el proyecto SmartWasteCollection (http://www.cogersa.es/metaspace/portal/14498/50330). El equipo beneficiario de ayudas del IUTA en años anteriores, junto a otros miembros de la Universidad de Oviedo, ha sido contratado para realizar labores de consultoría en el marco de este proyecto.</td></tr>
<tr><td rowspan="4">b) Resultados académicos</td><td rowspan="2">Contribuciones a congresos académicos</td><td>Coque, Jorge; González-Torre, Pilar L.; Fernández Alonso, Joaquín. “CSR by means relationships among cooperatives, capitalist firms and non-profit organizations: experiences recovering food”. Comunicación en International Co-operative Alliance International Research Conference (New strategies for co-operatives: understanding and managing co-operative creation, transition and transformation). Almería, mayo de 2016 [ANEXO 1]</td></tr>
<tr><td>González-Torre, Pilar L.; Coque, Jorge; Robles Gullón, Ana. “Residuos alimentarios vs donaciones: el caso asturiano de las plazas de abastos”. Comunicación en XXVI Congreso de la Asociación Científica de Economía y Dirección de la Empresa (ACEDE): Organizaciones y personas en evolución. Vigo, junio de 2016 [ANEXO 2]</td></tr>
<tr><td rowspan="2">Artículos en publicaciones periódicas indexadas</td><td>González-Torre, Pilar L.; Coque, Jorge (2016): “How is a food bank managed? Different profiles in Spain”, Agriculture and Human Values, 33(1): 89-100 [ANEXO 3]</td></tr>
<tr><td>González-Torre, Pilar L.; Coque, Jorge (2016): From Food Waste to Donations: The Case of Marketplaces in Northern Spain”, Sustainability, 8: 575-596 [ANEXO 4]</td></tr>
<tr><td>c) Resultados de divulgación</td><td colspan="2">Con referencia a contenidos de las casillas anteriores de este mismo cuadro y del cuadro anterior, puede destacarse lo siguiente:
– Publicidad indirecta que esta línea de investigación está recibiendo en las acciones de divulgación del proyecto SmartWasteCollection, con abundante presencia en redes sociales y medios de comunicación convencionales.
– Publicaciones académicas.
– Talleres participativos con diversos agentes del sector estudiado: Banco de Alimentos de Asturias, entidades receptoras de alimentos, entidades donantes o colaboradoras… [ANEXO 5]</td></tr>
</table>

2.5 Trabajos o necesidades futuras

Para completar el trabajo en curso, se han programado las siguientes tareas, parte de las cuales ya están en marcha:

- Finalizar las encuestas a unidades de convivencia receptoras de entidades beneficiarias del Banco de Alimentos de Asturias.

- Realizar estudios sobre la potencialidad de recuperación de alimentos en cadenas de supermercados implantadas en Asturias, similar a los hechos en plazas de abastos, empresas de catering, grandes hoteles y cadenas de hipermercados.
- Finalizar el estudio del sector agroalimentario donante del Banco de Alimentos de Asturias, mediante entrevistas en profundidad adicionales.
- Organizar un taller participativo durante 2017, con asistencia de representantes de todas las organizaciones estudiadas (Banco de Alimentos de Asturias, entidades no lucrativas beneficiarias, empresas donantes…) para discutir los resultados alcanzados hasta ese momento, validarlos (o, en su caso, corregirlos) y proponer desarrollos para el siguiente periodo.

2.6 Divulgación de los resultados (publicaciones, artículos, ponencias…)

Al final del epígrafe 2.4 se ha dado cuenta de este punto.

3. MEMORIA ECONÓMICA

Financiación		Personal	Inventariable	Fungible	Otros gastos
IUTA	SV-16-GIJÓN-08	4.100			
Otras fuentes	Dpto. Admón. de Empresas Universidad de Oviedo		250 €	150 €	
	Proyecto MEC DPI2013-41469-P				2.500 €
Estudiante con ayuda a la investigación	Nombre	Celia de las Heras García			
	Tareas	– Entrevistas y/o encuestas a cadenas comerciales u otras empresas donantes (o potenciales donantes) del Banco de Alimentos de Asturias – Análisis de información primaria y secundaria – Intervención en talleres con entidades estudiadas para devolución participativa y contraste de la información obtenida			
	Período	21 de noviembre de 2016 a 30 de junio de 2017			

4. OTROS PROYECTOS Y CONTRATOS CON FINANCIACIÓN EXTERNA

Título del proyecto/contrato	Análisis y diseño de redes logísticas eficientes, robustas y sostenibles
Referencia	DPI2013-41469-P
Investigador/a/es principal/es	Belarmino Adenso Díaz Fernández y Pilar L. González Torre
Equipo investigador	Jorge Coque Martínez Belarmino Adenso Díaz Fernández Santiago García Carbajal Pilar Lourdes González Torre Ester Gutiérrez Moya Sebastián Lozano Segura
Periodo de vigencia	2013-2016
Entidad financiadora	Ministerio de Economía y Competitividad
Cantidad subvencionada	42.000 euros

[**ANEXO 1**]

Coque, Jorge; González-Torre, Pilar L.; Fernández Alonso, Joaquín. “CSR by means relationships among cooperatives, capitalist firms and non-profit organizations: experiences recovering food”. Comunicación en *International Co-operative Alliance International Research Conference (New strategies for co-operatives: understanding and managing co-operative creation, transition and transformation)*. Almería, mayo de 2016.

Portada: mención expresa a financiación recibida del IUTA (resaltado mediante fondo amarillo).

UNIVERSIDAD DE ALMERÍA · International Co-operative Alliance Committee on Co-operative Research · CÁTEDRA COEXPHAL

ICA 2016 ALMERÍA

NEW STRATEGIES FOR CO-OPERATIVES:
UNDERSTANDING AND MANAGING CO-OPERATIVE CREATION, TRANSITION AND TRANSFORMATION

CSR by means relationships among cooperatives, capitalist firms and non-profit organizations: experiences recovering food

Bancos de Alimentos · Food Banks Canada · FOOD BANK · FEEDING AMERICA

Funded by Spanish Economy and Competitiviness Ministry (DPI2013-41469-P)
& University Institute of Industrial Technology of Asturias –IUTA- (SV-15-GIJÓN-1-11)

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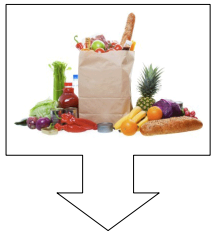
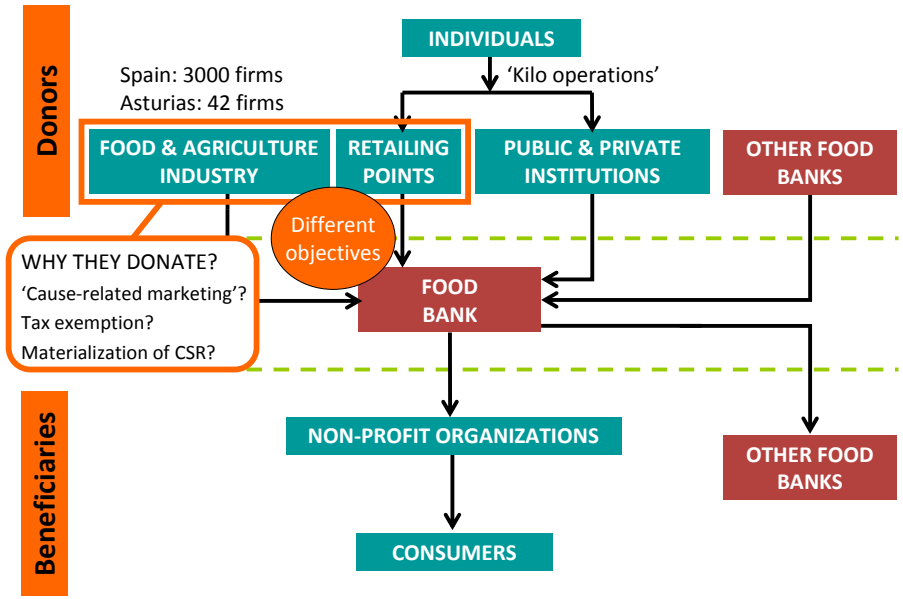
CSR by means relationships among cooperatives, capitalist firms and non-profit organizations: experiences recovering food

INTRODUCTION
THEORETICAL FRAMEWORK
METHODOLOGY
RESULTS
CONCLUSIONS

- Nearly 1,000 million people worldwide at risk of malnutrition, hunger or starvation
- Spain: 40% population < 8,000€/year; ≈ 30,000 families with children suffer from hunger
- 1/3 (EU: 50%) of the food is lost or wasted all along the supply chain
- Food banks: NPOs to deal with part of this problem
  - recuperating food (donors → beneficiaries)
  - sensitizing population against waste and social inequality





Food and agriculture sector as a donor of the Food Bank of Asturias (2013)

530,000 kg donated

32% of the total donations

TYPE OF FOOD	QUANTITY (kg)
DAIRY PRODUCTS	202,216
FRUITS	154,890
BEVERAGES	69,856
VEGETABLES	47,630
LEGUMES	21,408
CEREALS	9,150
OILS AND FATS	3,884
MEATS AND DERIVATIVE PRODUCTS	3,600
SUGARS AND SWEETS	2,265
EGGS	1,106
FISHES AND DERIVATIVE PRODUCTS	294

BIBLIOGRAPHIC AND EMPIRICAL PREPARATION

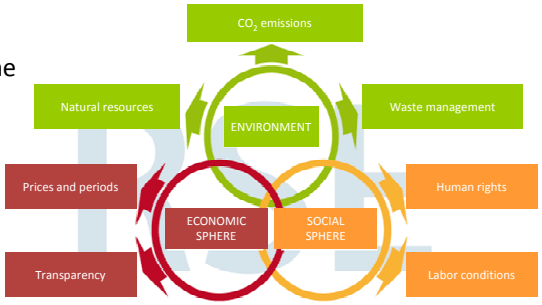
Previous researches + academic sources on food banks and CSR

CONTENT ANALYSIS

Corporate Social Responsibility reports from the web sites of 10 firms of food and agriculture sector (including 2 cooperatives) who donate to the Food Bank of Asturias (FBA)

CORPORATE SOCIAL RESPONSIBILITY

- ✓ Need to show business activity toward the society
- ✓ Restore to society a part of the resources received
- ✓ Part of the strategic management
- ✓ Internal/external direct/indirect stakeholders' influence on business
- ✓ Voluntary nature vs. standardization



ISO AENOR Forética EFQM SAI SOCIAL ACCOUNTABILITY INTERNATIONAL fundación masfamilia GRI Empowering Sustainable Decisions

Sample unities: 10 CSR memories on internet

Code	Sub-sector	Geographic scope	Position in the supply chain
HIPER1	Chains of hypermarkets	National	Retailer
HIPER2		International	
HIPER3		National	
HIPER4			
INDUS1	Food industries	National	Producer
INDUS2		International	
INDUS3			
INDUS4			
SUPER1	Chains of supermarkets	National	Retailer
SUPER2		International	

CODING: Responsibility Spreading Index (IDR)

TOPIC AREAS	Content categories
LOCAL SOCIETY AND COMMUNITY (IDR_S)	Policies, statements and social management systems (ISR_{S1})
	Participation in society (ISR_{S2})
	Donations of food (ISR_{S3})
CLIENTS AND PRODUCTS (IDR_C)	Sustainable consumption
	Consumer healthy protection
	Customer support services
	Other information
EMPLOYEES (IDR_P)	Workplace health and safety
	Human development and training
	Work conditions and social protection
	Other information
ENVIRONMENT (IDR_M)	Policies, statements and environment management systems
	Conservation and sustainable use of resources
	Pollution prevention: investments and regulation compliance
	Mitigation of environment impact: products

- Definition of social objectives (IDR_{S11})
- Awards and certificates (IDR_{S12})
- Participation in forums (IDR_{S13})

CODING: Responsibility Spreading Index (IDR)

Score	Interpretation	Criteria
0	The company does not broadcast information on this item	This item is not mentioned
1	The information broadcasted on this element is of type qualitative (expressed in non-numeric form)	Existence of public commitment through conventions, agreements, or business policies; and it is communicated in a generic way
2	The information broadcasted on this element is of type quantitative (expressed by means of figures)	Information on results achieved is shown in numerical form

- ✓ *Thematic broadcasted beyond the natural environment: category customers (Cause-related marketing) followed by category society (visibility)*
- ✓ *Greater attention to indirect context (society and natural environment) than to direct stakeholders (customers and employees)*
- ✓ *Domestic companies with higher spreading index than international ones*
- ✓ *Hypermarkets and production companies more involved in communicating*
- ✓ *Domestic companies more directly involved with FBA and FESBAL*
- ✓ *Supermarkets and hypermarkets involved in kilo operations*
- ✓ *Production companies greater emphasis than supermarkets and hypermarkets in promotion of healthy eating habits*

- ✓ *No remarkable differences between capitalist and cooperative firms*
- ✓ *All the reports mention the donation of food*
- ✓ *Poor information on social assistance programs (amounts allocated, number of beneficiaries, types of donated food, motivation for these activities beyond the mere results,…)*
- ✓ *Limited use of international standards (ISO 26000, GRI…)*

LIGHTS AND SHADOWS

- ☒ *Only 10/42 companies spread their CSR by means of reports (they are SMEs, lack of incentives)*
- ➢ *OBJECTIVES:*
  1. *'Cause-related marketing':*
     - ☑ *Agreements with non-profit entities*
     - ☒ *Poor information*
  2. *Tax exemption: Special Regime of 49/2002 Act*
  3. *Materialization of CSR:*
     - ☑ *Specific management system within the strategy of several companies*
     - ☑ *Special concern for the communities of its scope*
     - ☒ *Most of the reports do not conform to international standards*

¿? *Research still exploratory → Need of deepen this information through interviews and surveys*

[**ANEXO 2**]

González-Torre, Pilar L.; Coque, Jorge; Robles Gullón, Ana. “Residuos alimentarios vs donaciones: el caso asturiano de las plazas de abastos”. Comunicación en *XXVI Congreso de la Asociación Científica de Economía y Dirección de la Empresa (ACEDE): Organizaciones y personas en evolución*. Vigo, junio de 2016.

Página 24: mención expresa a financiación recibida del IUTA (resaltado mediante fondo amarillo).

XXVI CONGRESO NACIONAL DE ACEDE
JUNIO 2016, VIGO

RESIDUOS ALIMENTARIOS VS DONACIONES: EL CASO ASTURIANO DE LAS PLAZAS DE ABASTOS

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XXV CONGRESO NACIONAL DE ACEDE
JUNIO 2016, VIGO

RESIDUOS ALIMENTARIOS VS DONACIONES: EL CASO ASTURIANO DE LAS PLAZAS DE ABASTOS

Resumen

La tendencia actual del número de personas necesitadas de ayuda para satisfacer necesidades básicas como la alimentación es creciente. Ante esta situación y en periodos de crisis, entidades como los bancos de alimentos cobran mayor protagonismo en este propósito social. En este contexto la presente investigación se centra en los mercados de abastos por ser grandes generadores de residuos orgánicos ya que casi todos sus establecimientos se dedican a la alimentación. El trabajo combina técnicas cualitativas (entrevistas a responsables de la mayor parte de los mercados de abastos asturianos y a inspectores de sanidad, así como un taller participativo con diversos agentes relacionados con la recuperación de alimentos) y cuantitativas (encuesta masiva dirigida a los puestos de los mercados donde se realizaron las entrevistas). Los resultados alcanzados permiten estimar el volumen de residuos orgánicos generados por estos mercados y proponer unas pautas que facilitarían gestionar mejor los excedentes con potencialidad de aprovechamiento, en primer lugar, como donaciones a bancos de alimentos y, en segundo, como biorresiduos valorizables.

Palabras clave:

Mercados/plazas de abastos; bancos de alimentos, biorresiduos, donaciones, Asturias

Área temática propuesta

Dirección de operaciones y tecnología: Gestión ambiental

Área temática alternativa

Dirección de operaciones y tecnología: Gestión de la cadena de suministro

RESIDUOS ALIMENTARIOS VS DONACIONES: EL CASO ASTURIANO DE LAS PLAZAS DE ABASTOS

1. ANTECEDENTES Y JUSTIFICACIÓN

Millones de personas en todo el mundo viven por debajo del umbral de pobreza. En 2010, el 21% de personas en países en desarrollo vivía con 1,25 dólares al día o menos (Banco Mundial, 2015). En particular, en el periodo 2011-2013 842 millones de personas (un octavo de la población mundial) sufrían hambre crónica. A causa de la última crisis económica, los avances parecen ralentizarse a la vez que aumentan las diferencias geográficas, que afectan incluso a países industrializados como España (Naciones Unidas, 2014).

En contraste con este panorama de necesidades básicas insatisfechas se observan fenómenos de pérdidas y de desperdicios de alimentos. Las primeras, las pérdidas de alimentos, se definen como la disminución de la masa de productos comestibles por los seres humanos en las etapas de producción, post-cosecha y procesamiento de la cadena de suministro; por su lado, las mermas que ocurren al final de la cadena se conocen como desperdicios de alimentos y están relacionadas con el comportamiento inadecuado de vendedores minoristas y consumidores (Parfitt *et al*., 2010). Alrededor de un tercio de los alimentos producidos para el consumo humano se pierde o desperdicia, lo que representa unos 1.300 millones de toneladas al año (FAO, 2012). En los países de ingresos más altos, los alimentos principalmente se desperdician, lo que significa que se tiran siendo todavía aptos para el consumo humano. En los países de ingresos bajos, por el contrario, las pérdidas superan claramente en cuantía a los desperdicios, lo que denota carencias tecnológicas.

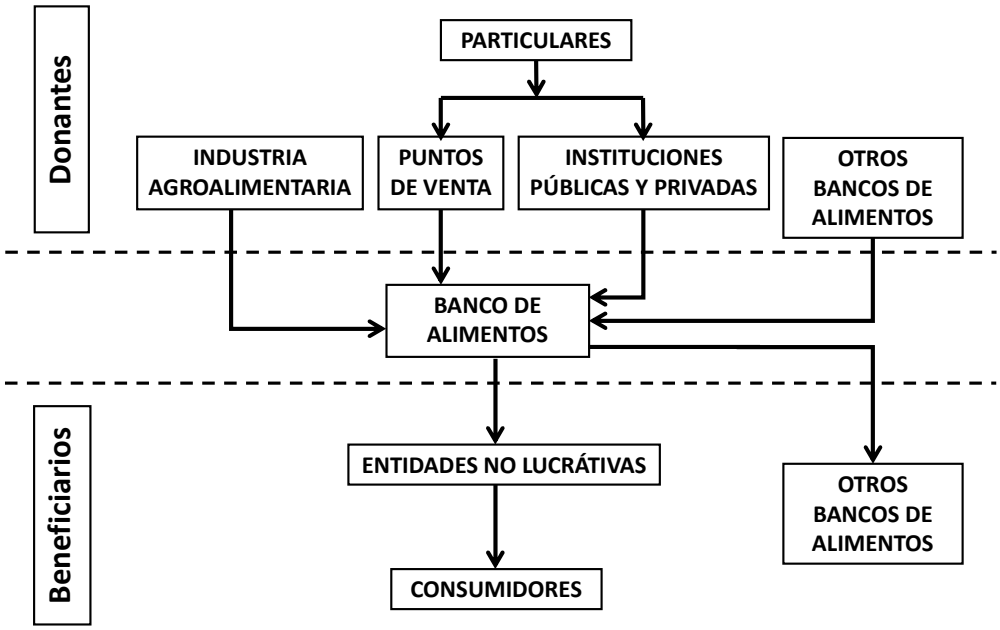
Según el Boletín Oficial de las Cortes Generales (2015), más de 100 millones de toneladas de alimentos fueron desperdiciados en Europa durante 2014. España es el sexto país europeo que más comida desperdicia (unos 8 millones de toneladas) tras Alemania, Holanda, Francia, Polonia e Italia (MAGRAMA, 2013a), siendo la causa mayoritaria las sobras que se producen durante las comidas en la etapa de consumo (86,4%) (HISPACOOP, 2012), mientras que en la distribución las principales razones son productos no perecederos mal etiquetados, pedidos anulados, finales de línea, promociones finalizadas, artículos dañados aptos para el consumo o embalajes incorrectos (Alexander y Smaje, 2008).

Frente a esta problemática, y especialmente dentro de sociedades desarrolladas, adquieren un papel crucial los bancos de alimentos, entendidos como "organizaciones sin ánimo de lucro basadas en el voluntariado y cuyo objetivo es recuperar excedentes alimenticios de nuestra sociedad y redistribuirlos entre las personas necesitadas, evitando cualquier desperdicio o mal uso" (Starkey *et al.*, 1998;Starkey *et al.*, 1999). Además de la definición anterior, a lo largo de la literatura son diversos los autores que han tratado de definir dicho concepto. Para Cotugna *et al*. (1994) son almacenes que recogen las

donaciones de excedentes alimentarios y los distribuyen a otras organizaciones no lucrativas, siendo esta última idea relativa a la distribución objeto de otros trabajos como el de Martins *et al*. (2011). Handforth *et al*. (2013) señalan que los alimentos recogidos y distribuidos por este tipo de entidades son normalmente productos envasados, frescos o congelados así como bebidas.

De las definiciones anteriores se deduce que los bancos de alimentos mantienen un puente entre los excedentes alimentarios de las industrias productoras y las necesidades humanas más inmediatas, convirtiendo los alimentos en recursos solidarios. Cada banco de alimentos depende de lo que le aportan sus "proveedores" (empresas donantes y otras entidades), y con ello satisface la parte de la demanda que puede de sus "clientes" (entidades beneficiarias) (figura 1).

Figura 1. Posición de los bancos de alimentos en la cadena logística (Coque *et al.*, 2012)



En España hay aproximadamente un banco de alimentos por provincia, lo que hace un total de 55 entidades en todo el país (FESBAL, 2015). El Banco de Alimentos de Asturias, creado en el año 1997, cubre actualmente las necesidades de unas 27.000 personas a través de cerca de dos centenares de entidades sociales no lucrativas (Banco de Alimentos de Asturias, 2015).

Esta investigación se centra en los mercados de abastos de Asturias como grandes productores de residuos derivados de productos frescos y, por tanto, como potenciales centros donantes de alimentos a colectivos necesitados a través del banco de alimentos de la región. Se incorpora asimismo la colaboración de COGERSA (Consorcio para la Gestión de Residuos Sólidos de Asturias) que se enfrenta a varios retos con relación al desperdicio de alimentos, todos ellos con el objetivo común de disminuir el depósito de biorresiduos en el vertedero. Estos últimos se definen como los desechos biodegradables de jardines y parques, residuos alimentarios y de cocina de hogares, restaurantes, servicios de restauración colectiva y establecimientos de venta al por menor, así como otros restos similares procedentes de plantas de procesado de alimentos (artículo 3 de la Ley 22/2011).

Un mercado de abastos es un conjunto de establecimientos detallistas, generalmente de alimentación, agrupados normalmente en un edificio de notable interés histórico-artístico (MINETUR, 2005). Una solución para la gestión de los restos de los alimentos que se comercializan en estos establecimientos sería la separación de los sobrantes en dos partes: en primer lugar, se apartarían los productos aprovechables por colectivos beneficiarios de entidades como el Banco de Alimentos de Asturias; y aquellos que no pueden ser reutilizados se tirarían a un contenedor específico para biorresiduos.

Existen experiencias relevantes de recuperación de alimentos perecederos en este ámbito en nuestro país entre las que destacan las de los mercados municipales de Cornellá de Llobregat (Barcelona) y de Torredembarra (Tarragona), cuyos ayuntamientos coordinan todas las fases necesarias para su implantación. En el primer caso, el transporte de los alimentos se llevó a cabo a través de voluntarios de Cruz Roja, siendo el destinatario final la Botiga Solidària, que ayuda a más de 600 familias. Respecto al de Torredembarra, se trata de un mercado semanal de fruta y verdura cuyos excedentes se destinan al Rebost dels Aliments de Torredembarra, una entidad perteneciente a Cáritas y que atiende a alrededor de 200 familias. Durante la experiencia llevada a cabo en 2013, se recogieron 2.571 kg de alimentos en el Mercado de Cornellá y 5.103 en el de Torredembarra, lo que supuso en términos económicos 8.237 € en el primero caso y 10.425 € en el segundo (Maestre Montserrat y Puig Ventosa, 2014).

2. OBJETIVOS

Dentro de un marco más extenso de investigación sobre la situación, gestión y potencialidades de los bancos de alimentos españoles, el presente trabajo se centra en el primer eslabón de la cadena de suministro (figura 1) dedicándose a los grandes productores de residuos agroalimentarios, concretamente los mercados de abastos de Asturias como fuente de alimentos para colectivos necesitados.

En otros términos, se trata de abordar la siguiente pregunta de investigación: ¿Encierran los mercados de abastos asturianos una potencialidad interesante para recuperar residuos orgánicos, ya sea como alimentos o como biorresiduos valorizables? En caso de una respuesta afirmativa, se plantearán otras cuestiones como ¿qué cantidades se están recuperando? o ¿cómo se podrían mejorar dichas cifras?

Como objetivos específicos, para responder a la/s pregunta/s de investigación antes planteada/s, se establecieron los siguientes:

- Realizar un estudio logístico de los mercados de abastos de Asturias, centrándose en su gestión de residuos para facilitar la recogida separada de alimentos aptos para donaciones a entidades como el Banco de Alimentos de Asturias o de biorresiduos valorizables.

- Elaborar unas pautas para gestionar mejor los excedentes alimentarios así como los residuos y, en particular los biorresiduos, en este tipo de áreas comerciales.

3. METODOLOGÍA

Para alcanzar los objetivos propuestos se ha aplicado una combinación de diferentes herramientas metodológicas:

- Revisión bibliográfica y documental: recopilación de estudios previos relativos a los temas centrales del proyecto (datos de pobreza y hambre; pérdidas y desperdicios de alimentos; bancos de alimentos y recuperación de alimentos; mercados de abastos).

- Opinión de expertos: reuniones con personas en diferentes entidades (COGERSA; Banco de Alimentos de Asturias; algunas de las entidades beneficiarias de dicho banco; Fundación Alimerka, como representante del sector de la distribución alimentaria).

- Estudio cualitativo mediante entrevistas a representantes de la mayoría de los mercados de abastos de Asturias y a inspectores de sanidad, así como un taller participativo.

- Estudio cuantitativo mediante encuestas a los establecimientos ubicados en los mercados de abastos en los que se realizaron las entrevistas del estudio cualitativo.

4. FASES DEL ESTUDIO EMPÍRICO

4.1. Análisis cualitativo

Inicialmente se pretendió obtener un panorama de la situación actual de los mercados de abastos asturianos haciendo hincapié en su gestión de residuos y, especialmente, en la fracción orgánica de los mismos; por ello se optó por un análisis cualitativo de carácter exploratorio.

Efectivamente, los métodos de investigación cualitativos contribuyen al conocimiento de sistemas organizacionales o sociales teniendo en cuenta contextos y fenómenos difusos, proponiendo soluciones adecuadas para situaciones particulares y ofreciendo descripciones que fundamenten posteriores generalizaciones (Sherman y Reid, 1994;Yin, 2009).

Ello no obsta al rigor de los procesos de trabajo. En este caso, se contrastaron los datos recogidos (opiniones de personas entrevistadas y documentación aportada por estas) mediante varios instrumentos aplicados secuencialmente que garantizan la validez externa, la validez interna y la fiabilidad de la investigación (Gibbert *et al*., 2008):

- Saturación de información, mediante ocho entrevistas en profundidad a informantes relacionados con los mercados de abastos diferentes entre sí y, por tanto, complementarios: gerentes,

administradores u otras personas (en los casos en los que no se disponía de alguien encargado exclusivamente de la gerencia del mercado), además de dos inspectores de sanidad. Las entrevistas se realizaron de forma personal y siguiendo un cuestionario semiestructurado consensuado con personal del equipo de investigación de la Universidad de Oviedo, de COGERSA y del Banco de Alimentos de Asturias. La duración de las entrevistas, realizadas entre octubre de 2014 y abril de 2015, fue de entre quince y treinta minutos.

- Codificación. Se emplearon las dos formas de codificar de Strauss y Corbin (1998). En primer lugar, se utilizaron códigos abiertos, es decir, tras una primera lectura de las entrevistas se señalaron palabras o trozos de texto que llamaban la atención. En segundo lugar, se procedió a realizar una codificación axial, es decir, una segunda lectura que permitió generar categorías y subcategorías, así como la relación entre ellas.

- Discusión en el equipo de investigación. Cada miembro elaboraba su propio mapa de categorías por separado con base en la trascripción de las entrevistas, que posteriormente era contrastado y discutido con el resto hasta alcanzar visiones consensuadas.

- Contraste y complementación de las entrevistas mediante fuentes documentales: planos, listados con puestos y actividades, y memorias con información general de los mercados.

- Contraste adicional mediante taller (2 de diciembre de 2014) para devolución y profundización de resultados provisionales del estudio cualitativo. Ese taller fue moderado por el equipo de la Universidad de Oviedo y concebido desde una óptica de investigación-acción participativa. Tal enfoque metodológico parte del compromiso social directo del mundo académico, del investigador frente al investigado, cuyos respectivos papeles tradicionales de sujeto y objeto de estudio se difuminan e intercambian al construir la verdad juntos (Díez, 2013). Durante estos procesos, los investigadores aportan apoyo a la comunidad (aquí, el Banco de Alimentos de Asturias con sus entidades beneficiaras y otros agentes “aguas arriba” de la cadena) en el análisis de sus problemas, formándose mutuamente.

- En concreto, la fiabilidad ha sido asegurada gracias a la construcción previa de un marco teórico tentativo, que aportó los contenidos y la estructura del guión de las entrevistas, a la grabación y transcripción de estas y, en general, a la sistematización de toda la información recogida y al seguimiento de un protocolo riguroso durante la totalidad del proceso.

Entrevistas a gestores de mercados de abastos

El censo, formado por un total de 14 mercados en la región, se estableció consultando un directorio público (Mercados Municipales, 2014), que fue comprobado y completado mediante consultas vía Internet y llamadas telefónicas. La unidad de análisis de este estudio era la unidad de gestión de los

mercados de abastos de cada concejo. Se contactó telefónicamente con todos los ayuntamientos (en el caso de que el mercado fuera de titularidad municipal) y con los gerentes y responsables de los mercados pertenecientes a los 12 concejos implicados. Finalmente, se consiguió entrevistar a 8 personas con relación a 9 mercados situados en 7 concejos diferentes (primera columna de la tabla 2). Es importante destacar que se incluyeron en el estudio tanto los mercados municipales como aquellas fórmulas comerciales similares a ellos pero de propiedad privada (ambos comparten las características de mercados cubiertos y de carácter permanente, de alimentación fresca o perecedera, en el que el cliente es el consumidor final). La tabla 1 esquematiza los bloques conceptuales básicos del guión utilizado en las entrevistas.

Tabla 1. Guión de las entrevistas a responsables de mercados de abastos (Elaboración propia)

BLOQUES	CONTENIDOS	FUENTES
A. DATOS DE LA PLAZA DE ABASTOS	Generales	Alonso Gordón (1999) Cámara de Comercio de Madrid (2009) Martín Cerdeño (2010) Medina Pindado *et al*. (2012) MINETUR (2005) Torre Outón (2012)
	Situación	Alonso Gordón *et al*. (2007) LNE (2010) Martín Cerdeño (2010) Torres Outón (2012)
B. GESTIÓN DE RESIDUOS	Práctica	MINETUR (2005)
	Contenedores	Alonso Gordón *et al*. (2007) MINETUR (2005)
C. RESIDUOS	Características	MINETUR (2005)
	Documentación	MINETUR (2005)
	Donaciones	Maestre Montserrat y Puig Ventosa (2014)

Los mercados de abastos son una forma comercial tradicional (Cámara de Comercio Madrid, 2009). La mayoría lleva varias décadas funcionando ya que se encuentran en edificios históricos situados en lugares del casco antiguo de las ciudades (Medina Pindado *et al.,* 2012). Existen casos muy diversos en cuanto a las características propias de cada mercado con relación a su dimensión y capacidad, antigüedad y estilo, número de plantas, estado de las instalaciones y tipo de gestión (Alonso Gordón, 1999). Así, algunos de ellos se ubican en edificios centenarios y otros en espacios más recientes, en algunas ocasiones remodelados para adaptar instalaciones longevas a las necesidades actuales. Asimismo, muchos han desaparecido o requieren una modernización física, funcional y operativa, mientras que otros compiten hoy en día exitosamente con el resto de formatos comerciales (Alonso

Gordón *et al.*, 2007). Los mercados tienen ciertas fortalezas que deben ser adecuadamente explotadas para permanecer en el escenario actual, como la calidad y variedad de la oferta, la proximidad a la demanda, el trato personalizado y la continuidad de la oferta que evita la necesidad de compras fuertes (Martín Cerdeño, 2010).

Habitualmente, los mercados de abastos son servicios públicos municipales y su propiedad es del ayuntamiento. Pueden ser gestionados directamente por la propia Administración o por terceros (Medina Pindado *et al.*, 2012). Esta tendencia se ilustra en el caso asturiano donde todos los mercados estudiados son de propiedad municipal, salvo el Mercado 7 que es privado. En la gestión indirecta solo se observa el modelo de concesión en los casos estudiados. Los Mercados 1 y 2 están gestionados a través de concesión administrativa. Los demás mercados cuya propiedad es municipal están gestionados directamente por los respectivos ayuntamientos.

En los mercados municipales más de un 80% de los establecimientos de venta son de tipo alimentario (MINETUR, 2005). En su actividad se ha vuelto esencial la distribución de productos perecederos o frescos: frutas, hortalizas, pescados, carnes y derivados cárnicos.

La tabla 2 resume información sobre los establecimientos de cada mercado estudiado. Un local disponible es la superficie en la que se ubica un establecimiento comercial. Un mismo establecimiento puede tener varios locales. Establecimiento abierto es aquel que se encuentra operativo cara al público. La superficie total es el espacio ocupado por el conjunto del mercado, incluyendo los locales, el acceso público y las instalaciones auxiliares.

Tabla 2. Información sobre locales y superficie de cada mercado (Elaboración propia con base en las entrevistas, la documentación facilitada por cada mercado y observación directa)

Nombre	Nº de locales disponibles	Nº de establecimientos disponibles	Nº de establecimientos abiertos	Superficie total de la plaza (m^2)	Superficie de los locales (m^2)
Mercado 1	21	21	18	1.000	540,00
Mercado 2	45	42	38	2.000	920,04
Mercado 3	166	42	34	1.630	710,00
Mercado 4.1	32	32	25	-	730,36
Mercado 4.2	23	14	5	-	750,23
Mercado 5	16	16	4	519	151,22
Mercado 6.1	16	16	9	1.053	237,00
Mercado 6.2	3	3	3	247	78,00
Mercado 7	60	58	36	6.000	954,00

El comercio en general y los mercados municipales en particular están sufriendo en las últimas décadas cambios importantes derivados principalmente de modificaciones en los hábitos de consumo. Eso ha provocado que la oferta comercial de los centros comerciales ofrezca alternativas que

combinan compra y ocio (Torres Outón, 2012). Los mercados municipales fueron una forma comercial eficaz para asegurar la oferta de productos de compra cotidiana, especialmente de alimentación, en épocas de gran crecimiento de la demanda, con unos elevados estándares de calidad a lo largo de varias décadas. Actualmente, hay mercados municipales que atraviesan momentos difíciles hasta el punto de que en algunas localidades asturianas está en peligro su supervivencia (LNE, 2010). Algunos mercados han adoptado nuevas estrategias comerciales para recuperar una parte del éxito de épocas pasadas. En otras localidades prevalece la costumbre de comprar en mercados municipales antes que en supermercados, especialmente determinados productos frescos por ofrecer varias ventajas: especialización, calidad de producto, trato personalizado, etc. Respecto al descenso del número de puestos y ventas, las respuestas son diversas, aunque parece clara la aceptación del hecho. Algunos mercados han cambiado su ubicación debido a que estaban situados en edificios muy grandes cuyo espacio no aprovechaban al haber pasado a precisar de menor superficie.

Los mercados municipales se han considerado tradicionalmente grandes generadores de residuos en el ámbito local al ser recintos de carácter colectivo y concurrencia pública y actividad diaria. La gestión de residuos es responsabilidad de la administración del mercado aunque el gestor que presta el servicio de recogida en sí puede ser diferente a la empresa que el ayuntamiento tiene contratada para la recogida de los residuos generados en el resto del municipio. Además, el conserje, que no es común en todos los mercados, puede incluir entre sus tareas la recogida interna de los residuos (MINETUR, 2005).

Algunos mercados tienen un almacén interno destinado a ubicar los contenedores pero solo disponen de un tipo de estos (los verdes para la fracción restante); otros, en cambio, utilizan los contenedores que se encuentran en la vía pública que emplea también la ciudadanía. La mayoría de los mercados tiran los residuos embolsados, aunque se observan casos en que se tiran sueltos, lo que obliga a lavar los contenedores a diario; es importante el uso de bolsas, sobre todo para residuos orgánicos, especialmente carnes y pescados (MINETUR, 2005).

Para un mercado tipo en España, en la composición media de los residuos generados predomina la materia orgánica (76% del total), debido a que, como ya se ha indicado, la inmensa mayoría de los establecimientos de venta son de tipo alimentario (MINETUR, 2005).

La prevención del desperdicio alimentario es una de las principales formas para la reducción de los residuos orgánicos. Acuerdos voluntarios con entidades sociales para el aprovechamiento de los excedentes alimentarios encajan perfectamente en el momento socioeconómico actual (Maestre Montserrat y Puig Ventosa, 2014). Dada su actividad mayoritaria, los mercados municipales tienen grandes volúmenes de excedentes alimentarios que podrían transformarse en donaciones a personas necesitadas. Esta práctica permanece imprecisa en los casos estudiados excepto un mercado donde se constatan donaciones más o menos sistemáticas.

Taller participativo

La conclusión más relevante del taller realizado en diciembre de 2014 contando con la participación de representantes de los principales agentes implicados en la investigación es el hecho de que las entidades beneficiarias del Banco de Alimentos de Asturias demandan más cantidad de alimentos frescos. Esta necesidad podría cubrirse en parte a través de excedentes de los mercados de abastos.

Los miembros del Banco de Alimentos de Asturias mostraron interés por los trabajos “aguas arriba” sobre potenciales entidades proveedoras, aunque expresaron dudas respecto a si “todos los alimentos pueden ser donados”. Estas dudas eran compartidas por otros asistentes.

El representante de COGERSA indicó que esta entidad recibe gran cantidad de excedentes alimentarios desde las plazas de abastos, que terminan en su planta de digestión anaerobia. Se debe intentar aprovechar los mismos en fases previas ya que en muchas ocasiones se encuentran en perfecto estado. Además, planteó la posibilidad de generalizar la experiencia de donaciones observada en algún otro mercado de abastos previamente.

Para finalizar la discusión, varios participantes explicaron que se deben aplicar procesos tecnológicos tatnopara asegurar el cumplimiento legal como para detener el deterioro de los alimentos. Por ejemplo, productos como los tomates serían transformados en salsa envasada para alargar su periodo de caducidad. Habría que preparar conservas, envases al vacío, etc., que se donarían en lugar de los alimentos frescos.

En suma, el taller respaldó el interés de continuar con la investigación y sugirió entrevistar a inspectores de sanidad para aclarar algunos puntos de controversia relativos a la seguridad alimentaria de las potenciales donaciones.

Entrevistas a inspectores de sanidad

Para que los alimentos desperdiciados sean aprovechables para el consumo humano es preciso manipularlos de manera segura y utilizar todos los medios para reducir el riesgo de intoxicaciones (Generalitat de Catalunya, 2013). Con el fin de precisar este aspecto, que había generado en el taller un debate no resuelto, se entrevistó a dos inspectores de sanidad, siguiendo un guión consensuado previamente con expertos de COGERSA y del Banco de Alimentos de Asturias (tabla 3).

Comenzaba la entrevista preguntando acerca de los alimentos que se pueden donar desde los mercados de abastos. El Reglamento (CE) Nº 178/2002 del Parlamento Europeo y del Consejo, de 28 de enero de 2002, establece que "no se podrán comercializar alimentos que no sean seguros". Por tanto, nada impide que alimentos "aptos para el consumo" sean donados. Respecto al estado de los alimentos que se pueden donar, uno de los inspectores indica que tienen que estar dentro de las fechas de consumo correspondientes y los envases íntegros, así como con ningún síntoma de deterioro o putrefacción.

Tabla 3. Guión de las entrevistas a los inspectores de sanidad (Elaboración propia)

BLOQUES	CONTENIDOS	FUENTES
A. ALIMENTOS	Tipos de alimentos a donar	Reglamento (CE) Nº 178/2002
	Estado de los alimentos que se pueden donar	Generalitat de Catalunya (2013) La Vanguardia (2012)
B. RECOGIDA	En la propia plaza	Generalitat de Catalunya (2013)
	Personal	Generalitat de Catalunya (2013) Grupo Impulsia (2012)
	Medidas de higiene	Generalitat de Catalunya (2013)
	Horario	La Vanguardia (2012) Maestre Montserrat y Puig Ventosa (2014)
	Comprobación	La Vanguardia (2012)
C. ENTREGA	Periodicidad	Generalitat de Catalunya (2013)
	Forma	
	Elementos de transporte	
	Normativa para el transporte	
	Diferencia según fin	Fundación Alicia y UAB (2013)
	Identificación y trazabilidad	Generalitat de Catalunya (2013)
D. OTROS ASPECTOS	Puntos críticos	Generalitat de Catalunya (2013)

El segundo bloque de preguntas aborda el tema de la recogida. Hay que asegurar que los alimentos que se donan se guarden a la temperatura requerida para su conservación correcta en un lugar separado del resto de alimentos y debidamente identificados (Generalitat de Catalunya, 2013); los alimentos envasados suelen indicar esa temperatura con una etiqueta. En la propia plaza, los requisitos para los alimentos destinados a donaciones comienzan con el correcto almacenamiento en los mercados, cuidando la cadena de frío, la estibación y el transporte según indiquen los fabricantes (caso de los productos envasados). Antes de aceptar la donación, es necesario asegurarse de que el establecimiento donador dispone de unas buenas instalaciones y condiciones higiénicas (Generalitat de Catalunya, 2013). Entonces, la formación en materia de higiene alimentaria del personal se reconoce como uno de los pilares básicos para asegurar la correcta aplicación de los requisitos en cada fase con el fin de conseguir alimentos seguros. Los inspectores recordaron la desaparición del antiguo carnet de manipulador e indicaron que los dependientes podrían realizar la recogida de los alimentos; ahora los propietarios de los establecimientos asumen la preparación de su personal, lo que antes era acreditado por ese carnet (Grupo Impulsia, 2012). Además, los voluntarios que distribuyen los alimentos tienen que tener la capacitación necesaria para garantizar una manipulación higiénica de los mismos (Generalitat de Catalunya, 2013). En cuanto a las medidas de higiene, no hay nada obligatorio, aunque

interesa sobre todo el vestuario del personal, la aplicación de utensilios limpios y en buen estado, los guantes de un solo uso y la higiene personal.

Otro factor clave es el horario de recogida, siendo aquel que no interfiera en la actividad normal del establecimiento, recomendándose las franjas finales de la jornada; en la experiencia de canalización de excedentes del Mercado de Cornellà de Llobregat, la recogida por las distintas paradas y posterior almacenaje a las cámaras frigoríficas del mercado se realizaba a última hora de la mañana, previamente al cierre (Maestre Montserrat y Puig Ventosa, 2014); en cambio, en la experiencia llevada a cabo en Reus, los alimentos frescos se recogían por la mañana y por la tarde ya estaban en manos de los colectivos beneficiarios (La Vanguardia, 2012).

Ha de comprobarse asimismo si los alimentos recopilados son aptos para el consumo. En Reus las cadenas de distribución y el mercado participante en las donaciones son eran los encargados de recoger y seleccionar los alimentos y después un centro especial de trabajo con personas con discapacidad intelectual realizaba una segunda criba siguiendo las instrucciones de La Agencia de Salud Pública (La Vanguardia, 2012); en Asturias, las entidades sociales que distribuyen "aguas abajo" del banco de alimentos de la zona deben comprobar que cada producto ha estado conservado correctamente a la temperatura que indica la etiqueta del envase o a la temperatura reglada si se trata de alimentos que se pueden comercializar sin envasar.

La entrega es el tercer punto abordado en las entrevistas, donde queda claro el papel de la temperatura como factor a tener en cuenta en la conservación incluso durante el transporte; si no se dispone de un vehículo frigorífico, es conveniente utilizar contenedores o fundas isotérmicas con una fuente de frío y hay que limitar el tiempo de transporte a una hora y media para mantener los productos a la temperatura adecuada (Generalitat de Catalunya, 2013). En cuanto a la periodicidad, el número de veces que se recojan los excedentes es importante, pues son alimentos frescos muy perecederos en su mayoría, teniendo en cuenta también los costes logísticos. Debe cuidarse asimismo la forma de entrega: en materiales no reutilizables y aptos para entrar en contacto con alimentos en el caso de los no envasados. Se insiste en la necesidad de mantener la cadena de frío para los productos que lo precisen y la limpieza de vehículos cada vez que se realice un transporte.

Otros factores a considerar son la normativa de seguridad para transportar (acuerdo internacional ATP, que establece la obligatoriedad de vehículos refrigerados o isotermos para una serie de productos y el respeto de determinadas temperaturas) o las personas encargadas de dicha tarea (insistiéndose en la higiene y la formación en manipulación de alimentos). Los requisitos legales para transportar y conservar los alimentos no discriminan entre los destinos de la comida, siendo indiferente que tengan una finalidad altruista o comercial; esto no es así en todos los países; en Estados Unidos e Italia los requerimientos varían en función de los objetivos sociales y el tipo de acuerdo entre el donador y el receptor (Fundación Alicia y UAB, 2013). Por otro lado, las entidades receptoras tienen que

asegurarse de recibir un albarán de entrega por parte del donador para el control de la trazabilidad (Generalitat de Catalunya, 2013), entendiéndose esta última como un conjunto de medidas destinadas a garantizar el seguimiento de la información relativa a un alimento desde la donación hasta la recepción por parte del beneficiario. La trazabilidad permite investigar las causas que hacen que un alimento sea considerado conforme o no, localizarlo a lo largo de la cadena de distribución y retirarlo si fuera necesario.

Finalmente, otro aspecto importante es que una vez que los alimentos son aceptados por las entidades beneficiarias es necesario asegurarse de que la temperatura de los mismos no supere la establecida para su correcta conservación y que los productos refrigerados y congelados se guarden rápidamente (Generalitat de Catalunya, 2013).

4.2. Análisis cuantitativo

La metodología cualitativa aplicada hasta aquí permitió explorar una realidad inicialmente desconocida pero presentaba carencias de generalización de los datos recolectados, y de que estos resultaban excesivamente agregados (al haberse obtenido mercado a mercado) lo que avaló el interés de una investigación transversal cuantitativa dirigida al conjunto de los mercados de abastos asturianos estudiados y centrada en los comerciantes de los diferentes establecimientos alimentarios ubicados en dichos mercados. La gerencia de cada mercado suele ser la responsable de poner los medios y la Administración Pública, generalmente municipal, la responsable de planificar las necesidades de gestión y de dedicar recursos para el control y la gestión de residuos (Alonso Gordón *et al*., 2007); sin embargo, los comerciantes, como principales generadores de residuos, deben ser conscientes de los problemas y de su importante papel en la adopción de medidas que contribuyan a mejorar la gestión de los residuos que generan sin perder con ello calidad en el servicio que prestan (MINETUR, 2005).

Entonces, la siguiente fase del trabajo de investigación se justifica por el objetivo de profundizar en los temas tratados en el análisis cualitativo ampliando el enfoque a una lógica híbrida cualitativa-cuantitativa (Molina Azorín *et al*., 2012).

Se pretendía en esta segunda etapa extender la investigación a los establecimientos de venta sitos en cada mercado para obtener información desde el punto de vista de los comerciantes sobre infraestructura, servicios y gestión, su situación actual y funcionamiento, describiendo también su panorama general con especial atención a los aspectos logísticos de gestión de residuos que realizan cotidianamente, así como indagar en aspectos que no habían quedado claros en el cualitativo, como las donaciones alimentarias.

Se realizaron encuestas en los 9 de los 14 mercados de abastos asturianos (tabla 4). La muestra se considera representativa pues, como se puede observar en la tabla 5, los 5 mercados que han quedado sin estudiar (los mismos cuyos gestores no pudieron ser entrevistados en el estudio cualitativo)

presentan un número relativamente muy bajo de establecimientos alimentarios (solo el 14,30% de los de este tipo en los mercados asturianos). Asimismo la encuesta es la metodología de investigación más adecuada por tratarse de una población objetivo relativamente amplia (tabla 5). Por tanto, el hecho de perseguir ahora información en detalle y profundidad confirma la necesidad de una técnica cuantitativa (Trespalacios *et al*., 2005).

Tabla 4. Ficha técnica de las encuestas (Elaboración propia)

Población objetivo	Mercados de abastos asturianos
Unidad de análisis	Establecimientos alimentarios
Tamaño muestral	150 establecimientos alimentarios
Tasa de respuesta	73,33% (110 establecimientos alimentarios)
Nivel de confianza	95%
Error muestral	4,84%
Método de realización	Personalmente
Periodo de realización	14 noviembre de 2014 – 21 de abril de 2015

Tabla 5. Establecimientos de los mercados de abastos asturianos (Elaboración propia)

	Denominación en este estudio	**Nº de establecimientos abiertos**	**Nº de establecimientos alimentarios**	**Nº de establecimientos encuestados**
MERCADOS ESTUDIADOS	Mercado 1	18	16	13
	Mercado 2	38	35	31
	Mercado 3	34	27	17
	Mercado 4.1	25	24	17
	Mercado 4.2	5	5	4
	Mercado 5	4	3	2
	Mercado 6.1	9	9	5
	Mercado 6.2	3	3	1
	Mercado 7	36	28	20
	SUBTOTAL	**172**	**150**	**110**
MERCADOS NO ESTUDIADOS	Mercado 8	8	7	-
	Mercado 9	9	7	-
	Mercado 10	4	2	-
	Mercado 11	7	5	-
	Mercado 12	6	4	-
	SUBTOTAL	**34**	**25**	**-**
	TOTAL	**206**	**175**	**110**

El equipo de investigación de la Universidad de Oviedo diseñó el cuestionario, previa reunión de expertos en la que se realizó una tormenta de ideas con base en la información obtenida en la revisión bibliográfica y en el estudio cualitativo anterior. Un pre-test posterior realizado en dos mercados de abastos pertenecientes al mismo concejo sugirió algunas modificaciones adicionales del borrador. La encuesta final está dividida en los bloques que muestra la tabla 6.

Tabla 6. Esquema de la encuesta a establecimientos de plazas de abastos (Elaboración propia)

BLOQUES	CONTENIDOS	FUENTES
DATOS DEL PUESTO	Actividad	Alonso Gordón (1999) Torres Outón (2012)
	Superficie	Alonso Gordón *et al*. (2007)
	Frío	Generalitat de Catalunya (2013) Martín Cerdeño (2010)
	Horas de atención al público	Alonso Gordón (1999)
CLIENTELA	Tipo	Martín Cerdeño (2010) Torres Outón (2012)
	Total	
	Facturación	
RESIDUOS	Tipo	MINETUR (2005)
	Motivos	Generalitat de Catalunya (2013)
GESTIÓN DE RESIDUOS	Separación	Cámara de Comercio Madrid (2002) MINETUR (2005)
	Forma	Alonso Gordón *et al*. (2007)
	Excedentes	Maestre Montserrat y Puig Ventosa (2014) MAGRAMA (2013b)
	Donaciones	
	Comenzar con donaciones	
	Requisitos	Maestre Montserrat y Puig Ventosa (2014)

Análisis descriptivo de los datos recogidos en establecimientos de alimentación

Los puestos dedicados a la venta de carnes representan el 30,8% del total de establecimientos activos en los mercados asturianos, los de pescadería el 17,4%, los de frutas y verduras el 14,5% y los de charcutería el 11,6%; seguidamente están las panaderías (7,6%), los establecimientos de resto de alimentación (4,7%) y los de congelados (0,6%). Respecto a la superficie de cada establecimiento, la media es de 18,82 m^2. Los establecimientos permanecen abiertos una media de 45 horas por semana, atendiendo al público unas 7 horas y media al día. El 94% afirma disponer de cámaras de frío para conservar los productos.

Una media de 74 clientes acuden a cada establecimiento por día, aunque los datos varían mucho (el máximo es de 500 clientes diarios).

El 81% de los establecimientos encuestados genera residuos de papel y cartón y el 78% fracción orgánica (de carne o pescado -60%- y de fruta o verdura -18%-). El porcentaje de residuos orgánicos no alcanza el 100% porque algunos establecimientos, como charcuterías, panaderías u otros, afirman no generar este tipo de residuos, hacerlo en cantidades insignificantes o que los excedentes son recogidos por la empresa proveedora.

Las cantidades diarias de residuos que son generadas en cada establecimiento permiten elaborar la distribución en peso según el tipo de fracción de la tabla 7, que guarda relación directa con la actividad desarrollada. Los residuos de carne y pescado son los más abundantes pues casi dos tercios de los establecimientos encuestados (65%) eran carnicerías, charcuterías o pescaderías.

Tabla 7. Datos sobre kilogramos totales de residuos diarios (Elaboración propia)

	Carne y pescado	Fruta	Papel	Plástico	Vidrio	Madera	Otros
Media kg/día	15,25	6,42	2,64	1,03	0,44	4,64	1,09
Total kg/día	1.006,7	128,36	235,21	60,8	2,64	64,98	13,06
%	66,59%	8,49%	15,56%	4,02%	0,17%	4,30%	0,86%

Las tablas 8 y 9 muestran la generación total de residuos diaria según los diferentes tipos de establecimientos de venta, lo que permite identificar los residuos generados por actividad y las actividades que más residuos generan. Destacan las pescaderías (45,68% de los residuos totales), seguidas de las carnicerías (28,26%) y las fruterías (19,00%).

Tabla 8. Distribución de la generación total de residuos por tipo y establecimiento referido a la totalidad de los encuestados (a) (Elaboración propia)

	Carnicerías (kg/día)	%	Charcuterías (kg/día)	%	Pescaderías (kg/día)	%
Carne o pescado	346,48	82,77	15,1	25,14	614,21	90,77
Fruta	0	0,00	0	0,00	0	0,00
Papel y cartón	48,96	11,70	33,06	55,04	44,47	6,57
Plástico	22,98	5,49	8,25	13,74	10,36	1,53
Vidrio	0,2	0,05	1	1,67	0	0,00
Madera	0	0,00	0	0,00	4,64	0,69
Varios	0	0,00	2,65	4,41	3	0,44
TOTAL	**418,62**	**100,00**	**60,06**	**100,00**	**676,68**	**100,00**
% TOTAL	**28,26**	**-**	**4,05**	**-**	**45,68**	**-**

Tabla 9. Distribución de la generación total de residuos por tipo y establecimiento referido a la totalidad de los encuestados (b) (Elaboración propia)

	Fruterías (kg/día)	%	Panaderías (kg/día)	%	Congelados (kg/día)	%	Varios (kg/día)	%
Carne o pescado	0	0,00	0,2	0,80	0	0,00	1	5,75
Fruta	124,37	44,19	0	0,00	0	0,00	2	11,50
Papel y cartón	84,56	30,05	12,64	50,32	1	50,00	10,02	57,62
Plástico	12,15	4,32	3,53	14,05	1	50,00	2,03	11,67
Vidrio	0	0,00	0	0,00	0	0,00	1,44	8,28
Madera	60,34	21,44	0	0,00	0	0,00	0	0,00
Varios	0	0,00	8,75	34,83	0	0,00	0,9	5,18
TOTAL	**281,42**	**100,00**	**25,12**	**100,00**	**2**	**100,00**	**17,39**	**100,00**
% TOTAL	**19,00**	**-**	**1,70**	**-**	**0,14**	**-**	**1,17**	**-**

En el 57% de los establecimientos se tiran residuos orgánicos porque son sobras (desperdicios) cuando se prepara un producto, esto es, en el caso de una carnicería, pieles, huesos, grasas o casquería, y en el de una pescadería pieles, espinas y cabezas. Más de la mitad (54%) afirma que este es el motivo mayoritario por el que tiran sus residuos. El 26% tira los residuos orgánicos porque están estropeados

y no se pueden consumir. El 20% se deshace de ellos porque son productos sobrantes que no ha conseguido vender.

El 36% tira los residuos mezclados y todos al mismo contenedor, dado que el 95% no dispone de contenedores diferenciados que permitan realizar la separación (el 5% restante reconoce que, aunque existen contenedores en el mercado para separar, es más fácil o rápido tirarlo todo al mismo sitio). Respecto a la forma de depositar los residuos orgánicos en el contenedor, en el 88% de los casos van embolsados y en tan solo el 11% se hace a granel.

En cuanto a la posibilidad de donar alimentos, en el 17% de los establecimientos se tiran, en el 40% se donan de algún modo y en el 70% los excedentes se gestionan de otra forma, como por ejemplo para alimentar animales o para elaborar otros productos como pan rallado. Si se realiza una clasificación por tipo de actividad, el 44% de los excedentes en las fruterías se donan, seguidas de las pescaderías (33%) y las carnicerías y charcuterías (27%). Los establecimientos donde más excedentes se tiran son las pescaderías con el 18%. Muchos puestos afirman no tener excedentes diarios, pues lo que no logran vender pueden conservarlo bien por las propias características de los productos (caso de las charcuterías), o porque se conservan en frío durante varios días adicionales (como las carnicerías o pescaderías).

En ninguno de los casos en los que se realizan donaciones se hace de forma coordinada por el mercado. La mayoría de ellas se realizan una vez a la semana (41%). El 37% de las donaciones se realiza más de una vez a la semana y el 22% esporádicamente. La media de donaciones anuales por establecimiento se sitúa en 329,33 kg, siendo el máximo 1.080 kg.

De los establecimientos que no realizan donaciones, el 49% está interesado en comenzar a donar alimentos. El 37% entregarían pescado y el 32% carne. En menor medida se encuentran charcutería y bollería (21%) y frutas y verduras (11%) y pan (11%). El 68% de los establecimientos interesados en donar podría hacerlo esporádicamente.

Por último, el 61% afirma que lo más conveniente sería una recogida puesto a puesto de los alimentos y el 27% que se deben conservar en frío. La posibilidad de un contenedor o espacio compartido en el mercado para depositar las donaciones solo convence al 15%.

Análisis clúster de los resultados

Una vez finalizado el análisis descriptivo, se trató de clasificar mejor los establecimientos de las plazas de abastos asturianas con el fin de ajustar las propuestas que incrementarían las donaciones. Por ello, se decidió llevar a cabo un análisis clúster donde la única variable de clasificación empleada es el total de residuos orgánicos generados por cada establecimiento, lo que se justifica en que el objetivo es recuperar los excedentes alimentarios de esta actividad económica y reducir así el flujo de residuos orgánicos.

Tras comprobar la normalidad de la variable de clasificación elegida (prueba Lilliefors) y el prerrequisito de la representatividad de la muestra (se cumple por la elevada tasa de respuesta obtenida, superior al 70% de la población objetivo según la tabla 4), se determinó que el número de clústeres adecuados a obtener es 2 (método de los conglomerados jerárquicos), puesto que analizando el dendograma (matriz de distancias), se detectó la existencia de dos clústeres diferenciados con diversos tamaños que agrupan a los establecimientos de las plazas de abastos asturianas. A continuación, un nuevo análisis clúster, usando el algoritmo de las k-medias, confirmó el resultado previo. Para garantizar la validez de la clasificación previa, se llevó a cabo un análisis discriminante mediante el método Lambda de Wilks, incluyendo la variable de clasificación. Esta prueba permitió rechazar la hipótesis nula de igualdad en las medias de la función discriminante entre los dos grupos identificados de establecimientos comerciales.

En la tabla 10 se describen los establecimientos de cada grupo. En el clúster A se sitúan 13 establecimientos comerciales que generan en su actividad diaria 8 veces más residuos orgánicos que los negocios del clúster B. Además, en el clúster A todos los residuos orgánicos proceden de carnes y pescados, mientras en el clúster B también se generan residuos de frutas y verduras, aunque en cantidades promedio ligeramente inferiores. En el clúster A se concentran además los establecimientos pertenecientes a mercados gestionados de forma privada bajo concesión administrativa.

Tabla 10. Principales características de los conglomerados (Elaboración propia)

Variable		**Clúster A**	**Clúster B**
Número de establecimientos		13	96
Tipo de actividad		30,8% carnicería, 69,2% pescadería	35,4% carnicería, 17,7% frutería, 13,5% pescadería
Superficie disponible (m2)		25,5	17,9
Disponibilidad cámara frío		100% Si	92,7% Si
Clientes diarios		110	67
Gestión mercado		46,2% concesión privada	45,8 gestión pública
Mezcla residuos		30,8% Si	36,5%
Uso contenedores separados		77,8% azul, 44;4% amarillo	65,6% azul, 34,4% amarillo
Residuos orgánicos (kg/día)		40,385	5,288
Residuos	Carnes y pescados (kg/día)	40,385	3,976
	Frutas y verduras (kg/día)	0,000	1,313
	Otros (kg/día)	2,9 papel y cartón, 0,9 envases ligeros	2,7 papel y cartón, 1,9 madera, 0,7 envases ligeros
Tipos sobrantes		100% preparación, 38,5% sobrantes, 38,5% no apto consumo	59,8% preparación
Frecuencia donación		33,3% 1 vez/sem, 33,3% esporádicamente	77,8% una o varias veces por semana
Donaciones anuales (kg/año)		100	317

Los establecimientos en los mercados tipo A son los que potencialmente podrían ofrecer más donaciones (cada uno de ellos genera muchos más residuos orgánicos que los de tipo B, unas 8 veces en peso como se ha visto en la tabla 10) y se ubican en mercados donde sería más fácil organizar coordinadamente tales donaciones por ser de los mejor gestionados (propiedad pública y gestión

privada, lo que se materializa en una clara unidad de mando personalizada en puestos específicos de gerencia).

En el clúster B se encuentra el mayor número de establecimientos, un total de 96, con actividades más diversas. Una gran parte de los mercados donde se ubican estos establecimientos están gestionados directamente por la administración pública local, que es quien también posee dichos mercados. Cada uno de los puestos de tipo B genera un octavo de residuos respecto a los del otro clúster, lo que se compensa parcialmente por su cantidad (el número de establecimientos supera en más de 7 veces a los del clúster A), y por su mayor propensión a donar (más del doble en frecuencia, más del triple en cantidad). No obstante, se ubican en mercados peor gestionados (dispersión entre diversos cargos públicos, carencia de puestos específicos de gerencia, decisiones políticas lentas, etc.).

A la luz de estos datos, parece recomendable que las campañas de información acerca de gestión de residuos orgánicos así como de promoción de donaciones altruistas de excedentes alimentarios sean arbitradas de forma diferenciada para cada clúster teniendo en cuenta tanto el tipo de actividad mayoritaria como el modelo de gestión en su mercado.

5. DISCUSIÓN Y CONCLUSIONES

Actualmente los residuos urbanos han aumentado significativamente en las ciudades, convirtiéndose en una preocupación para la sociedad y, en mayor medida, para los responsables políticos y los gestores de residuos que deben buscar soluciones para darles una salida adecuada y acogerse a las nuevas normas que les afectan. En particular, los mercados de abastos son espacios típicamente generadores de residuos orgánicos y presentan un potencial interesante para fomentar la minimización, la donación y el reciclaje de los mismos.

El objetivo principal de este trabajo era estudiar la gestión de biorresiduos en los mercados de abastos asturianos para facilitar la recogida separada de excedentes alimentarios aptos para donaciones o de restos aprovechables para valorización. Finalmente se ha conseguido estudiar a 9 mercados de abastos asturianos pertenecientes a 7 concejos diferentes que parecen suficientemente representativos.

Se ha comprobado que los mercados difieren unos de otros según el tipo de gestión que tienen, que permite clasificarlos en tres tipos (tabla 13): el grupo I integrado por dos mercados de propiedad municipal pero gestión privada a través de concesión administrativa, el grupo II en el que hay 6 mercados de propiedad y gestión municipal, y el grupo III formado por un solo mercado de propiedad y gestión privada. En esta primera fase de la investigación, se evidenció un mejor conocimiento de los dos gerentes pertenecientes a los mercados del grupo I; en los grupos II y III la ausencia de figuras centrales en la gestión del mercado dificultó la obtención de información en algunos casos y fue necesario el contacto con varias personas de diferentes departamentos o áreas implicadas.

Los inspectores de sanidad consultados dejaron claro que se pueden donar alimentos procedentes de los mercados de abastos apoyándose en el Reglamento CE 178/2002. Nada impide entonces que alimentos seguros, y por lo tanto "aptos para el consumo", sean donados por los puestos de venta de estos mercados a organizaciones como los bancos de alimentos o los comedores sociales. Para evitar problemas, sería conveniente que los acuerdos entre las empresas alimentarias donantes y las organizaciones beneficiarias se reflejaran por escrito, estableciendo claramente que se trata de alimentos aptos para consumo humano y que cumplen con todas las garantías nacionales y comunitarias para su comercialización y, por parte de las organizaciones, el compromiso de transportarlos y almacenarlos en condiciones adecuadas hasta su consumo.

Dado que las donaciones procedentes de los mercados de abastos tratan con un tipo de producto que entraña dificultad por ser muy perecedero, hay que disponer de una sistemática muy afinada para evitar incurrir en riesgos para la salud humana. Por lo tanto, para que las donaciones tengan éxito habría que aplicar una metodología de proximidad porque no hay tiempo material para enviar los productos a una plataforma central (el Banco de Alimentos de Asturias en este caso) sino que estos deben ser directamente entregados a entidades beneficiarias con sede próxima a cada mercado. Las entidades beneficiarias pueden ser de dos tipos, de reparto y de consumo: las primeras, distribuyen los alimentos recibidos entre las personas beneficiarias de su entidad; las de consumo, tras recoger los alimentos, los preparan y los sirven en sus comedores sociales. Parece lógico que las entidades de consumo sean las más apropiadas para recibir estas donaciones ya que pueden dar una salida más rápida a los alimentos perecederos, asegurándose cocinarlos y servirlos el mismo día de la recepción.

La segunda fase del estudio mediante encuestas a los comerciantes de los mismos 9 mercados para obtener información acerca de cantidades de residuos, excedentes y donaciones se justifica en que ellos son quienes pueden ofrecer datos más concretos y desglosados del día a día de la actividad del mercado de abastos. No hay que olvidar que también tienen un importante papel en la adopción de medidas que contribuyan a mejorar la gestión de dichos residuos. Las donaciones de excedentes era un tema que había quedado en el aire en el análisis cualitativo, por lo que gran parte de la encuesta y el consiguiente procesado de datos se centró en este aspecto. El análisis descriptivo permitió conocer datos relevantes sobre cantidades de residuos y gestión, que fueron utilizados posteriormente en un análisis clúster para clasificar los establecimientos.

Se estimó la generación total de residuos orgánicos diaria en el total de los mercados de abastos asturianos en 1.797 kg de residuos orgánicos diarios (tabla 11) o, lo que es lo mismo, unas 561 toneladas al año. Además, en estos mercados se podrían recuperar para fines sociales al menos unas 36 toneladas de alimentos anuales (tabla 12), cifra que no puede considerarse realmente alta en comparación con las más de 858 toneladas recuperadas por el banco de alimentos de la región durante 2014 (Banco de Alimentos de Asturias, 2015) por lo que debería revisarse así como extender el estudio a otros tipos de establecimientos o entidades productoras de residuos alimentarios. A pesar de

ello, son donaciones de productos frescos, altamente demandados por los receptores/beneficiarios finales.

Tabla 11. Estimación de los residuos orgánicos generado diariamente (Elaboración propia)

Tipo actividad	Media kg orgánicos/día	Estimación del total de establecimientos (kg orgánicos/día) en los mercados de la muestra	Estimación del total de establecimientos (kg orgánicos/día) en los mercados no participantes en la muestra	Estimación total mercados de abastos asturianos (kg orgánicos/día)
Carnicería	8,66	459,06	17,32	**476,38**
Charcutería	2,55	38,15	5,10	**43,25**
Pescadería	30,71	921,31	122,84	**1044,15**
Frutería	6,91	172,74	34,55	**207,29**
Panadería	1,25	11,45	2,50	**13,95**
Varios (alimentarios)	0,77	3,90	7,70	**11,60**
TOTAL	**-**	**1.606,61**	**190,01**	**1.796,62**

Tabla 12 Estimación de potenciales donaciones anuales (Elaboración propia)

		Mercados de la muestra		**Mercados no pertenecientes a la muestra**	
Tipo de actividad	**Donaciones medias (kg/año)**	**Establecimientos totales**	**Estimación donaciones (kg/año)**	**Establecimientos totales**	**Estimación donaciones (kg/año)**
Carnicería	219	53	11.607	2	438
Pescadería	394	30	11.820	4	1.576
Frutería	358	25	8.940	5	1.788
			32.637		**3.802**

Tabla 13. Clasificación de los mercados según gestión y clúster (Elaboración propia)

		Tipos de mercados									
		Grupo I		**Grupo II**						**Grupo III**	
Propiedad		Municipal		Municipal						Privada	
Gestión		Privada									
Mercados		M. 1	M. 2	M. 3	M. 4.1	M. 4.2	M. 5	M. 6.1	M. 6.2	M. 7	Total
Clústers de los puestos	**A**	4	2	1	1	0	0	0	0	5	13
	B	9	28	16	16	4	2	5	1	15	96
Total		13	30	17	17	4	2	5	1	20	109

Con más detalle, el análisis clúster proporcionó una división de los establecimientos en dos grupos. El clúster A, casi ocho veces más pequeño que el B, se encuentra repartido principalmente por los mercados de gestión privada. Son establecimientos formados por carnicerías y pescaderías con una generación media de residuos orgánicos muy superior a la de los establecimientos del clúster B y con

menos tendencia a donar. El clúster B está formado también por fruterías y otros establecimientos alimentarios, que generan menos residuos y que donan más.

En la tabla 13 se puede ver la combinación de la clasificación obtenida del estudio cualitativo (grupos I, II y III según gestión) y del cuantitativo mediante análisis clúster (clústers A y B) desglosada por mercados y puestos en cada uno de ellos.

Esta clasificación condiciona la forma en la que se aplicarían en la práctica los planes de mejora, pues hay que tener en cuenta el número y tipo de establecimientos así como el modelo de gestión en cada mercado. Esos planes, que se expresan a continuación en forma de lista de recomendaciones genéricas, van dirigidos a los principales agentes: gerentes, administradores o encargados, y comerciantes. Entonces, y como primera medida general, se hace una recomendación básica a los mercados pertenecientes al grupo II (gestión pública): la propuesta de centralizar la gestión en una persona perteneciente a un departamento afín dentro del correspondiente ayuntamiento (medio ambiente, obras, contrataciones, patrimonio…).

Una vez que todos los mercados dispongan de una persona encargada, ya sea gerente, administrador, presidente o similar, se proponen las siguientes orientaciones a esas personas:

- Relación fluida con el gestor de residuos y el Banco de Alimentos de Asturias, mediante reuniones frecuentes sobre requisitos de recogida, seguimiento…

- Formación en materia de biorresiduos y sensibilización a los comerciantes, a través de jornadas informativas y de motivación, así como con carteles.

- Provisión de recursos para recogida separada y donaciones. Los gerentes deben facilitar a sus comerciantes contenedores y espacios adecuados.

- Control de la nueva recogida: el gerente debe ser conocedor del grado de llenado diario de los contenedores de residuos orgánicos y de qué puestos están donando o se muestran interesados en donar.

- Difusión y marketing del buen desempeño cara a los clientes, mediante paneles, octavillas, placas en los puestos colaboradores y otros medios similares

En cuanto a las propuestas dirigidas a los comerciantes, pueden señalarse varias medidas:

- Control de las cantidades generadas. Los comerciantes deben ser conocedores de las cantidades de residuos de su establecimiento y el valor económico de estas.

- Minimización de los biorresiduos. Gestionar los residuos orgánicos no tiene sentido si antes no se ha intentado disminuir su producción protegiendo adecuadamente los productos.

- Campañas de sensibilización sobre las condiciones que padecen algunas personas y colectivos para priorizar la donación de excedentes aptos para el consumo humano.

- Convenio de colaboración con las entidades beneficiarias, donde los establecimientos garanticen que donarán alimentos aptos para el consumo humano y las entidades beneficiarias que los manipularán adecuadamente dándoles una salida rápida.

- Garantía de trazabilidad de los alimentos donados mediante albaranes entregados por los comerciantes a las entidades beneficiarias.

Finalmente, respecto a las limitaciones del presente trabajo que sugieren futuros desarrollos, debe señalarse en primer lugar que no se ha podido estudiar en profundidad a todos los mercados de abastos asturianos, en muchos casos por la carencia de una cabeza gestora claramente definida. Además, ninguna de las personas entrevistadas supo aportar datos acerca de la cantidad de residuos que produce su mercado, limitando sus respuestas a porcentajes aproximados de las fracciones generadas, y la estimación del volumen potencial de donaciones arroja una cifra realmente baja. Todas estas limitaciones podrían aminorarse mediante encuestas adicionales, observación directa o muestreo de los residuos en cada mercado. Se ha comprobado asimismo que muchos mercados de abastos han reducido su actividad como consecuencia de la crisis y de los cambios en los hábitos de compra, que dan prioridad a otros establecimientos como los supermercados o centros comerciales, a los que debería extenderse la investigación. Por último, en la revisión bibliográfica se han encontrado varias experiencias de recuperación de alimentos frescos procedentes de los mercados de abastos en Cataluña, lo que sugiere el interés de ampliar el estudio al nivel nacional.

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[**ANEXO 3**]

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How is a food bank managed? Different profiles in Spain

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Abstract Within the current economic situation, poverty indexes in developed countries are becoming more and more alarming. This makes the role of food banks very relevant, and in addition contributes towards reducing the problem of food waste. Motivated by the social importance of these non-profit organizations, this paper analyzes the impact of food banks on the supply chains to which they belong. Differences in the functioning of these supply chains are highlighted attending to the relations induced by the food banks. First, the international research background for this topic is summarized; then, the results of an empirical study in Spain are presented. Data were collected through surveys and analyzed using cluster methodology. Two different types of food bank were identified. These are described, characterized, and compared in terms of efficacy and efficiency.

Keywords Food bank · Non-profit organizations · Spain

Abbreviations

EU	European Union
FEBA	Fédération Européenne des Banques Alimentaires (European Federation of Food Banks)
FESBAL	Federación Española de Bancos de Alimentos (Spanish Federation of Food Banks)
USA	United States of America

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Introduction

Extreme poverty, defined as the lack of capacity to have the necessary resources to cover the minimum basic human requirements for living, is expected by 2015 to be 883 million people (United Nations 2011, p. 4). In Spain in particular, 21.6 % of the population (more than 10 million people out of the 46.5 million inhabitants, according to INE 2014) is considered "poor" as they have annual incomes lower than 7040 euros (INE 2013), and these figures worsen year by year.

This poverty increase is particularly worrying when considered in parallel with the problem of food waste in developed countries (Pothukuchi and Kaufman 1999; Hodges et al. 2011). Food is a basic human right, together with water, education, peace, and health care (McIntyre 2003). And "if food is a social good, then we should ask how to make nutritious food available to all people irrespective of their social and political location" (Dixon 2014, p. 184). The global food system, however, generates high quantities of waste (Godfray et al. 2010), as both packaging and the food itself. Almost one-third of the food produced annually for human consumption worldwide (approximately 1300 million tons) is wasted (FAO 2011).

The food waste problem is even higher in developed countries, caused especially by retailers and end consumers, who discard still eatable food (Kantor et al. 1997). Food waste is very diverse: raw food, cooked dishes, precooked food, including also food discarded before and after cooking at home, as well as products discarded in the manufacturing, distribution, service, and sale processes (Mena et al. 2011).

The reasons for such waste are equally diverse (Alexander and Smaje 2008): wrongly labelled non-perishable products, cancelled orders, ends of line (the last few

units of a product on store shelves that are retired for selling), finished promotions, damaged products but still valid for consumption, or wrong packaging. Other meaningful reasons are seasonal orders, order quantity excess, development or test of new products, limited time allowed on shelves, unexpected events, or low quality control (Alexandre and Smaje 2008).

In this context, food banks could be the key to reducing famine by decreasing the sources of food waste. For that reason we set the following research question: Can a specific way be identified of driving food banks' supply chains whose success features might then inspire improvements in the rest? Our interest in this is founded on the fact that food banks have received very little attention in both the academic and practitioner literature on logistics. This research analyzes food waste management in terms of available resources (human, material, and finance) in food banks, and food banks' relationships with their donors and beneficiaries. Such information is used to identify different types or groups of food banks, demanding different and specific improvement measures.

After having identified that the literature about food banks' management and logistics is scarce, the interest of the study comes from the innovative idea of combining the social purposes of non-profit organizations with a traditional topic of business management—the relationship among different members of their supply chain. This means that this research covers a clear gap in the literature by studying food banks from the classical point of view of business management (which we do not believe has ever been applied to this aim), their position in the supply chain in which they are integrated, and their relationships upstream and downstream.

After this section, we define the concept of food banks, highlighting their evolution over time and showing an international panorama. Then the text explains the methodology used in the research, and presents and discusses the results; finally, the last section summarizes the main conclusions.

Food banks

Food banks are defined as non-profit organizations based on volunteering, whose purpose is to recover food excesses in our society and redistribute them among needy persons, avoiding any food waste or misuse (Starkey et al. 1998, 1999). Various and different academic approaches to the concept of food banks can be found. Among the more recent definitions are those of Martins et al. (2011) who understand that a food bank is a non-profit organization of social solidarity that distributes food through a wide variety of non-profit institutions of social solidarity which feed low-income people; or Handforth et al. (2013) who think that a food bank serves as a center for collecting donations of tinned, fresh, and frozen foods, and drinks. The operating scope of these entities is mainly focused in developed countries, although there are organizations in Third World countries executing similar activities (Schneider 2013).

Food banks have different areas of activity. On the one hand, there are programs to identify food excess sources and food companies that could contribute with donations, for later distribution through non-profit organizations. On the other hand, there are awareness campaigns that include volunteer recruitment and food collection. In most cases, food banks are not responsible for the final distribution of the food to the needy population; rather they distribute it among different, officially known, charitable institutions with non-profit purposes, which have direct contact with the needy population (Berner and O'Brien 2004). Valid food for consumption but not marketable, that would have been destroyed, is delivered in this way to the most needy people. In other words, food banks have the commitment to maintain a well-driven chain, building the bridge between on the one hand food excess and on the other, human need. In fact, the aim of a food bank is giving value to food that otherwise would be considered as waste and therefore thrown away. Part of the waste food along the food supply chain should not be sent directly to landfill because it is safe and nutritious for human consumption and therefore ought to be recovered by a food bank.

The first food bank was created in 1966: St. Mary's Food Bank, in Phoenix, Arizona, USA. It was founded by John Van Engel, a retired man who participated in the collection of fruit and vegetables organized by a helping institution (Cotugna and Beebe 2002). John heard a mother, whose husband was in prison, explaining that she was able to feed her nine sons by collecting the food that had fallen down to the ground when trucks downloaded at a supermarket. This inspired Van Engel, who decided to promote the first volunteering bank. The idea was soon imitated all over the country and many agricultural and food companies joined the initiative. In Europe, the first food bank was created in Paris in 1984. The first Spanish food bank, however, would not be created until 1987, in Barcelona (FESBAL 2014).

Despite the common goal of nurturing the most needy, food banks are adapted to the environment in which they operate and are the result of specific historical processes. Table 1 summarizes the main characteristics of food banks in three continents showing where there are important differences, particularly in terms of user profile and network size. For example, in Canada there are many food banks, every one of which has a smaller coverage than the USA or European ones.

Although the first food bank in Spain was founded later than in the USA, Spanish food banks have now been

Table 1 Geographical differences of food banks in various countries

Country	USA	Canada	South Africa	United Kingdom	Spain
Donation type	Food and money	Food and money	Only food	Only food	Only food
Start of activity	1966	1981	2009	1986	1987
Donors	Private and governmental	Private (people or organization)	All types of organizations	Private and governmental	Private and governmental
Funding by government	State and local	Local	State	Not applicable	Not applicable
Main users	Low-income families	Children and people with unhealthy diets	Young and adult homeless and/or malnourished	Low-income families	Low-income families
Total number of food banks	>200	<500	5	250	55
Total number of people served	>37,000,000	>800,000	>300,000	>120,000	>1,000,000
Network or association	Feeding America	Food Banks Canada	Foodbank South Africa	FEBA; The Trussell Trust	FEBA; FESBAL (Federación Española de Bancos de Alimentos)

Based on Yadlowski and Thériault (1998), Nichols-Casebolt and Morris (2001), Irwin et al. (2007), Warshawsky (2011), Feeding America (2013), Food Banks Canada (2014), Foodbank South Africa (2013), The Trussell Trust (2013), Lambie-Mumford (2013), FEBA (2014), FESBAL (2014)

working for nearly 30 years. Table 2 gives an idea of the relative importance of the European and Spanish food banks, where it can be seen that although the percentage of food recovered is very little, Spain recovers nearly three times the rest of the continent. Moreover, Spanish food banks provide for nearly one million beneficiaries, i.e. 2 % of the whole population, or 12 % of the population at risk of poverty (INE 2014).

The activity of a food bank depends on its suppliers (food companies and other donators), which affects the quantity of food obtained that their clients (the distributing organizations) regard as enough to satisfy the needs. It actually acts as a wholesaler, although the food bank is driven by the availability of donated supplies—precisely the opposite of a conventional supply chain. Management of food banks has become additionally complex due to the manipulation of perishable products in many cases, which are subject to losses of quality and quantity (Rajan et al. 1992; Cai et al. 2013).

Figure 1 shows the different parts of the standard supply chain for a food bank in a developed country and its position, which is similar to a wholesaler, within this chain. This supply chain has another particularity: it is partially integrated by non-profit organizations, which rely on volunteer labor to achieve a social objective (Larson and McLachlin 2011).

Entities that collaborate with food banks are food producers, distributors, shopping malls, wholesalers, warehouses, retailers, transportation companies, financial entities, advertising and communication agencies, public institutions, and different types of national and international organizations. The entities managing the food banks can obtain food either from normal operations or as an output of different governmental help programs. The procedures and organizations involved are different in each case. The operation of the food bank starts once the food has been collected. Food is then classified by volunteers; the beneficiaries are usually phoned to arrange for collection while the food is preserved for later distribution.

Food banks focus their efforts on helping the communities most affected by poverty and famine or malnutrition. Among the various beneficiaries are the following: soup

Table 2 Food recovered by the food banks in the whole European Union and in Spain

	Total wasted food	Food recovered by food banks	
	Tons × 1000	Tons × 1000	%
European Union	89,000	400	0.4
Spain	7700	107.5	1.4

Based on FEBA (2014), Magrama (2013), and authors' own survey of the Spanish food banks

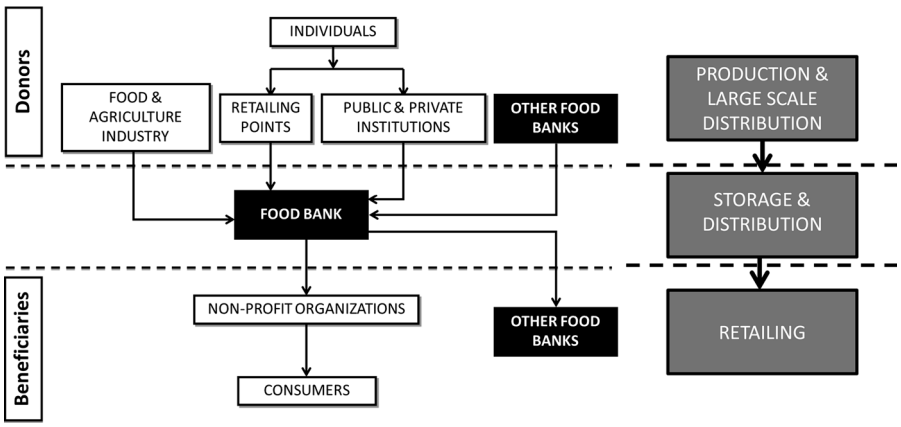

Fig. 1 Position of food banks in a typical supply chain

kitchens, hostels for the homeless, family associations, children's associations, youth associations, addiction rehabilitation associations, religious residential centers, labor unions, etc. With regard to social purposes, coordination of the supply chain becomes more complex (Egri and Váncza 2013), due to the intermittent relationship with the suppliers and the difficulties in balancing economic and social commitments.

From the five key elements of any logistics process—transport, storage, inventory, information and packaging (Islam et al. 2013)—we have used the first four in this paper to analyze the logistics practices of food banks. On the one hand, transport is the factor with the greatest influence on the logistics process, and storage and inventory are the physical means for the success of such process. On the other hand, information is an intangible factor, linked to all the others, that takes a key role in food banks, especially in the form of awareness-raising campaigns; these campaigns are addressed to transmitting human values in order to improve the connection between demand (beneficiaries) and offer (donors). Finally, we have excluded packaging, taking into account that this activity is not generally a common and/or core factor when talking about food banks that operate as intermediary agents.

In short, the role of a food bank could have a positive impact on both the environment and in society, firstly reducing waste, and secondly giving the potentially wasted food to needy people. But, do all food banks have a similar behavior? As explained in first section, scarce studies in the literature address the study of food banks from the point of view of management. Therefore, that is the gap in the understanding of these particular non-profit organizations that are analyzed in our research. The paper tries to identify a single, common way of functioning or, in case of a possibly negative answer to that question, to identify a reference model for improving the way the rest of the food banks function.

Methods and procedures

From results of a previous case study in Spain (Coque et al. 2012) and prior literature reviews (see international outlook in second section and questionnaire justification below) we show that the operating results of a food bank are conditioned by the characteristics of the organization and the conditions in which it operates. As we have already mentioned, this research tries to analyze if all the food banks in Spain are virtually similar or if different groups can be identified, based on such characteristics and conditions. Taking into account that we did not have a wide knowledge on the Spanish food banks and that our main purpose was exploring the possible existence of different groups within them, a cluster analysis on a massive amount of survey data seemed to be the most viable approach (see below for more details).

Sample selection

The target population of this empirical research includes all the food banks located within Spain—a total of 55 banks. Considering that this study also tries to achieve as complete an overview as possible, we considered surveying to be the most appropriate research methodology. As the size of the target population is not too large, the questionnaire was sent to the full population of food banks. The decision of each entity to participate or not in the survey determined the sampling.

Data collection was carried out in 2012, in two phases. The first step was executed in July, prior to the summer holiday period. The second was executed in the period from September to December in order to increase the response rate. Previously, by the end of June, a pre-test had been made to four entities with the purpose of testing and improving the questionnaire. The size of the final sample achieved was 42 food banks, which means a response rate

of 76.4 %. We then tabulated the information achieved from the questionnaire and treated it statistically using cluster analysis to check if the classifying variables allowed the differentiation between different types of food bank in Spain, as suggested by the literature. After that, we made a descriptive analysis of the identified groups that had been validated through discriminant analysis.

Questionnaire

Based on previous literature reviews (especially those of Cotugna and Beebe 2002; Cotugna et al. 1994; Daponte and Bade 2006; do Paço and Agostinho 2012; Tarasuk and Eakin 2005), the research team discussed a first draft of the questionnaire to arrive at a prototype, improving it by the feedback of experts from the research, whose opinions contributed highly to the final quality. During the pre-test we detected some difficulties, such as barriers to identifying the right contacts and the lack of time to respond by some food banks. Some contact data were not correct in the initially available information. On the other hand, some of the data requested in the questionnaire were not directly available and then collection became time-consuming. Lessons learned from this test were again discussed within the research team and incorporated in the final version of the questionnaire. This process was intended to guarantee the efficacy and consistency of the questionnaire. The final version consisted of 36 questions grouped in seven areas: general data about each entity, bank operation, volunteers, material resources, donators, beneficiaries, and image. The main questions used in that research have been provided in the "Appendix".

We obtained the list of the whole population of food banks from the Spanish Federation of Food Banks (FESBAL). Firstly we contacted each food bank via telephone to explain the aim of the research and to request its participation in completing the questionnaire. After that, we sent the questionnaire by email, except in a couple of cases where it was sent via traditional mail due to their lack of computers. This process was repeated twice, the first time between June and July and the second between September and December 2012. We did not offer any incentive to complete and return the questionnaire.

Classifying variables

To select the classifying variables, we looked upstream and downstream of the food bank in the supply chain. Upstream, we have the donators (Fig. 1)—corresponding to suppliers in traditional supply chains. Donations may come from different sources: volunteer donations by public or private entities, on the one hand (Johnson and Hawkins 2010), and "kilo operations" (donations of food by individuals and firms through public and private organizations), on the other. Downstream we have the distributing and consuming entities, corresponding to the clients in traditional supply chains (Fig. 1). They could belong to two different types: distribution centers (where batches of food are redistributed among the people and beneficiary groups) and consumption centers (whose users are provided with cooked and prepared food to be consumed on the premises) (Berner and O'Brien 2004).

Taking into account upstream and downstream agents, the classifying variables considered were percentage of public donators and percentage of kilo operations (upstream), and percentage of distribution centers (downstream). On average, 7.5 % of donations came from public entities and a little less than 30 % from kilo operations. Therefore, private contributions are clearly significant. When looking at the different types of distributing entities, the distributing and consuming organizations appeared to be quite balanced, although the quantity is a little lower in the second case than in the first one (45.3 %).

Method of analysis

Cluster analysis uses data from different variables to join cases (the food banks) into internally homogeneous groups but differentiates among them (Morgan and Griego 1998). This statistical test is then a good tool to answer our research question. If the classification variables allow to state different groups of food banks attending to their behavior, then different clusters must be obtained as a result. We used the computer software SPSS v.19 to do this. The main reason for carrying out a cluster analysis was then the research question, because we try to identify different types of food banks by looking at their operations. These different groups can help to identify more efficient behaviors that could be copied by the other food banks.

Results

Before starting the cluster analysis itself, it was necessary to check two prerequisites: the representativeness of the sample and the non-existence of multicollinearity between the variables. The first was guaranteed by the sample size, which is more than 75 % of the target population. To ensure the absence of multicollinearity (or linear relationship) between the classification variables, we carried out an analysis of bivariate correlation, where a coefficient near to 1 shows a strong linear dependence between each pair of variables and a coefficient near to 0 indicates the absence of dependence. These results showed the independence between these variables since the correlation coefficients were not significant (significance level around 0.1).

Table 3 Descriptive analysis by conglomerates

Mean (standard deviation)	Conglomerate 1 (35 cases)	Conglomerate 2 (7 cases)
Upstream of the supply chain		
% Public entity donors	8.51 (9.14)	2.45 (2.91)
% Private entity donors	63.79 (15.83)	38.19 (27.11)
% Kilo operations	23.22 (12.94)	59.35 (29.60)
Downstream of the supply chain		
% Distribution centers beneficiaries	39.64 (20.89)	74.34 (17.69)
% Consumption centers beneficiaries	56.51 (22.79)	25.66 (17.69)

The number of clusters to obtain is usually determined using the method of hierarchical clusters. Analyzing the dendogram or distance matrix (both of which represent the differences among internally homogeneous groups), we detected the membership of the Spanish food banks in two different clusters with different sizes (Table 3). A new cluster analysis, using the k-means algorithm, confirmed the previous result, which means that our previous decision of estimating two different clusters is appropriate.

The first cluster was composed of 35 food banks, while the second one contained only seven entities. Using a descriptive analysis of clusters (Table 3), the high level of participation of the food banks of cluster 2 in kilo operations is clear. Kilo operations are nearly three times higher in cluster 2 than in cluster 1, and collaboration with the distribution centers is essential (almost two-thirds of food bank activity is dedicated to this).

To validate the quality of the clusters obtained, we proved the existence of statistically significant differences in the classification variables of both clusters. Previously we carried out a Kolmogorov–Smirnov test to check the normality of the distributions of the classification variables (Table 4, second column). It showed that we must reject the hypothesis that the variable of the percentage of public entities donors (in-kind donations) is normally distributed. Then, as one of the classification variables is not normally distributed, a non-parametric Mann–Whitney test for independent samples checked the equality of the means of the variables. Table 4 (third column) shows that the null hypothesis of similarity in the average of the variables can be rejected only in the cases where variables are related to the kilo operations and the distribution centers. Although the differences in the distribution of the variable on donations of public entities cannot be ensured, the existence of differences in the other two classification variables employed is clear and therefore the cluster analysis carried out is considered to be validated.

To verify the existence of other differences between both clusters obtained with regard to the internal management of the respective food banks, we show in Table 5 all the variables studied, as well as the verification tests of the similarity between the two clusters (we use non-parametric tests due to the fact that the condition of normality needed for the use of parametric tests of this type does not exist in many cases). There are statistically significant differences in the distribution of daily time to the different activities of each food bank, and in the sources of funding (Table 5). Conglomerate 1 is characterized by spending a large part of the day-to-day in actions in logistics management, while in conglomerate 2, although the administrative and logistical tasks represent more than half of the working day, the food banks drew particular attention to the effort invested in awareness work. Besides, the first cluster accounts for private entities as the main source of funding (more than 25 % of its financial resources have this origin), while the second cluster receives from the food bank's own partners one-third of the financial resources of the organization.

Table 4 Analysis of normality of the classification variables

Statistical (significance)	Normality test	*U* Mann–Whitney test
% Public entities	1.441 (0.031)	74,500 (0.103)
% Kilo operations	1.035 (0.234)	213,000 (0.002)
% Distribution centers	0.511 (0.956)	220,000 (0.001)

We performed the corresponding discriminant analysis using the four variables indicated in bold in Table 5 (time spent in logistics management, time spent in awareness tasks, funding by private entities, and funding by partners' quotas), which show statistically significant differences between the two clusters obtained previously. Starting from a set of elements already grouped, this statistical test allows finding linear relationships between the independent variables that best discriminate the pre-set groups (Morgan and Griego 1998). In addition, it enables constructing a decision rule that sets the group ownership of a new item to categorize. This uses the Wilks' Lambda method, where the variables are introduced step by step, incorporating in each of them the variable with the highest Snedecor's F and with less Wilks' Lambda (Table 6). As a final result, the last of the variables in Table 5, the time invested in awareness, is excluded from the model.

With regard to the canonical discriminant functions obtained, the canonical correlation coefficient is 0.694, indicating that almost 70 % of total variability is due to the

Table 5 Analysis of other differences between the clusters

Variables	Descriptive: mean (standard deviation)		Mann–Whitney: statistic (sig.)
	Conglomerate 1 "Specialised food banks"	Conglomerate 2 "Complete food banks"	
Years of operation	15.56 (7.79)	14.56 (6.88)	113.500 (0.759) =
Staff			
N° volunteers	37.41 (37.95)	56.71 (55.16)	164.000 (0.161) =
N° paid workers	1.38 (1.83)	2.00 (2.89)	128.500 (0.832) =
% Time spent			
Administrative management	22.28 (11.90)	28.57 (16.51)	157.500 (0.179) =
Logistics management	**60.98 (17.09)**	**37.14 (16.80)**	**35.500 (0.003*)** ≠
Kilo operations	11.15 (13.62)	15.00 (7.07)	172.500 (0.055) =
Awareness	**9.56 (13.74)**	**15.00 (7.07)**	**186.000 (0.018*)** ≠
Collected			
Donations (kg)	1,098,110.55 (1,356,526.79)	652,770.00 (645,214.24)	88.000 (0.244) =
EU programs (kg)	891,030.70 (750,609.40)	1,110,028.86 (992,421.48)	135.000 (0.673) =
Funding sources			
Public entities	36.02 (16.41)	34.00 (19.33)	105.000 (0.717) =
Private entities	**26.51 (25.21)**	**1.00 (2.24)**	**40.000 (0.018*)** ≠
Individuals	18.38 (25.41)	23.10 (33.80)	98.000 (0.879) =
Members' quotas	**6.81 (8.81)**	**34.80 (33.80)**	**157.500 (0.002*)** ≠
Volunteers			
Years	58.57 (11.47)	55.93 (8.66)	98.500 (0.417) =
% Men	76.75 (20.50)	80.48 (17.61)	136.500 (0.634) =
Material resources			
Warehouses (m^2)	989.86 (651.71)	642.86 (680.95)	82.000 (0.171) =
N° transport elements	2.91 (2.31)	2.71 (1.50)	130.500 (0.781) =
N° handling elements	5.23 (4.25)	4.00 (2.64)	107.500 (0.611) =
% Collected food			
Dairy	19.22 (10.83)	20.14 (8.07)	81.000 (0.678) =
Fresh fruit	14.96 (13.15)	11.20 (12.16)	62.500 (0.626) =
Fresh vegetables	10.13 (8.62)	10.40 (12.39)	64.500 (0.695) =
Fresh fish	1.34 (2.10)	0.54 (0.46)	84.500 (0.537) =
Biscuits and pastries	7.43 (5.74)	8.09 (6.72)	75.500 (0.883) =
Pasta and rice	10.19 (8.70)	14.53 (6.90)	104.500 (0.118) =

Variables in bold present statistically significant differences between two clusters obtained

differences between the two groups. On the other hand, the Wilks' Lambda test, in which the null hypothesis is the equality in the average of the discriminant functions of groups, presents a coefficient of 0.519 with a significance level of 0.000. This result allowed the rejection of the equality between the two clusters. The Fischer's two discriminant functions we obtained allowed us to classify correctly 94.7 % of the cases.

Next we analyzed the effectiveness and efficiency of both identified groups of food banks. Starting with the effectiveness, there is clearly a greater diversification of the activity in the food banks of cluster 2. This means that they paid more attention to other activities that are different from logistics. Together with the logistics tasks inherent in this type of entity, the foods banks in cluster 2 also employ part of their efforts to raising awareness. Food banks belonging to cluster 2 we have called "complete food banks" while food banks in cluster 1 are called "specialized food banks."

Finally we used an efficiency ratio through relations output/input. We considered the quantity of managed food per year in tons as output, and the time employed per a volunteer in logistics activities as input. Understanding this measurement unit is relevant in order to understand the results obtained and is a great indicator of the efficiency of the main activity of a food bank, i.e. its logistics activities.

Table 6 Test for equality of means of the groups

Variables	Wilks' Lambda	F	Significance
Quotas of partners	0.699	15.518	0.000
Donations of private entities	0.839	6.929	0.012
Time spent in logistics management	0.841	6.782	0.013
Time spent in awareness	0.988	0.453	0.505

Cluster 2 is significantly more efficient than the food banks in cluster 1, because they have over twice the tons of managed food per annual volunteering time (2.9 against 1.4). Previously, in Table 5, we found no statistical differences in the quantities of collected food between both clusters. Volunteers in cluster 2 spend much more time in awareness activities and less time in logistics activities. They are more efficient in the physical movement of food and they also improve the social concern. In other words, volunteers in cluster 2 spent their time better on logistics actions, and therefore these logistics procedures should be imitated by food banks belonging to cluster 1.

Discussion

In cluster 1 the number of Spanish food banks is significant (more than 80 % of the sample). They are entities supported mainly by private food donors (more than 60 % of their donations are of this type), although the contribution made by public entities should also be highlighted (their percentages quadruple the data of cluster 2—see Table 3). Internally, in both clusters, volunteers are the essential human resource in the activity of the food banks (as previous researchers, such as do Paço and Agostinho 2012, found), although "specialized food banks" have a smaller staff throughout the typology (employers, volunteers, and paid staff). These figures of human resources mean that the logistics management (collection from donors, handling and storage of food, as well as their adequate distribution in time and form to the beneficiary centers) is the fundamental activity of each food bank, in which the food banks of cluster 1 invest more than 60 % of their workday. The lack of enough human resources could be the reason that the food banks in cluster 1 spend far less effort in raising awareness (Table 5).

Along with the human factor, we found a better use of volunteers in "complete food banks," doubling their productivity rates from those of cluster 1. If one considers any person participating in the activity of the food bank, whether voluntary or paid, the trend is the same. It can also be seen that the volunteers would explain better the efficiency in the logistics tasks of the food bank, because when the calculation introduces the data of paid staff there is less difference in the ratios between the two clusters (from 52 to 40 %). This may be due to the fact that the few salaried workers are more involved in administrative and management work than in the logistics tasks that are the main activity of the food bank.

Because of the logistics work described above, we note that each "specialized food bank" collected annually an average of more than 1000 tons of food donated by companies and individuals, dropping to 900,000 kg from the programs of the European Union (Table 5). Nearly one-fifth of these foods are milk, followed by fresh fruit and drinks. These data conflict with other previous studies where the diversity of products distributed differs (Cotugna et al. 1994) and give an idea of the third logistics factor to consider, inventories (Islam et al. 2013), given the amount of food managed. Such discrepancy could be explained by the differences in eating habits among countries and their cultures. Storage and transport to manage these quantities of food are the first and second logistics criteria defined by Islam et al. (2013). Following with cluster 1, the average surface for storing does not reach 1000 m^2, and the available surface for office space is less than 100 m^2 (Table 5). Each food bank also has an average of two or three means of transport, and five or six different types of handling equipment.

The main sources of funding for the "specialized food banks" are private entities, followed by public entities at a regional or national level (municipalities collaborate to a lesser extent when one looks at the figures of participation together with cluster 2). It must be borne in mind that the non-profit entities studied have the characteristic of being supported mainly by donations of food, having little or no financial resources (Johnson and Hawkins 2010). This trend is usual in Europe, unlike what happens in North America (Nichols-Casebolt and Morris 2001) or in South Africa (Foodbank South Africa 2013).

With regard to the profile of volunteering, there are no differences between the two identified clusters. In both cases, the average age is over 55 years, and the presence of retired men and with some kind of study qualification, mainly secondary, is extended.

To highlight some peculiarities of the cluster 1 volunteers, we must pay attention to the participation of housewives (slightly more than 8 %), as well as the fact that almost 20 % of the volunteers have only primary education. In any case, the gender of the volunteer of food banks is usually masculine; these data collide with the predominance of women as volunteers in other types of non-profit entities (Franco Rebollar and Girard 2011).

With regard to cluster 2, unlike cluster 1, the kilo operations are more usual. These actions account for almost 60 % of the food collection of these entities (Table 3). The social product offered by cluster 2 is more complete, due to the fact that a great part of kilo operations is prepared for attending to a particular social need and these food banks therefore better achieve their social goals.

Again, the whole activity of a food bank can be carried out thanks to the participation of selfless volunteers. Although they spend much of their time and effort either working in logistics, management or administrative tasks, they also pay special attention to awareness, in the case of cluster 2, which means a greater amount of kilo operations is carried out (Table 3). Likewise, they receive larger amounts of food from EU plans (Table 5), which involves a more bureaucratic burden but lower logistics work. Besides, the productivity ratios of the human resources reveal a greater efficiency in cluster 2. For this reason, speaking in average terms and in relation to cluster 1, these "complete food banks" have smaller warehouses and larger spaces to be used for offices, as well as fewer amounts of handling equipment and more computer equipment.

There are also differences in the beneficiaries of the food banks between both clusters. Complete food banks essentially serve distribution centers (almost 75 % of the cases—Table 3). In addition, dairy is again the food mostly distributed by the food banks of cluster 2 (following the European tendency where the largest collected product group is dairy—Schneider 2013), but followed on this occasion by pasta and rice (Table 5). This last group of food has also been one of those most distributed in food banks of other countries, as Cotugna et al. (1994) already showed at the end of the last century.

Conclusions

After having pointed out the relevance of the differences between several countries, particularly with regard to the size of the networks of the food banks available and the profile and number of their beneficiaries, this research carried out in Spain has allowed us to test the existence of two different types of food bank in response to the relationship they have, both up and down, within the supply chain; that is to say, Spanish food banks have been classified depending on their ties with their suppliers, in this case the donor entities, and with their customers, the beneficiary organizations. The verification of such a dichotomy is our first contribution to the general knowledge within the non-profit sector field.

We have covered a second gap by means of our conceptual approach, which combines the classic management studies on the supply chain with topics related to non-profit entities, i.e. the sector to which food banks belong. In the literature review there was a clear lack of research from such a point of view. The first part of approach pays attention to factors such as transport, storage, inventory, and information; the second part deals with voluntary staff, income from selfless sources, and a solidarity network.

As a third innovation, we have described the respective profiles of both clusters in order to highlight the features of the most successful food banks, which could suggest ways of improvement to other food banks.

In the first cluster there is the largest number of cases, whose profile would be the most widespread throughout the national territory. They are entities that focus their efforts on logistics activities, with no remaining time or other resources for other tasks such as awareness campaigns, which could improve their logistics results and provide a greater comprehension of their social product. The reason for this decision could be found in the reduced availability of staff (both workers and volunteers) at all hierarchical levels of each organization. Their main funding source is private. Upstream in the supply chain, most of the received donations are also private. Downstream, its main beneficiaries are consumption centers.

A second cluster of food banks is composed of only seven entities, which present differentiating features from generality. They focus their efforts equally on administrative and logistical tasks, but with a greater emphasis on the awareness tasks and kilo operations; these two last actions are particularly interrelated and enhance the social concern for the hungry. We must point out here that their main funding source comes from the partners themselves, which gives them greater stability. Upstream, most of the donors come from kilo operations, while, downstream, distribution centers are their main beneficiaries. This may be due to the fact that the demand of these centers is more heterogeneous and fluctuating than in the consumption centers, which requires a greater capacity for management. The food banks belonging to the second cluster are more flexible in their management when compared with those of cluster 1, and can better meet the specific needs of the distribution centers, due to the fact that they can organize kilo operations for recovering food to cover a particular social need for food. Indeed, we have verified (by interviews with staff in charge of the food bank studied) that distribution centers have raised more than consumption centers over the recent socioeconomically crisis years; so, second cluster food banks are answering more precisely to their environment's needs. Their operation is therefore more effective and efficient in all fields. With respect to efficiency, we cannot forget that the management field of the traditional supply chain has usually devoted its studies to costs (Sezen 2008), which is especially important in food banks—in the non-profit sector in general—when we realize the resource shortages with which they have to work.

In the final analysis, the first type of cluster is characterized by smaller entities whose scarce human resources are concentrated—probably from being too short-term and at an accelerated pace—on fulfilling the food bank's primary purpose: collecting and distributing food. In the second type of cluster, a small number of larger organizations with more resources and a strategic overview are observed, allowing them to offer a more comprehensive social product that includes social awareness. This action could put in doubt some of the criticism that food banks often receive, i.e., that they could actually cause chronic social demands to alleviate hunger, which could justify the public sector's inaction in trying to meet such demands (Daponte and Bade 2006).[1] Therefore, it could be concluded that the food banks of the second cluster are the "leaders" in their activity, serving as reference models or examples to the entities belonging to the first cluster of "followers." We believe the system of food redistribution is better (more complete and interconnected) when human values are enhanced. This is the case of the complete food banks, where special attention is paid to the awareness tasks, as compared to the entities of cluster 1, which are also concerned in the movement and management of food. As Dixon (2014) states by means of describing several cases of nourishment self-help in the US, sharing information on both hungry causes and solutions is a key measure to advance towards food justice.

Such dichotomy corresponds with the more general overview of the Spanish non-profit entities, which is in spite of a huge heterogeneity that makes their study as a whole difficult (Ariño Villarroya 2008). Most of the Spanish non-profit entities are small organizations and quite specialized, while the rest are large, complex, and usually diversified entities that, paradoxically, tend to be best known by occupying more space in the media.

[1] Beyond this consideration, we cannot deny criticisms, or direct attacks, that food banks frequently receive for limiting themselves to solving a short term social need, i.e., the lack of food at home, and not eradicating the problem at its source, i.e. hunger and poverty around the world, declining the role of governments in addressing these social requirements. For example, "Food Banks should not be seen as a 'normal' part of a national safety net. They are charity-based, not rights-based, and they should not be seen as a substitute for the robust social safety nets to which each individual has a right […] Governments should not be allowed to escape their obligations because private charities make up for their failures" (statement by Olivier De Schutter, Special Rapporteur for the United Nations, in New Mexico, July of 2014). Although we agree essentially with these approaches, by means of this research we also recognize the important temporary role that food banks play for wider sectors of poor people. Therefore, analyzing the daily activity of food banks and their relationship up and downstream in their supply chain in order to improve it would be useful at the moment. And, as we indicate in these conclusions, the more complete offer of cluster 2 food banks, that includes social awareness, would better fight the whole problem (i.e., the actual problem).

In addition, in this work, we have studied the resources that are within each food bank (human, material, and financial), and their results (quantities of food collected and distributed, and their typology). Taking into account the human resources in particular, and given the average age of volunteers, which is the main work factor in this type of non-profit entity, we feel it would be advisable to promote the recruitment of younger people sensitized to the aim of food banks. These new volunteers could supplement perfectly the work experience gained over the years by the current, older volunteers. This rejuvenation of the staff would allow a better distribution of tasks, which in many cases requires specific knowledge of new information technologies (such as Evans and Clark 2010, point out). This would enhance the internal and external coordination of each food bank, which would improve their performance.

Since there are clear differences in the relationships between food banks of both clusters identified with the predecessors and successive links of their supply chain, future extensions of this research work will seek to address in greater depth, on the one hand, the beneficiaries, distinguishing between distribution centers and consumption centers, and, on the other hand, studies of donor organizations. We have identified other several interesting areas for future research related to resources shortages (food, money, labor), managing volunteers, or type and quality of goods handled. These ideas point to new lines of work to continue the research in this field. Moreover, our work has been limited to studying the differences and similarities of food banks within one specific country, Spain; subsequent studies could extend the research to other countries to establish comparisons within the European Union, or of its reality versus similar situations in other continents.

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Appendix: Main questions of the questionnaire

1. Year of food bank's foundation:
2. Please, indicate the number of people in each case: Volunteers __, Paid workers __
3. Every day in the food bank, how much time is spent on the following actions?

Administrative management	%
Logistics management	%
Kilo operations	%
Awareness	%

4. What quantities of food are received from…?
   Donation __kg/year, EU programs __kg/year
5. Kind of food managed:

Drinks	%
Dairy	%
Fresh fruit	%
Fresh vegetables	%
Fresh fish	%
Pulses	%
Biscuits and pastries	%
Pasta and rice	%
Cheese	%

6. The main funding sources of the food bank are:

Public entities	%
Private entities	%
Individuals	%
Partners' quotas	%

7. About the volunteers:
   Average __years old and __% men
8. About materials resources:
   __square meters for warehouses, __ transport elements, __ handling elements
9. How many donors does the food bank have?
   __ public entity donors, __ private donors, __ entities collaborating with kilo operations
10. How many centers' beneficiaries does the food bank have?
    __ consumption centers' beneficiaries, __distribution centers' beneficiaries

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[**ANEXO 4**]

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Article

From Food Waste to Donations: The Case of Marketplaces in Northern Spain

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Abstract: There is a growing increase in the number of disadvantaged people whose basic needs, such as food, should be covered. In crisis periods, food banks and other entities have a special role to play in that social function. This research focuses on the marketplaces that are great generators of organic food waste due to the fact that almost all of their stalls are dedicated to the sales of fresh food. The work combines both qualitative (interviews with the person responsible for most of the marketplaces in a northern Spain region and with two health inspectors, as well as a participatory workshop with different stakeholders related to food recovery: a regional waste management company, a food bank and several beneficiary entities) and quantitative techniques (a massive survey of the market stalls where the interviews were previously conducted). The results allow us to estimate the volume of organic waste generated by these marketplaces and to propose guidelines that would facilitate a better management of the food surpluses with potential for use, in the first place, as donations to food banks and, secondly, as recoverable bio-waste.

Keywords: marketplaces; food banks; bio-waste; donations; northern Spain

1. Introduction

Millions of people around the world live below the poverty line. In developing countries, in 2010, 21% of people were living on $1.25 a day or less [1]. In the period of 2011–2013, 842 million people (one-eighth of the world's population) suffered chronic hunger. Due to the latest economic crisis, the advances seem to have slowed down, but the geographical differences have increased, even affecting industrialized countries, such as Spain [2].

In contrast to this situation of unsatisfied basic needs, the phenomena of food losses and waste are observed. On the one hand, food losses are defined as the decrease in the mass of edible products by humans in the stages of production, post-harvest and processing into the supply chain; on the other hand, food waste occurs at the end of the supply chain and is related to the inappropriate behavior of retailers and consumers [3]. About one-third of food produced for human consumption is lost or wasted; this figure represents about 1300 million tons per year [4]. In most high-income countries, the food is mainly wasted; this means that food is thrown away while still in a suitable condition for human consumption (for example, in the USA, 40% of food goes uneaten daily [5]); in low-income countries, food losses exceed the amount of food waste, which clearly denotes technological shortcomings. Therefore, an American consumer wastes 10-times as much food as a Southeast Asian [6].

More than 100 million tons of food were wasted in Europe in 2014 [7]. Spain is the sixth European country with the most wasted food (about eight million tons) after Germany, Holland, France, Poland and Italy [8]. The main cause of this waste is the leftovers produced during meals at the consumption stage (86.4%) [9], while in the distribution system, the main reasons are non-perishable mislabeled

items, canceled orders, line endings, completed promotions, damaged units, but still suitable for consumption, or incorrect packaging [10].

In addition to this social problem, especially in developed societies, the role played by food banks is crucial. A food bank can be defined as a non-profit organization based on voluntary activity whose aim is to recover food surpluses from society and redistribute them to those in need, avoiding any waste or misuse [11,12]. In addition to this definition, within the literature review, there are many other authors who have tried to define the concept. For Cotugna *et al.* [13], food banks are stores for collecting donations of food surpluses and distributing them to other non-profit organizations. This last idea related to distribution is the focus of the definition in other research, e.g., Martins *et al.* [14]. Handforth *et al.* [15] state that food collected and distributed by such entities is usually packaged, fresh or frozen, and beverages. In this context, food banks play the role of the "good Samaritan"; although not applicable universally, in the USA and Canada, the saying is widely used to protect someone who tries to serve or help with respect to needs and well-being.

From the previous definitions, we can deduce that food banks maintain a bridge between the food surpluses in producing industries and the rest of society, on the one hand, and the most immediate and basic human needs, *i.e.*, transforming food into solidarity/caring resources, on the other. Each food bank depends on what their "providers" (donor companies and others) bring or contribute, and thus, part of their clients' demand (beneficiary organizations) can be satisfied (Figure 1). Being run by its offering, and not by its demand, represents the opposite logic to that of every commercially-conventional supply chain and brings serious management problems.

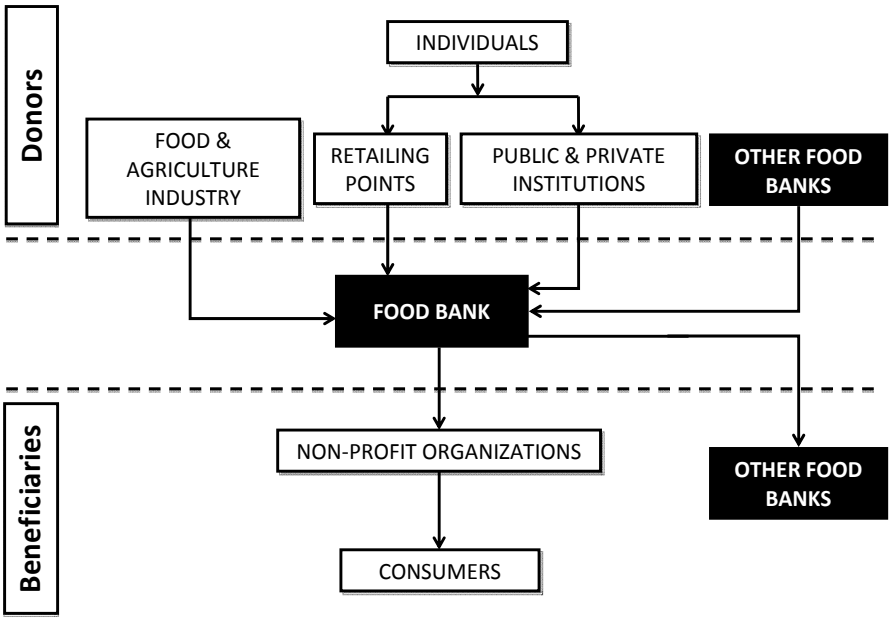

Figure 1. Position of food banks in the logistics chain [16].

In Spain, there is around one food bank per province, making a total of 55 entities nationwide [17]. The Food Bank of Asturias, created in 1997, currently covers the needs of 27,000 people through nearly 200 social non-profit entities [18]. Asturias is a northern autonomous one-province community with a little over 10,000 square kilometers and 1,000,000 inhabitants.

This research focuses on the marketplaces of Asturias as large producers of food waste from fresh items and therefore as potential donors of food to collection centers in need through the food bank in the region.

On the one hand, marketplaces belong to the processing and packaging step in the food supply chain, where food recovery or redistribution is really relevant. Food recovery is the collection of

wholesome food for distribution to the poor and hungry. On the other hand, food banks are the recovery organizations responsible for collecting and transporting food donations, although food ready for donation does not always match the needs of food recovery organizations [5] (p. 14).

Another challenge is the reduction of bio-waste quantities going into landfill; or the reduction of the great amounts of natural resources associated with discarded food [19]. Bio-wastes are defined as biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and local retailers and similar residues from food-processing plants [20].

A marketplace is a set of retail shops, usually selling food, normally grouped within a building of great historical and artistic interest [21]. A solution for managing the remains of food sold in these shops would be the separation of the surplus into two parts: firstly, the usable products would be sent to social entities coordinated by a food bank; and what cannot be reused must be placed in specific bio-waste containers.

There are a few relevant experiences regarding perishable food recovery in marketplaces in Spain. One is the case of the local marketplaces of Cornella de Llobregat (Barcelona) and Torredembarra (Tarragona), whose councils coordinate all of the necessary steps for food recovery implementation. In the first case, the transport of food is carried out by Red Cross volunteers, and the final recipient is the Botiga Solidaria, which helps more than 600 families [22]. Regarding Torredembarra, this is a weekly marketplace of fruit and vegetables whose surpluses are sent to Rebost dels Aliments Torredembarra, an entity belonging to Caritas, which serves about 200 families [22]. During 2013, 2571 kg of food were collected in Cornella and 5103 in Torredembarra, representing economically € 8237 in the first case and € 10,425 in the second [22].

Within the wider research on the situation, the management and the potential of Spanish food banks' framework, this paper focuses on the first link in the supply chain (Figure 1), paying particular attention to one of the major producers of food and agricultural waste, specifically the marketplaces in Asturias, as a source of food for needy groups.

In other words, it seeks to address the following research question: do marketplaces in Asturias encompass an interesting potential to recover organic waste, either as consumable food or recoverable bio-waste? In the case of an affirmative answer, other issues will be considered, such as the amount of food that can be recovered or if/how these figures could be improved.

The specific objectives to respond to these research questions are established as follows:

- Conduct a study of marketplaces in Asturias, focusing on facilitating the separation of food as donations to organizations, such as the Food Bank of Asturias, or as recoverable bio-waste.
- Develop guidelines to better manage food surpluses, as well as waste and, in particular, bio-waste, in this kind of commercial area.

The generalizable goal of the research is then proposing ways to advance on the challenge of transforming food waste into food donation. The paper focuses on food waste management in the retail trade in order to improve the supply of food redistribution. As this is a topic only lightly treated in the current literature, the present work offers a multi-case study that could (and should) be replicated and adapted to other contexts, building gradually useful knowledge for social purposes.

In the next section, the methods used in this research are briefly explained. The main results (of the qualitative analysis, firstly, and of the quantitative study, secondly) are presented in Section 3. Finally, a discussion and relevant conclusions are included in Section 4.

2. Methods

After an in-depth literature review, consisting of the compilation of previous studies on the central themes of the project (data on poverty and hunger; losses and food waste; food banks and food recovery; marketplaces), to achieve the objectives of this research, a combination of different methodological tools has been applied:

- Expert opinion: meetings with people from different entities (waste manager, food bank responsible, some of the beneficiary entities of the food bank and a representative of the food retail sector).
- Qualitative study by means of interviews with the representatives of most marketplaces in Asturias and two health inspectors, as well as a participatory workshop. This step of the research allows having a complete overview of the marketplaces studied.
- Quantitative study by surveying shops in marketplaces in which interviews were conducted previously during the qualitative study. In this last step, more details are obtained about the analysis unit.

3. Results and Discussion

3.1. Qualitative Analysis

Initially, we wanted to obtain an overview of the current situation of Asturian marketplaces, emphasizing their waste management, especially the organic part; therefore, we chose a qualitative exploratory analysis.

Indeed, qualitative research methods contribute to the understanding of organizational or social systems, taking into account contexts and diffuse phenomena, proposing appropriate solutions for particular situations and offering descriptions to substantiate subsequent generalizations [23,24].

This does not detract from the rigor of the work processes. In this case, the data collected (interviewees' opinions and documentation provided by them) were compared using various instruments applied sequentially to ensure external validity, internal validity and reliability of the research [25]:

- Saturation of information, through eight in-depth interviews with informants related to marketplaces that were different from each other, but complementary: managers, administrators or others (in cases where no one was exclusively in charge of the marketplace management), as well as two health inspectors. The interviews were conducted face to face and followed a semi-structured questionnaire, elaborated for the research team of the University of Oviedo, the waste manager entity in the region studied and the Food Bank of Asturias. The interviews took place between October 2014 and April 2015, the length of each one being between 15 and 30 min.
- Coding: The two ways of coding of Strauss and Corbin [26] were used. Firstly, open codes, *i.e.*, after a first reading of the interviews, words or pieces of text that called for attention were highlighted. Secondly, we proceeded to perform an axial coding; this means that second categories and subcategories were generated, and then, the relationships among them were established.
- Discussion within the research team: Each member made their own map of categories based on the transcript of the interviews, which were subsequently verified and discussed with the rest of the team to reach consensus.
- Contrast and complementarity of interviews with documentary sources: plans, lists of jobs and activities and memories with an overview of the marketplaces.
- Additional contrast by having a workshop (that took place on 2 December 2014) to return to and deepen the provisional results of the qualitative study. This workshop was moderated by the research team at the University of Oviedo and conceived of from a perspective of participatory action research. Such a methodological approach begins with direct social academic commitment, calling into question who is the researcher and who the researched, whose respective traditional roles of subject and object in the study fade and exchange to build the truth together [27]. Researchers provide support to the community (in this particular case, the Food Bank of Asturias and its beneficiary entities and other actors situated "upstream" in the supply chain) to analyze their problems throughout mutual training processes.

- In particular, reliability was ensured by the prior literature review, which provided the content and structure of the script for interviews, the recording and transcription of these and, in general, by the systematization of all information collected and the monitoring of a rigorous protocol for the entire process.

3.1.1. Interviews with the Managers of Marketplaces

The population, taken from a total of 14 marketplaces in the Asturian region, was established from a public directory [28]. This population was verified and supplemented via the Internet and by phone calls. In the study, the unit of analysis is the unit of management of the marketplace in each council. Those belonging to the 12 councils involved were contacted by telephone. Finally, we were able to interview eight managers with respect to nine marketplaces located in seven different councils (first column of Table 1). The second column of Table 1 includes the number of the respective available shops, which is important given the relationship between the total food surpluses and the marketplace occupation grade. The third column shows the number of open operating shops, which is used to estimate the actual food surpluses produced.

Table 1. Information about each marketplace shop (based on the interviews, the documentation provided by each marketplace and direct observation).

Marketplace	Number of Available Shops	Number of Open Operating Shops	Total Surface (m^2)	Shops' Surface (m^2)
1	21	18	1000	540.00
2	42	38	2000	920.04
3	42	34	1630	710.00
4.1	32	25	-	730.36
4.2	14	5	-	750.23
5	16	4	519	151.22
6.1	16	9	1053	237.00
6.2	3	3	247	78.00
7	58	36	6000	954.00

It is important to point out that the study included municipal marketplaces and commercial shops similar to them, but that were under private property (both share the characteristics of permanently-covered marketplaces, and both are mainly devoted to selling fresh or perishable food, where the customer is the final consumer). Table 2 outlines the basic conceptual blocks of the script used in the interviews.

Table 2. Script of interviews with marketplaces' managers.

Blocks	Contents	Sources
A. Information about the marketplace	General (property, number of shops, available surface) Situation (types of purchase)	[21,29–33] [21,32–35]
B. Waste management	Practices (who is responsible for waste management) Containers (types of them)	[21] [21,32]
C. Wastes generated	Features (types of them) Donations (potential of food surplus)	[21] [22]

Food markets are a traditional commercial form [29]. There are diverse cases of marketplaces in terms of the characteristics of each one in relation to its size and capacity, age and style, number of floors, state of the facilities and style of management [30]. Thus, some of them are located in ancient/historic buildings [31] and others in more recently-built areas; sometimes marketplaces have been remodeled to adapt old facilities to current needs. Furthermore, many marketplaces have disappeared or require a

physical, functional and operational modernization, while others can compete successfully nowadays with other retail formats [32]. Marketplaces have certain strengths that should be properly exploited to remain in the current scenario, such as the quality and variety of supply, the proximity to demand, the personalized service and the concentration of supply that avoids the need for lengthy shopping [33].

Usually, marketplaces are local utilities owned by the town hall. They can be managed directly by the local government or by third parties [31]. This trend is illustrated in the Asturian case where all of the marketplaces studied are local authority property, except for Market 7, which is privately owned. In the indirect management, only the concession model is observed in the cases studied. Markets 1 and 2 are handled through administrative concessions. Other marketplaces within municipal property are managed directly by the respective town halls.

In the local marketplaces, more than 80% of outlets are food [21]. During daily activity, the distributions of perishable or fresh, fruit, vegetables, fish and meat have become essential products. Table 1 summarizes the information about the shops in each marketplace studied. An available space is the surface on which a commercial shop is located. One shop may have several spaces. An open operating shop is one that is open to the public. The total area is the surface occupied by the whole marketplace, including the shop's spaces, public access and ancillary facilities.

In recent decades, trade in general and local marketplaces in particular have suffered important changes resulting mainly from changes in consumer habits. That means that the commercial supply of shopping centers must offer different alternatives that combine shopping and leisure facilities [34]. Over several decades, local marketplaces were an effective way to ensure retailing offering daily purchases, especially food, in times of high demand growth and with high quality standards. Currently, there are local marketplaces having difficulties to the point that in some Asturian places, their survival is in danger [35]. Some marketplaces have adopted new business strategies to recover part of their past success. In other locations, the custom of buying in local marketplaces rather than supermarkets is prevailing, especially for buying certain fresh products due to the capability of marketplaces to offer several advantages: specialization, product quality, personalized services, *etc.* Regarding the decline in the number of shops and sales, the answers are different, although the acceptance of that fact seems clear. Several marketplaces have changed their location because they were located in large buildings whose space was not all being used because they had begun to need smaller areas.

Local marketplaces have traditionally been regarded as local large waste generators, because they are collective enclosures for public attendance and daily activity. In each marketplace, a person must be responsible for waste management, although the manager in charge of the collection service in the marketplace may be different from the company that has been contracted for the collection of waste generated in the rest of the city/town. In addition, the concierge, although not common in all marketplaces, could have the internal waste collection among his/her tasks [21].

Some marketplaces have an internal warehouse in which to locate the containers, but have only one type of container (dark green for the remaining waste); however, others use public containers that are also used by all citizens. Most marketplaces throw their waste out in bags, although some throw it out without bags. For this latter behavior, containers must be cleaned daily; the use of bags, especially for organic waste, such as meat and fish, is important [21].

For a typical Spanish marketplace, the average composition of waste generated is dominated by organic material (76% in total), because, as already mentioned, the vast majority of shops sell food [21].

Preventing food waste is one of the main ways to reduce organic waste. Voluntary agreements with social organizations for the use of surplus food fit perfectly into the current socioeconomic period [22]. Given their major activity, local marketplaces have large volumes of food surpluses that could be transformed into donations for needy people. This practice remains vague in the cases studied, except in one marketplace, where more or less systematic donations are made.

3.1.2. Participatory Workshop

The most important conclusion of the workshop, held in December 2014 with the participation of representatives of the main stakeholders of the research, is the fact that the beneficiary organizations of the Food Bank of Asturias are demanding greater quantities of fresh food. A part of this need could be met through food surplus from marketplaces.

Members of the Food Bank of Asturias showed an interest in the "upstream" research of potential suppliers' entities, but expressed doubts as to whether "all foods can be donated". These doubts were shared by other attendees.

The waste management company in Asturias (only a mixed capital, public and private-firm for all of the region) receives large amounts of food surplus from the marketplaces, which end up in the anaerobic digestion plant. Exploiting them in previous phases should be tried because in most cases, these food surpluses are fit for human consumption. In addition, the waste management company representative raised the possibility of generalizing the experience of donations previously observed in some other marketplaces.

To end the discussion, several participants explained that technological processes should be applied both to ensure legal compliance and to stop food deterioration. For example, products such as tomatoes could be transformed into bottled sauce to lengthen their shelf life. Food should be prepared, canned, vacuum packaged, *etc.*, which would be donated instead of fresh food.

In sum, the workshop supported the interest of continuing research and suggested interviewing health inspectors to clarify some controversial issues concerning the food security of potential donations.

3.1.3. Interviews with Health Inspectors

To use food waste for human consumption, it must be safely handled, and all means to reduce the risk of poisoning must be also used [36]. In order to clarify this aspect, which generated an unresolved debate in the workshop, two health inspectors were interviewed, following a script previously agreed upon with experts of waste management and the Food Bank of Asturias (Table 3).

Table 3. Script for interviews to health inspectors.

Blocks	Contents	Sources
A. Food	Type of food to donate	[37]
	State of food that can be donated (risk of poisoning)	[36,38]
B. Collection	Staff (number and training for food handling)	[36,39]
	Hygiene measures (temperature-cold chain)	[36]
	Pickup time	[22,38]
C. Delivery	Periodicity (number of times that the surplus is collected)	[36,37,40]
	Delivery methods	
	Means of transport (guarantee of temperature maintenance)	
	Rules for transport (legislation)	
D. Other factors	Critical points (security standards, recipient entities)	[36,40]

The interviews began by asking about food that can be donated from marketplaces. Regulation (EC) No. 178/2002 of the European Parliament and of the Council of 28 January 2002 states that unsafe food cannot be marketed [37]. Therefore, only food "suitable for consumption" could be donated. Regarding the state of food that can be donated, one of the inspectors indicated that food must be donated within the dates of consumption and with packaging integrity, as well as without any signs of deterioration or putrefaction.

The second set of questions dealt with the issue of collection. The food that is donated must be stored at the required temperature for proper storage in a separate place from other food and correctly identified [36]; packaged food usually indicates that temperature on its label. In the marketplace

itself, the requirements for donations start with proper storage, guaranteeing the cold chain, stowage and transport as indicated by the manufacturer (if the items of donated food are packaged products). Before accepting the donation, it is necessary to check that the shop donor has good facilities and hygienic conditions [36]. Then, staff training in food hygiene is recognized as one of the basic pillars to ensure proper implementation of the requirements at each stage in order to achieve safe food. In addition, volunteers who distribute food must have the necessary training to ensure hygienic handling [36]. Regarding hygiene measures, there is nothing mandatory, but of particular interest are staff clothing, the application of clean utensils that are in good condition, gloves for a single use and personal hygiene.

Another key factor is the pickup time, ensuring that it does not interfere with the normal activity of the shop, *i.e.*, recommended to be in the final hours of the day. In the experience of surplus channeling in the marketplace of a Catalonian town, the collection and subsequent storage in the cold storage area of the marketplace took place in the late morning, prior to closing [22]. However, in the experience of another Catalonian town, fresh food was collected in the morning, and by the afternoon, it was already in the hands of the beneficiary groups [38].

It must also be checked that the collected food is fit for human consumption. In Reus, the distribution chains and the marketplace participants for donations were responsible for collecting and selecting food, and then a special working center with people with intellectual disabilities performed a second screen following the instructions of the Agency of Public Health [38]. In Asturias, social entities distributing "downstream" of the food bank area should ensure that each product has been properly kept at the temperature that the package label indicates or at the regulated temperature if the product is unpackaged.

Delivery is the third point addressed in the interviews, where the role of temperature is clear as a factor to consider in conservation, even during transportation; if a refrigerated vehicle is not available, it is appropriate to use containers or an isothermal sheath with a cold source, and the transport time must be limited to one and a half hours to keep products at the right temperature [36]. Concerning the frequency, the number of times that the surplus is collected is relevant, because most of the food is highly perishable, *i.e.*, fresh items, and also logistics costs have to be taken into account. Delivery should also take care of the delivery method: non-reusable materials and suitable for contact with food in the case of unpackaged food. Legislation insists on the need to maintain the cold chain for products that need it and to have clean vehicles whenever a transportation takes place.

Other factors to consider are security standards/rules for transport (agreement on international transport of perishable goods and special vehicles, which establishes the obligation to have refrigerated vehicles or isotherms for a set of products and to respect certain temperatures) and the people responsible for this task (with emphasis on hygiene and training in food handling). On the one hand, the legal requirements for transporting and storing food do not discriminate among food destinations, being indifferent to having an altruistic or commercial purpose. This is not true in all countries; in the United States and Italy, for example, requirements vary according to the social objectives and the type of agreement between the donor and the recipient [40]. On the other hand, the recipient institutions must ensure receiving a delivery order by the donor for traceability control [36]. Traceability allows investigation into whether food is considered compliant or not, locating it along the distribution chain and removing it if necessary.

Finally, another important aspect is that once food is accepted by the beneficiary entities, it is necessary to ensure that its temperature does not exceed what has been established for proper conservation and that cooled and frozen products are quickly saved [36].

The two health inspectors interviewed made it clear that food from marketplaces can be donated, relying on EC Regulation 178/2002 [37]. Then, safe food, *i.e.*, food "fit for consumption", could be donated by the shops of these marketplaces to organizations such as food banks or soup kitchens. To avoid problems, it is desirable that agreements between food business donors and recipient organizations are reflected in writing, clearly stating that it is edible food for human consumption

and complies with all national and community guarantees for commercialization. Additionally, the organizations must assume the commitment to transport and store the food under proper conditions until consumption.

3.2. Quantitative Analysis

The qualitative methodology applied previously allowed the exploration of an initially unknown reality, but showed a lack of the generalization of the data collected, and these were too aggregated (they had been obtained marketplace to marketplace). For this reason, a quantitative transversal research was undertaken on the set of Asturian marketplaces studied and focused on the traders of the different food shops located in those marketplaces. The manager of each marketplace is generally responsible for making available the resources and public administration, usually local, for planning the management needs and for waste control and management [34]. However, traders, as the main generators of waste, should be aware of their important role in the adoption of measures to help improve waste management without losing the quality service they provide [21]. They have the current problems of the massive increase in food waste, so the role of marketplaces in the appropriated channeling of these surpluses must be analyzed in detail.

Then, the next step of the research was justified by the deepening of the topics covered in the qualitative analysis, extending the approach to hybrid logic, *i.e.*, qualitative-quantitative [41].

In this second step, we extended the research to the food sale shops in each marketplace to obtain information from the point of view of traders on infrastructure, services and management, their current status and operation, also describing their overview with a focus on daily logistics management of waste and investigating aspects that had remained unclear in the qualitative analysis, such as food donations.

Surveys were conducted in nine of the 14 Asturian marketplaces (Table 4) belonging to seven different councils. The confidence level refers to the percentage of all possible samples that can be expected to include the true population parameter [42]. In our sampling, the confidence level is 95%, which implies that the 95% of the confidence intervals would include the true population parameters. The sample error refers to the precision of the statistical estimate [43].

Table 4. Survey sheet.

Target Population	Asturian Marketplaces
Analysis Unit	Food shop
Sample Size	150 food shops
Response Rate	73.33% (110 food shops)
Confidence Level	95%
Sample Error	4.84%
Method	Survey face to face
Period	14 November 2014–21 April 2015

The sample is considered representative because, as shown in Table 5, the five marketplaces not studied (*i.e.*, those whose managers had not been able to be interviewed in the qualitative study) have a relatively low number of food shops (only 14.30%). The survey is also the most appropriate research methodology because the target population is relatively large (Table 5). Therefore, we pursue now in detail and in depth the information that confirms the need for a quantitative technique [44].

The research team at the University of Oviedo designed the questionnaire after meeting with experts where a brainstorming session was undertaken based on information and considerations obtained in the literature review and the previous qualitative study. A subsequent pre-test was conducted in two food marketplaces belonging to the same council. This pre-test suggested some additional amendments to the draft. The final survey is divided into the blocks shown in Table 6.

Table 5. Shops in Asturian marketplaces.

Marketplace		Number of Open Shops	Number of Food Shops	Number of Surveyed Shops
Marketplaces studied	1	18	16	13
	2	38	35	31
	3	34	27	17
	4.1	25	24	17
	4.2	5	5	4
	5	4	3	2
	6.1	9	9	5
	6.2	3	3	1
	7	36	28	20
	Subtotal	172	150	110
Marketplaces not studied	8	8	7	-
	9	9	7	-
	10	4	2	-
	11	7	5	-
	12	6	4	-
	Subtotal	34	25	-
	Total	206	175	110

Table 6. Outline of the survey of shops in marketplaces.

Blocks	Contents	Sources
Information about the shops	Activity (what is sold)	[30,34]
	Surface	[32]
	Availability of cold facilities	[33,36]
	Timetable for public attendance	[30]
Clients	Daily quantity	[33,34]
Waste generated	Types (paper and cardboard, organic fraction, glass, *etc.*)	[21]
	Reasons (why is waste generated)	[36]
Waste management	Separation (possible or not)	[21,29]
	Methods of waste management	[32]
	Surpluses (types and quantities)	
	Donations (types and quantities)	[8,22]
	Begin to donate (asking about possibilities)	
	Requirements for food donations	[22]

The first block refers to general data about every stall. An important fact in this section is the activity of the marketplaces, traditionally engaged in selling fresh products with extra quality [34]. For this reason, marketplaces occupy a strong position in the distribution of fruit, vegetables, fish, meat and charcuterie [30].

With respect to the surface area of each shop, many marketplaces require a minimum for this figure. In the case of fresh food stalls, the optimal dimensions can be set between 15 and 20 square meters of retail space, depending on the size and type of marketplace where they are located [32].

To achieve successful results in this research and due to the fact that the marketplaces develop a commercialization of perishable goods [33], the availability of cold systems to preserve the products is relevant information to obtain. As they are proposed to be fresh food donations, we must ensure that they have been properly preserved at the required temperature by maintaining the cold chain [36].

Nowadays, it is necessary to introduce certain changes to the marketplaces to compete with more modern commercial formulae. One of these changes is a broader timetable adapted to the new needs of customers [30].

The second block in Table 6 is relatively short and focuses on the kinds of customers that attend this type of point of sale (individuals, restaurants or others), because they will affect sales and billing. The most common commercial business is to attend to the final consumer [34]. Generally, housewives are the biggest group of shoppers in municipal marketplaces (52%), followed by employed (27%) and retired people (16%), unemployed people (4%) and students (1%), being the smallest group of buyers in the marketplaces [33].

The third section deals with questions related to waste generated. The aim is to know in detail the type of waste from each type of stall in the marketplace and the reasons for it. As already discussed in the previous qualitative analysis (see Section 3.1), in a marketplace, the greatest amount of waste is composed of the organic waste, followed by cardboard [21].

Surpluses are generated, and food is thrown away. In order to reduce waste at its source, it is important to know the reasons why food is thrown away in marketplaces: defects in packaging, poor appearance of the item, expiry date or overproduction [36].

The fourth and last block of questions deals with waste management. Marketplaces are one of the main purchase channels for fresh items, and traders who develop their activity in them have to take the necessary measures to improve the quality of their services and simultaneously to protect the environment [29]. Recently, domestic waste has increased significantly in cities, becoming a concern for society. Therefore, affordable and simple solutions based on habit changes and infrastructure collection and treatment must be considered [21]. Then, each trader's decision to carry out proper waste separation is really crucial.

A study undertaken in 2007 on the improvement of marketplaces' management [32] shows that information and education campaigns aimed at traders and market managers were very efficient. Therefore, it is necessary to know if these types of campaigns have been conducted in the marketplaces studied.

Butchers and fishmongers in marketplaces must manage their waste through companies that transform it into other usable products, which will be an indicator of the degree of commitment to waste management in each marketplace. In these stalls, it is also important to throw away organic waste into the container (the right way is in bags), because they can stain the container and produce bad odors. A clean look of all spaces commonly used in the marketplace is an essential factor to make the action of buying a pleasant one [32].

Surplus food channeling is an opportunity for waste prevention with a strong social impact that has an increasing implantation [22]. Then, creating pathways for the use of food surplus that cannot be offered for sale due to different reasons could be the right way to solve this social problem [8]. One of these pathways could be food banks. Apart from the environmental and economic benefits (due to the reduced requirements of collection and treatment), this performance incorporates social added value. The issue of donations was not entirely clear in the qualitative analysis, so it will be analyzed in depth by means of the quantitative study. The collection of surplus from different stalls and their subsequent storage in the refrigerator may be the best way to keep food in good condition [22] to achieve such social goals.

Face to face surveys were carried out in all of the marketplaces studied before. From the 172 shops that are presently open in these 10 marketplaces, only 150 are food sellers.

Surveys took place from 14 November 2014–21 April 2015. At the end of the interviews with the managers of marketplaces, the need for surveying to fulfill the research was considered and explained. Therefore, in most cases, the interviewed managers were the link to contacting people in charge of each shop.

Once the fieldwork was finished, a database with all of the collected information was prepared for the subsequent analysis of the data (see Sections 3.2.1–3.2.3).

3.2.1. Descriptive Analysis of Data Collected in Food Shops

The shops dedicated to meat selling represent 30.8% of total shops in Asturian marketplaces, fish 17.4%, fruit and vegetables 14.5% and cooked meats 11.6%; 7.6% are bakeries; 4.7% other food shops; and 0.6% are frozen foods. Regarding the surface area of each facility, the average is 18.82 m^2. The shops are open an average of 45 h per week, serving the public about seven hours a day, and 94% of shops have cold storage facilities to preserve products.

An average of 74 customers come to each facility per day, although the data vary widely (the maximum is 500 customers a day).

Eighty one percent of shops generate paper and cardboard waste, and 78% is the organic fraction (meat or fish is 60%, fruit and vegetables 18%). The percentage of organic waste does not reach 100% because some shops, such as delicatessens, bakeries or others, say they do not generate this type of waste, or they do so in insignificant amounts, or surpluses are collected by the supplier.

The daily amounts of waste that are generated at each shop allow us to estimate the distribution in weight by each kind of waste (see Table 7), which is directly related to the activity. On the one hand, the line "average" refers to the average value obtained with the sample data; on the other hand, the sum of the same data is represented in the line named "total". Meat and fish waste are the most abundant, as almost two-thirds of surveyed shops (65%) were butchers, delicatessens or fishmongers.

Table 7. Data on daily waste.

	Meat and Fish	Fruit and Vegetables	Paper	Plastic	Glass	Wood	Others
Average (kg/day)	15.25	6.42	2.64	1.03	0.44	4.64	1.09
Total (kg/day)	1006.7	128.36	235.21	60.8	2.64	64.98	13.06
%	66.59%	8.49%	15.56%	4.02%	0.17%	4.30%	0.86%

Tables 8 and 9 show the total generation of daily waste for different types of shop, allowing the identification of waste generated by activity and the activities that generate the most waste. Fishmongers are the highest (45.68% total waste), followed by butchers (28.26%) and greengrocers (19.00%).

Table 8. Distribution of the total waste generation by type of shop (a).

	Butchers (kg/day)	%	Delicatessen (kg/day)	%	Fishmongers (kg/day)	%
Meat or fish	346.48	82.77	15.1	25.14	614.21	90.77
Fruit and vegetables	0	0.00	0	0.00	0	0.00
Paper and cardboard	48.96	11.70	33.06	55.04	44.47	6.57
Plastic	22.98	5.49	8.25	13.74	10.36	1.53
Glass	0.2	0.05	1	1.67	0	0.00
Wood	0	0.00	0	0.00	4.64	0.69
Others	0	0.00	2.65	4.41	3	0.44
Total	418.62	100.00	60.06	100.00	676.68	100.00
% Total	28.26	-	4.05	-	45.68	-

In 57% of shops, organic waste is thrown away because it is not required when a product has been made/prepared, *i.e.*, in the case of a butcher, skins, bones, fat or offal, and that of a fishmonger, skins, guts and heads. More than half (54%) of stallholders surveyed said that this is the main reason why they throw away their waste. Twenty six percent throw away organic waste because it is made up of damaged products that cannot be consumed. Twenty percent dispose of waste because it is composed of surplus products that have failed to sell.

Table 9. Distribution of the total waste generation by type of shop (b).

	Greengrocers (kg/day)	%	Bakeries (kg/day)	%	Frozen Food Shop (kg/day)	%
Meat or fish	0	0.00	0.2	0.80	0	0.00
Fruit and vegetables	124.37	44.19	0	0.00	0	0.00
Paper and cardboard	84.56	30.05	12.64	50.32	1	50.00
Plastic	12.15	4.32	3.53	14.05	1	50.00
Glass	0	0.00	0	0.00	0	0.00
Wood	60.34	21.44	0	0.00	0	0.00
Others	0	0.00	8.75	34.83	0	0.00
Total	281.42	100.00	25.12	100.00	2	100.00
% Total	19.00	-	1.70	-	0.14	-

Thirty six percent produce mixed waste and put all of it in the same container, due to the fact that 95% of shops do not have separate containers that allow for the separation of waste (the remaining 5% recognize that although there are containers in the marketplace to separate waste, it is easier or faster to dispose of it all in the same place). With respect to how organic waste is deposited in the container, in 88% of cases, it is inside disposal bags, and only 11% is done in bulk.

As for the possibility of donating food, in 17% of shops, food waste is thrown away; in 40%, food surpluses are donated somehow; and in 70% of cases, they are handled differently, such as to feed animals or to produce other products, such as breadcrumbs. If a classification is carried out by type of activity, 44% of the food surplus from greengrocers is donated, followed by fishmongers (33%) and butchers and delicatessens (27%). The shops where most surpluses are thrown away are the fishmongers (18%). Many traders claim not to have a daily surplus, because what they are not able to sell they can preserve due to the food characteristics (this is the case in delicatessens) or they can preserve food under refrigeration for several additional days (as in butchers or fishmongers).

In none of the cases in which donations are made is this done in a coordinated way by the marketplace. Most of the donations are made once a week (41%). Thirty seven percent of donations are made more than once a week and 22% sporadically. The annual average of donations by shops stands at 329.33 kg, the maximum being 1080 kg.

Considering only the shops that do not make donations, 49% are interested in starting to donate food, 37% would deliver fish and 32% meat. To a lesser extent, there are delicatessens (21%), greengrocers (11%) and bakeries (11%) that would donate; 68% of shops that are interested in donating could do it sporadically.

Finally, 61% said that a food pickup system, shop by shop, would be the best practice, and 27% consider that food donated should be kept cold. The possibility of providing a shared container or space in the marketplace in which to deposit donations only convinced 15% of traders.

3.2.2. Cluster Analysis of Results

When the descriptive analysis was completed, we tried to better classify the shops of Asturian marketplaces in order to adjust the proposals for improvements that would increase donations. Therefore, we decided to carry out a cluster analysis where the only classification variable used is the total amount of organic waste generated by each shop, which is justified because the aim is to recover the food surpluses of this economic activity and, thus, to reduce the organic waste stream.

After checking the normality of the classification variable chosen (using a Lilliefors test) and the prerequisite of sample representativeness (that is met by the high response rate, over 70% of the target population according to Table 4), the suitable number of clusters to obtain was determined, and the result was two (according to the method of hierarchical clusters). When analyzing the dendrogram (or the distance matrix), the existence of two different clusters with different sizes of grouping of shops in Asturian marketplaces was detected. Then, a new cluster analysis using the algorithm k-means confirmed the previous result. To ensure the validity of the previous classification, a discriminant

analysis (employing the Wilks lambda method) was conducted, including the classification variable. This test allowed the rejection of the null hypothesis of equality in the averages of the discriminant function between the two groups identified as commercial shops.

In Table 10, shops belonging to each group are described. In Cluster A, there are 13 commercial shops that generate in their daily activities eight-times more organic waste than businesses in Cluster B. In addition, in Cluster A, all organic waste comes from meat and fish, while Cluster B also generates waste from fruit and vegetables, although on average, slightly lower amounts. Shops in Cluster A also belong to marketplaces privately managed under administrative concessions.

Table 10. Main characteristics of the clusters.

Variable		Cluster A	Cluster B
Number of shops		13	96
Type of activity		30.8% butchers, 69.2% fishmongers	35.4% butchers, 17.7% greengrocers, 13.5% fishmongers
Available surface (m^2)		25.5	17.9
Availability of cold chamber		100% Yes	92.7% Yes
Daily clients		110	67
Marketplace management		46.2% private concession	45.8% public management
Waste mixture		30.8%	36.5%
Separated containers		77.8% blue, 44.4% yellow	65.6% blue, 34.4% yellow
Organic waste (kg/day)		40.385	5.288
Wastes	Meat and fish (kg/day)	40.385	3.976
	Fruit and vegetables (kg/day)	0.000	1.313
	Others (kg/day)	2.9 paper and cardboard, 0.9 light packaging	2.7 paper and cardboard, 1.9 wood, 0.7 light packaging
Types of waste		100% preparation, 38.5% leftovers, 38.5% no available for consumption	59.8% preparation
Donation frequency		33.3% once a week, 33.3% sporadically	77.8% once or several times per week
Annual donations (kg/year)		100	317

Shops in marketplace Type A could potentially offer more donations (each one generates much more organic waste than shops of Type B, about eight-times more by weight as seen in Table 10), and they are located in marketplaces where donations would be easily coordinated, because they are better managed (public ownership and private management, which is embodied in a clear and customized command unit integrated for specific management positions).

In Cluster B, there is the largest number of shops, a total of 96, with more diverse activities. Most of the marketplaces where these facilities are located are managed directly by the local public administration, which is also who owns them. Each shop of Type B generates an eighth of the waste, compared to the other cluster, which was partially balanced by the amount (the number of shops is more than seven times that of Cluster A) and its greater propensity to donate (more than double in frequency, more than triple in quantity). However, they are located in the worst managed marketplaces (dispersion among various public offices, lack of specific management positions, slow political decisions, *etc.*).

In light of these data, it seems advisable that information campaigns about organic waste management and promotion of altruistic donations of food surplus are refereed differently for each cluster, taking into account both the type of majority activity and the management model in its marketplace.

Food banks are non-profit organizations, and they have scarce resources (especially economic ones). Attending to the cluster analysis results, the food bank in the region studied must focus on the sensibilization campaigns to shops and marketplaces belonging to Cluster A for the following reasons:

- As Cluster A only has 13 shops, the food bank does not need too many resources to inform/make contact with them.
- These few shops are the greatest generators of food waste. If they are properly managed, the flow of food donations could be increased considerably.
- These shops are dedicated mainly to selling meat and fish, which are basic items for a nutritional and balanced diet.
- These shops belong to privately-managed marketplaces, so the presence of an administrator could help to begin organizing the food donations.

3.2.3. Estimations of Potential Food Recovery

Once the potential of food donations from marketplaces is clear, the next research step is estimating the quantities that could be recovered.

Firstly, depending on the type of property/management, it has been found that marketplaces differ from one another. Therefore, they can be classified into three types (Table 11): Group I (integration of two marketplaces municipally owned, but privately run through an administrative concession), Group II (in which there are six marketplaces with municipal property and management) and Group III (that consists of a single marketplace privately owned and operated). This first step has shown a better understanding by the two managers belonging to marketplaces in Group I; in Groups II and III, the absence of a central manager made it difficult to obtain information in some cases, and it was necessary to contact several people from different departments or areas involved.

Table 11. Classification of marketplaces.

		Types of Marketplace									
		Group I			**Group II**					**Group III**	
Property		Local			Local					Private	
Management		Private									
Marketplaces		1	2	3	4.1	4.2	5	6.1	6.2	7	Total
Type of Shop	**A**	4	2	1	1	0	0	0	0	5	13
	B	9	28	16	16	4	2	5	1	15	96
Total		13	30	17	17	4	2	5	1	20	109

The total daily generation of organic waste in all of the Asturian marketplaces was estimated at 1797 kg (Table 12), which means about 561 tons per year. In addition, these marketplaces could recover annually for social purposes at least 36 tons of food (Table 13), a figure that cannot be considered really high compared to that of the more than 858 tons per year recovered by the food bank in the region during 2014 [18]. The study should now be revised and extended to other types of commercial shops or food waste producing entities. However, donations of fresh food that are highly demanded by the final recipients can be observed.

Furthermore the greatest quantities of fresh food waste in marketplaces are produced by fishmongers; this result is not exactly equal to the food losses in the distribution and sales in the USA, Canada, Australia and New Zealand, for which seafood was in second place after fruit and vegetables [5].

Table 12. Estimation of daily organic waste generated.

Type of Activity	Average Organic Waste (kg/day)	Total Estimation of Organic Waste (kg/day) in the Sample	Total Estimation of Organic Waste (kg/day) in Non-Participants (Outside the Sample)	Total Estimation of Organic Waste (kg/day)
Butcher	8.66	459.06	17.32	476.38
Delicatessen	2.55	38.15	5.10	43.25
Fishmonger	30.71	921.31	122.84	1044.15
Greengrocer	6.91	172.74	34.55	207.29
Bakery	1.25	11.45	2.50	13.95
Other (food)	0.77	3.90	7.70	11.60
Total	-	1606.61	190.01	1796.62

Table 13. Estimation of potential annual donation.

		Marketplaces in the Sample		Marketplaces outside the Sample	
Type of Activity	Average Donation (kg/year)	Total Shops	Donations Estimated (kg/year)	Total Shops	Donations Estimated (kg/year)
Butcher	219	53	11,607	2	438
Fishmonger	394	30	11,820	4	1576
Greengrocer	358	25	8940	5	1788
			32,637		3802

3.3. Suggestions for Guidelines to Improve Recovery and Donation of Food

In more detail, the cluster analysis provided a division of the shops into two groups. Cluster A, nearly eight-times smaller than B, is integrated mainly by private management marketplaces. They are shops formed by butchers and fishmongers with an average generation of organic waste much higher and with fewer tendencies to donate than Cluster B. Cluster B is also formed by greengrocers and other food shops that generate less waste and donate more. These results promote a more initial intensive awareness campaign from food banks to shops belonging to Cluster A due to the fact that they produce greater quantities of food waste, but they are a smaller number of shops (so it is easier and less expensive to carry out donations successfully).

Looking at the results obtained, three groups of recommendations and improvements are suggested considering both the type of management and the cluster to which it belongs (Table 14).

Table 14. Classification of marketplaces for recommendations.

	Group I	Group II	Group III
Cluster A	Marketplaces 1 and 2	-	Marketplace 7
Cluster B		Marketplaces 3 and 4.1	
		Marketplaces 4.2, 5, 6.1 and 6.2	

The role of the different stakeholders in the organic waste supply chain is crucial for successful results. Therefore, recommendations for future improvement actions are focused directly on the different players involved in each marketplace: town hall, manager and sellers.

In Group I, the proposals are different for Clusters A and B, but similar in Marketplaces 1 and 2, due to the fact that they have the same management model, and in both, the figure of the manager is clear. For instance, Cluster A shops belong to butchers and fishmongers that generate large quantities of organic waste, where more than half are not recoverable, being bones, skins and fish heads, all of them coming from product preparation; they have to be informed of the correct disposal methods for

these kinds of waste. The Cluster B shops have to be made aware of the new rule for putting organic waste into a separate dustbin.

In Group II there are also different proposals, but both for Cluster B, because only two shops of this group belong to Cluster A (Table 11), and it is not worth making differentiated efforts for them. On the one hand, an action plan has been devised for Marketplaces 3 and 4.1, because they have the same management model and the same number of shops (16). On the other hand, proposals and improvements are made for Marketplaces 4.2, 5, 6.1 and 6.2, which have a local management and a low number of shops open.

Group III is only integrated for Marketplace 7, which has a great number of active shops. Two different action plans for sellers, one for shops in Cluster A and another one for Cluster B, are elaborated with reference to the special features of this marketplace.

Tables 11 and 14 are the combination of the classification obtained from the qualitative study (Groups I, II and III according to management) and the quantitative study using cluster analysis (Clusters A and B). As expressed in the previous paragraphs, this classification determines how improvement proposals would be applied in practice, because the number and type of shops and the management model in each marketplace must be taken into account. These proposals, which are then expressed as a list of general recommendations, are aimed at the key stakeholders: managers, administrators and traders. Then, as a first general measure, a basic recommendation is made to the marketplaces belonging to Group II (public administration): the management should be centralized in a person belonging to a specific department within the council (environment, works contracts, heritage, *etc.*).

Following the results and once all marketplaces have a person in charge, either a manager, administrator, president or similar, the following guidelines for these people are proposed:

- Establishing a fluid relationship between the waste manager and the Food Bank of Asturias, through frequent meetings on the requirements for collection, monitoring, *etc.*
- Training for traders on bio-waste and awareness, through information and motivation sessions, as well as posters or other local/inexpensive broadcasting media.
- Providing appropriate resources for separate collection and donations. Managers of marketplaces should supply traders with waste containers and adequate space for them.
- Control of the new collection: the manager must be aware of the degree of daily filling of organic waste containers and what shops are donating or are interested in donating.
- Dissemination and marketing of good performance towards customers, through display panels and leaflets in the collaborator shops and other similar means.

All of these improvement proposals, firstly for managers and later for traders, could have a general interest in order to be extrapolated to any marketplace.

As for the specific proposals to traders, several measures can be identified:

- Control of the amounts of waste generated: Traders should be knowledgeable about the quantities of waste from their shops and the economic value of these.
- Minimization of bio-waste: Managing organic waste is meaningless if the reduction of its production has not been previously tried by protecting products adequately.
- Awareness campaigns on the situation of certain disadvantaged collectives in order to prioritize the surplus as donations for human consumption.
- Collaboration agreement between beneficiary entities and donor shops to quickly co-manage edible food for human consumption.
- Traceability guarantee of food donated by invoices delivered by traders to the recipient entities.

4. Conclusions

Currently, urban waste has increased significantly in cities, becoming a concern for society and even more so for policy makers and waste managers who need to find solutions to give waste a proper output and adapt themselves to the new rules that affect their activity. In particular, food marketplaces are typically organic waste generation spaces and present an interesting potential to promote the minimization, donation and recycling of that waste.

The main objective of this research was to study the management of bio-waste in Asturian marketplaces to facilitate separate deliveries of suitable food surpluses for donations or to value the usable remains. Finally, nine Asturian marketplaces, belonging to seven different councils that seem sufficiently representative, were studied.

The results of this research show the potential of food marketplaces as donors to food banks and other beneficiary entities. Although the estimates of the potentially recoverable amounts may seem small compared to the amounts currently managed by any food bank represented by the Food Bank of Asturias, they have a great importance because of their character, *i.e.*, fresh food, which is in high demand by the final beneficiaries, who suffer significant shortcomings of this kind of product.

Another research concern is the need to meet legal requirements and to ensure the required sanitary conditions, the main concern being the maintenance of the cold chain. Health inspectors consulted assured us that food from marketplaces could be donated if the European regulation is taken into account, the agreements between food business donors and recipient organizations about which products are acceptable are made clear in writing, and the organizations are responsible when transporting them and are able to store them appropriately.

Because donations from marketplaces are very perishable products and have consequent difficulties, as other authors, such as Gunders [5] and O'Donnell [45], state, it is necessary to have available a very finely-tuned system to avoid incurring risks to human health. Therefore, for the successful organization of donations, a proximity methodology must be applied [46], because there is no material time to ship products through a central platform (the Food Bank of Asturias in this case), so they should be delivered directly to beneficiary entities with their headquarters next to each marketplace. There are two types of beneficiary organizations [47]: distribution and consumption; the first ones distribute food received among the beneficiaries of the entity; the consumption entities prepare and serve food in their soup kitchens after collecting donations. It seems logical that consumption organizations are the most appropriate for these donations from marketplaces because they can provide faster output of perishable foods, by cooking and serving them on the day of receipt. However, in any case, both donors and recipients must be provided with the necessary technical resources for preservation to ensure that food will be consumed appropriately from the point of view of health conditions.

The second step of the study, surveying traders of the same nine marketplaces for information on quantities of waste, surplus and donations, was justified by the fact that they are the ones who can provide more specific data, disaggregated day-to-day on marketplace activity. We must not forget that they also have an important role in the adoption of measures to help improve the management of such waste. Surplus donations were an issue that had been in the air in the qualitative analysis; therefore, much of the survey and data processing are focused on this aspect. The descriptive analysis allowed us to obtain relevant data on waste quantities and management, which were later used in a cluster analysis to classify shops.

One of the main conclusions of the research carried out is the role of a manager in charge of decision making in each marketplace as a key factor, and the relationship with the type of property/management of the marketplace. For this and other reasons explained at the end of Section 3.2.2, the scarce efforts and resources of food banks or other charitable non-profit organizations must be focused on stalls and marketplaces belonging to Cluster A (all of them are privately managed and have a clear person in charge). In marketplaces where a manager does not exist, this responsibility should be assigned.

Previous improvements (see Section 3.3) could also be considered in other research focused on other, different parts of the food waste management supply chain.

This research has enabled the staff in charge of the food bank in the region analyzed to see the potential of the food marketplaces as food donors. These commercial places had not previously been addressed for that non-profit entity. Furthermore, the results of cluster analysis have allowed them to better focus their initial efforts to undertake the successful performance and awareness campaigns. Thus, in the near future, food will be conveniently channeled in order to be consumed by human beings, avoiding harmful landfill (both for environmental and social reasons). Therefore, the research question has been answered, and the potential of organic waste in marketplaces as consumable food has been clearly demonstrated.

Although the fieldwork has been carried out in a small region in the north of Spain, the methodology applied could be replicated in order to estimate the potential food recovery nationwide or in other countries. In fact, the literature review found several fresh food recovery experiences from marketplaces in Cataluña, suggesting the interest of expanding the study initially to the national level. Anyway, most of the qualitative results and reflections above are easily extrapolatable and adaptable to any First World region.

Apart from the size of the covered geographic area, other limitations of this research and suggestions for future developments come up, firstly, from the fact that the study has not been carried out in depth in all Asturian marketplaces, in many cases through the lack of a clearly-defined head manager. Moreover, none of the people interviewed knew the exact data on the amount of waste produced in their marketplace, limiting their responses to approximations of the percentages of the fractions generated. Furthermore, the potential estimation of donations indicates a really low figure. Another interesting way to investigate this topic should deal with incentives for both reducing waste and donating recoverable products beyond a moral obligation, as well as the costs of the required infrastructure. All of these limitations could be lessened by additional surveys, direct observation or sampling of waste in each marketplace. Finally, it has also been found that many marketplaces have reduced their activity and changed their buying habits as a result of the actual economic crisis; one clear effect of this is the priority given to other shops, such as supermarkets or shopping centers, to which the research should be extended.

Acknowledgments: This research has been funded by the Ministry of Economy and Competitiveness (DPI2013-41469-P). In addition, part of the empirical work has received funding from the City Council of Gijón through the University Institute of Industrial Technology of Asturias (IUTA), SV-15-GIJON-1-11 project. Finally, we must acknowledge the cooperation of both the Food Bank of Asturias and COGERSA (Initials in Spanish for Consortium for Waste Management of Asturias), as well as the marketplaces and health inspectors and other staff, without whose participation conducting this research would not have been possible.

Conflicts of Interest: The authors declare no conflict of interest.

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[**ANEXO 5**]

Informe del taller participativo organizado por el IUTA en la Escuela Politécnica de Ingeniería de Gijón el 1 de diciembre de 2016

1. Datos generales

Fecha	1 de diciembre de 2016
Hora	9h30 a 14h00
Lugar	Salón de Actos del Edificio Polivalente de la Escuela Politécnica de Ingeniería de Gijón, Universidad de Oviedo
Asistencia	- Banco de Alimentos de Asturias (BAA): coordinadora general (puesto remunerado) y miembro del Patronato responsable de logística (voluntario). - 70 representantes de una treintena de entidades receptoras del BAA. - Universidad de Oviedo: directora del IUTA, dos profesores del área de Organización de Empresas y dos estudiantes asistentes de investigación. - Un miembro de cada una de las empresas COGERSA, SADIM y ABAmobile.

Presentación del Banco de Alimentos de Asturias

ÁREA DE LOGÍSTICA

Responsabilidad de la organización y coordinación del almacén

Tres proyectos:

- **PLAN FEAD**
- **BANCO DE ALIMENTOS**
- **FRUTAS Y HORTALIZAS PLAN EUROPEO**

PROYECTO	ENT ORGANIZADORA	TIPO DE ALIMENTOS	SOLICITUD	REPARTO	CRITERIOS DE REPARTO
PLAN FEAD	FEGA, el Banco de Alimentos es un mero distribuidor	Alimentación no perecedera	Convocatoria anual establecida por el FEGA	TRES FASES	Establecidos por el FEGA
BANCO DE ALIMENTOS	BANCO DE ALIMENTOS	Alimentación perecedera y no perecedera	Ante el área de entidades receptoras	Según disponibilidad y productos	Establecidos por el Banco de Alimentos
FRUTAS Y HORTALIZAS	Consejería de medio rural y pesca	Frutas y verduras	Ante la Consejería	Según disponibilidad y productos	Por número de usuarios aceptados por la Consejería

PROCEDENCIA ALIMENTOS

Donaciones de empresas y particulares, que han nacido de la **confianza** y la **profesionalidad** que demuestra esta entidad. (confianza y profesionalidad que deben de cumplir las entidades receptoras).

CRITERIOS DE REPARTO

	Destinatarios	Criterios	A destacar	Convocatoria
Productos perecederos	Ent solicitantes Con recursos para su recogida y distribución	Objetivos, según nº de usuarios, necesidades y stockaje del almacén	MERCASTURIAS (reparto rápido e inmediato debido al tipo y estado de los productos)	Correo electrónico salvo excepciones y/o urgencias
Productos no perecederos	Entidades de reparto	Objetivos, según nº de usuarios, necesidades y stockaje del almacén		Correo electrónico salvo excepciones y/o urgencias

INFORMACIÓN GENERAL

- **CONVOCATORIA A TRAVÉS DE CORREO ELECTRÓNICO, SALVO URGENCIAS**
- **VEHÍCULOS ACORDE CON LA CANTIDAD Y/O TIPO DE PRODUCTO**
- **NO PRESIÓN PARA LLEVARSE LOS ALIMENTOS**
- **LA RENUNCIA DEBE DE REALIZARSE ANTES DE LA PREPARACIÓN DE PEDIDOS**
- **CUMPLIMIENTO DE LA FECHA Y DÍA ASIGNADO PARA EL REPARTO**

INFORMACIÓN GENERAL

- **REGISTRO DE CAJAS VERDES Y PALETS. Las cajas verdes no son para el almacenamiento de los productos en los almacenes, sino para el traslado.**
- **LA ENTIDAD ES LA RESPONSABLE DE LA CARGA EN SUS VEHÍCULOS, NO LOS VOLUNTARIOS DEL BANCODE ALIMENTOS**
- **RESPETO, TANTO PERSONAL COMO A SU TRABAJO, AL VOLUNTARIADO**

ÁREA DE ENTIDADES RECEPTORAS

Responsable de la coordinación, control y supervisión de las Entidades receptoras

ENTIDAD RECEPTORA: organización receptora de los alimentos gestionados por el Banco de Alimentos, que cumple con los requisitos establecidos.

USUARIO DE LOS ALIMENTOS: aquella personas que se encuentra en situación y/o riesgo de exclusión social, acogida en una ent. receptora

CRITERIOS

(*Establecidos por el Patronato*)

- **Entidad legalmente constituida**
- **Ámbito de actuación en Asturias**
- **Lleve a cabo proyectos de intervención con personas – familias en riesgo y/o exclusión social**
- **Justifique la necesidad de los usuarios de los alimentos**
- **Disponer de un local, en buenas condiciones, para el almacenamiento de los alimentos**
- **Disponer de recursos, humanos, material y/o económicos, para la recogida y distribución de los alimentos**

JUSTIFICACIÓN DE LA NECESIDAD DE LOS USUARIOS DE LOS ALIMENTOS

- **Valoración elaborada por un profesional en el área social**
- **Aquella entidad que no posee dicho profesional será a través de recogida documental de su situación personal/ familiar y/o económica:**
  - **Fotocopia DNI, NIF o pasaporte**
  - **Certificado empadronamiento**
  - **Acreditación de la situación económica – laboral**
  - **Documentación recomendada basada en las solicitud de entidades como Cruz Roja - Cáritas**

INFORMACIÓN GENERAL

- **El Patronato, anualmente, establece la revisión y control de las entidades receptoras y del número de usuarios de los alimentos**
- **Será de carácter obligatorio la presencia tanto del representante de la entidad como de la documentación exigida en la fecha y hora acordada**
- **La modificación del número de usuarios se realizará en dichas revisiones, siendo considerado como usuario aquellos expedientes que se encuentren con la documentación correcta y actualizada**
- **La no presentación de la entidad en la fecha y hora acordada implicará la suspensión del reparto hasta la regulación de su situación**

INFORMACIÓN GENERAL

- **Respeto, tanto personal y del trabajo, de este equipo de voluntarios**
- **VISITAS PLAN FEAD**
  - **El Ministerio ha establecido la obligatoriedad al Banco de Alimentos de visitar a todas las entidades, adheridas al Plan, para la comprobación de los requisitos/ criterios establecidos en el mismo y aceptados por las entidades.**
  - **Cuando una entidad no acepte la visita o el impedimento para que no se lleve a cabo, implicaría una posible baja del Plan (según requerimiento del Ministerio)**

2. Presentación de la Universidad de Oviedo

MEJORA DE LA GESTIÓN DE LOS BANCOS DE ALIMENTOS

Jornada 1-12-2016

EQUIPO DE INVESTIGACIÓN 2016:
Nicolás Álvarez Gil
Celia de las Heras García
Pilar L. González Torre
Jorge Coque Martínez

Líneas de trabajo acordadas hace 2 años

- ✗ Encuestar al resto de unidades de convivencia beneficiarias de entidades de reparto
- ✓ Continuar estudio entidades donantes actuales
- ✓ Continuar estudio entidades donantes potenciales
- ✓ Diseñar base de datos para gestión centralizada
- ✓ Analizar otros aspectos de gestión del BAA

ENTIDADES DONANTES DEL BANCO DE ALIMENTOS DE ASTURIAS

- Cadena logística del BAA
- Mercados de abastos
- Catering
- Grandes hoteles
- Hipermercados
- Conclusiones

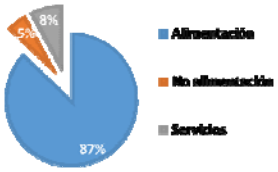
Cadena logística del BAA

Mercados de abastos

- En 2015: **14 Mercados de abastos** (12 concejos asturianos)

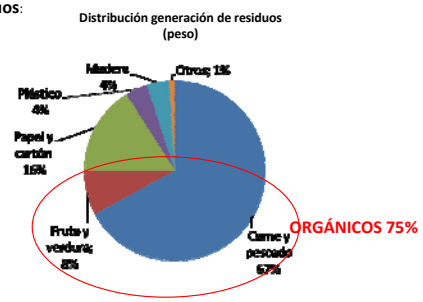
Mercados de abastos

- Actividad mayoritaria: **Alimentación**



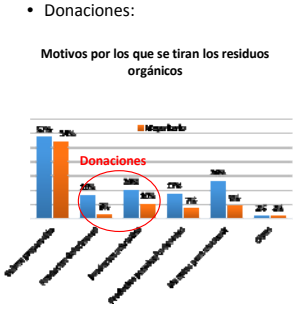
Mercados de abastos

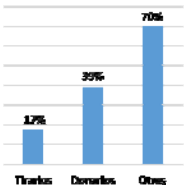
- **Residuos**:



Mercados de abastos

- Donaciones:

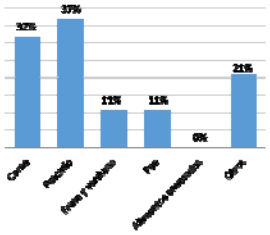


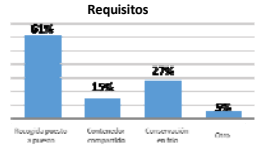


Mercados de abastos

- Donaciones **potenciales**:

49% estarían dispuestos a donar





Mercados de abastos

- **Donaciones potenciales**:

		MERCADOS DE LA MUESTRA		MERCADOS NO PERTENECIENTES A LA MUESTRA	
Tipo de actividad	Donaciones medias (kg/año)	Establecimientos totales	Estimación donaciones (kg/año)	Establecimientos totales	Estimación donaciones (kg/año)
Carnicería	219	53	11.607	2	438
Pescadería	394	30	11.820	4	1.576
Frutería	358	25	8.940	5	1.788
			32.637		3.802

Recuperación anual: 36 toneladas de alimentos

Catering

- En 2016: industria de catering en el Principado de Asturias
- Objetivo: conocer **si pueden donar o no** los alimentos que sobran, normalmente ya cocinados.

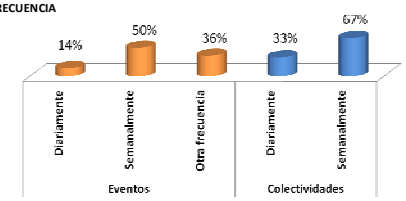
2 tipos
- **Eventos**
- **Colectividades**

Catering

- **Compra de alimentos**:

CANTIDAD
- **Eventos** — 130 kg/día
- **Colectividades** — 520 kg/día

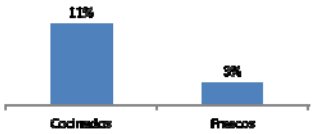
FRECUENCIA



Catering

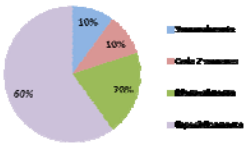
- **Despilfarro de alimentos**:

EL 71% DE LAS EMPRESAS NO APROVECHA TODOS SUS ALIMENTOS → EVENTOS: 11%
COLECTIVIDADES: 13,50%
AMBOS: 13%



Catering

- **Donaciones de alimentos**:



59% DONADORAS

41% **NO** DONADORAS → 71% INTERESADAS EN DONAR → **40% SEMANALMENTE**
20% CADA 2 SEMANAS
40% ESPORÁDICAMENTE

Pueden donar **Platos cocinados** + **Alimentos no cocinados**

Catering

- **Donaciones de alimentos**:

TIPO	CANTIDAD COMPRADA (Kg/día)	EMPRESAS DE CATERING	COMIDA COMPRADA (Kg/día)	% SOBRANTE	ESTIMACIÓN SOBRANTES DIARIOS
EVENTOS	130	10	1.300	11,00	143
COLECTIVIDADES	520	1	520	13,50	70
COLEC/EVENTOS	325	1	325	13,00	42
TOTAL	-	12	2.145	-	255

93 t/año

Grandes hoteles

- En 2016: empresas hoteleras de **4 y 5 estrellas** del Principado de Asturias (alojamiento + grandes banquetes)

- **Objetivo**: tras finalizar servicio de banquetes, **donar los alimentos sobrantes**, normalmente ya cocinados

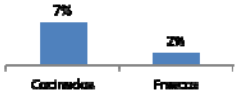
2 tipos → **4 estrellas**
5 estrellas

Grandes hoteles

- **Despilfarro de alimentos:**

EL 71% DE LAS EMPRESAS APROVECHA TODOS SUS ALIMENTOS → 8% DE ALIMENTO DESAPROVECHADO

EL **82%** DE LOS HOTELES ESTÁN AL TANTO DE LA PROBLEMÁTICA DESPILFARRO ALIMENTARIO



Pueden donar **Platos cocinados** + **Alimentos no cocinados**

Grandes hoteles

- **Donaciones de alimentos**:

SOLO UN HOTEL DONADOR → **Disponen de infraestructuras de conservación**

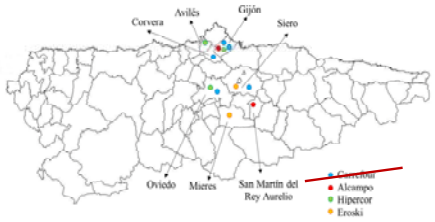
63% interesados → **80% esporádicamente**
20% 1 vez/semana

CANTIDAD MEDIA COMPRADA (kg/día)	EMPRESAS HOTELERAS	COMIDA DIARIA COMPRADA (kg/día)	% SOBRANTE POR TÉRMINO MEDIO	ESTIMACIÓN SOBRANTES DIARIOS
338	7	2.368	8	189

69 t/año

Hipermercados

- En 2016: **12 hipermercados** (4 grandes grupos)



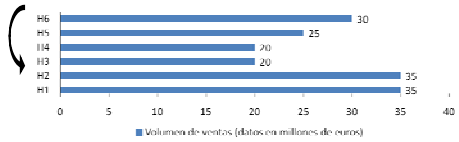
Hipermercados

Actividades desarrolladas ⇨
- Ventas al por menos
- Actividad mayoritaria: **alimentación**

Competencia ⇨ Supermercados ⇨
- Políticas de marketing
- Elevado número de supermercados
- Bajos precios

Productos envasados ⇨
Grupo I y III: tendencia a envasar
Grupo II: tendencia a no envasar

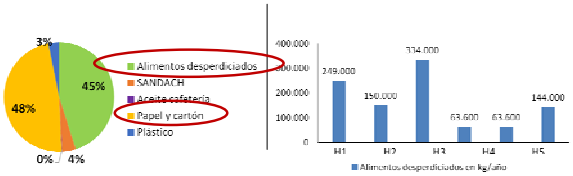
Volumen de ventas ⇨ **75%** ventas de alimentación



Hipermercados

Generación de residuos ⇨
- Papel y cartón / orgánicos
- Sin políticas de reaprovechamiento
- Posibilidad de donación (falta de regulación)

50% son orgánicos



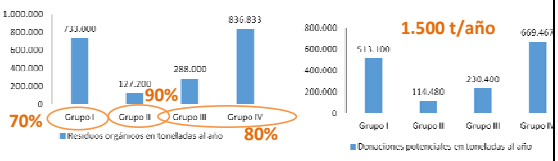
Motivos para desechar ⇨
- Fechas de consumo (caducidad/preferente)

Hipermercados

- Los resultados del estudio fueron:

Donaciones ⇨
- Esporádicas: donar aceite y productos de alimentación infantil (anual)
- Regulares: Grupos I y II (semanal)
- Poca donación de perecederos
- Disponibilidad de sistemas de frío

Donaciones potenciales ⇨
- Fechas de caducidad: protocolos estrictos
- Productos con defectos estéticos en el envasado
- Productos en perfecto estado de consumo



Conclusiones

Entidad Donante	Donaciones potenciales	Alimentos a donar
Mercados de abastos	36 t/año	**Alimentos frescos** •Frutas y verduras •Pescado •Carne
Catering	93 t/año	**Platos cocinados Alimentos frescos**
Grandes hoteles	69 t/año	
Hipermercados	1.500 t/año	**Alimentos envasados Alimentos frescos Conservas**

TOTAL: 1.700 t/año

Propuestas de futuro

- Profundizar estudios previos
- Nuevos sectores
  - Restaurantes
  - Supermercados
  - Farmacias
  - Otros
- Finalizar encuestas a colectivos beneficiarios
- ¿ _____ ?

3. Coloquio: preguntas y sugerencias de las entidades

Tras las presentaciones del BAA y de la Universidad de Oviedo, las personas representantes de las entidades receptoras plantearon las siguientes cuestiones y sugerencias de mejora durante el coloquio:

- **Colegios con cocina propia.** Se plantea la posibilidad de que alumnos que lo necesiten puedan llevar a casa parte del excedente de la comida ofrecida durante el horario escolar. Actualmente la imposibilidad de hacerlo con estudiantes o con otras entidades se debe a razones higiénico-sanitarias. Además se comenta la problemática de que dichos niños no tendrían una dieta variada, pues cenarían lo mismo que comieran en el colegio.
- **Política y tasas de residuos**. Se menciona la necesidad de que se impongan tasas y límites por parte de los ayuntamientos o gobiernos provinciales para disminuir la cantidad de comida tirada y que pueda convertirse en donaciones. COGERSA asegura que cerca del 2020 se impondrán medidas más restrictivas acerca de la gestión y la generación de residuos, incluidos aquellos procedentes de la alimentación, lo que podrá aumentar la concienciación y la potencialidad de las donaciones.
- **Recogida directa de mermas por parte de las entidades receptoras en los hipermercados y supermercados**. Acceder a estas cadenas comerciales puede evitar una gran parte de la pérdida de alimentos actual. Es posible, actualmente Carrefour y Alimerka tienen proyectos de recogida de sus mermas, y la entidad receptora *Expoacción* ya se beneficia de los mismos.
- **Reparto en las propias entidades**. Buscar un reparto más equitativo y que persiga un mayor aprovechamiento. Una potencial nueva línea de investigación estudiaría cómo se gestiona ese reparto. Surgen dos problemas principales: dificultad de ser equitativo al asignar alimentos mediante hojas de cálculo que no tienen en cuenta la imposibilidad de asignar medias raciones o fracciones de raciones en determinados productos en función de los integrantes de cada unidad de convivencia lo que obliga a redondear por exceso o por defecto (p.e., latas de conserva); y la problemática de los beneficiarios que, por picaresca u otras causas, solicitan comida en diferentes entidades receptoras (falta información para controlarlo).
- **Productos no demandados por las personas y colectivos beneficiarios**. Algunos beneficiarios rechazan determinados productos (pasta, arroz, legumbres, etc.) por ya contar con ellos, por el elevado consumo energético que requiere su preparación o por desconocimiento de cómo realizar esta. Mejorar la información sobre esto que posee el BAA sería muy interesante para reajustar los repartos.
- **Enfocar las operaciones kilo a los alimentos más demandados por las personas y colectivos beneficiarios**. Se plantea la posibilidad de fomentar mediante recomendaciones las donaciones en las operaciones kilo de los productos que son más necesitados o que se donan en menor medida (leche, alimentación infantil, aceite de oliva, etc.). Actualmente el BAA ya lo

hace, al igual que algunas cadenas comerciales. Extender dicha técnica al resto de centros dónde se lleven a cabo operaciones kilo puede suponer una mejora muy relevante.

- **Entidades receptoras sin infraestructuras para almacenaje**. Reparten cada tres días en función de los integrantes de cada unidad de convivencia.
- **Posibilidad de implementar campos de cultivo**. Se plantea la posibilidad de implementar zonas de cultivo en Asturias, tanto rurales como urbanas o periurbanas para abastecer a las entidades receptoras de productos frescos como frutas y verduras. Alguna entidad receptora ya lo hace (p.e., en La Fresneda).
- **Necesidad de formación para la preparación de los alimentos**. Ciertos beneficiarios manifiestan no tener los conocimientos necesarios para preparar los productos que reciben. Parece por tanto interesarte que las entidades de reparto aporten formación en ese campo además de la entrega de los alimentos.
- **Problemas de discriminación en algunas entidades**. Una entidad vinculada a un grupo étnico manifestó que se encuentra con problemas de racismo por parte de la sociedad, lo que produce que reciban menos donaciones de particulares (p.e., en operaciones kilo) que las destinadas a otros colectivos.
- **Otro modelo para representar la cadena logística de donaciones**. Modelo de semejanza a un árbol (raíz = entidades donantes; tronco = banco de alimentos; ramas = entidades receptoras; hojas = personas y colectivos beneficiarios).

4. Presentación de COGERSA, SADIM y ABAmobile

Escenario actual

¿Se conocen entre sí?¿Os conocéis todos?

¿Están cerca o lejos el uno del otro?¿Sabéis dónde están los demás?

¿Alguno puede donar?

¿Alguno necesita alimentos? Vuestras organizaciones sí

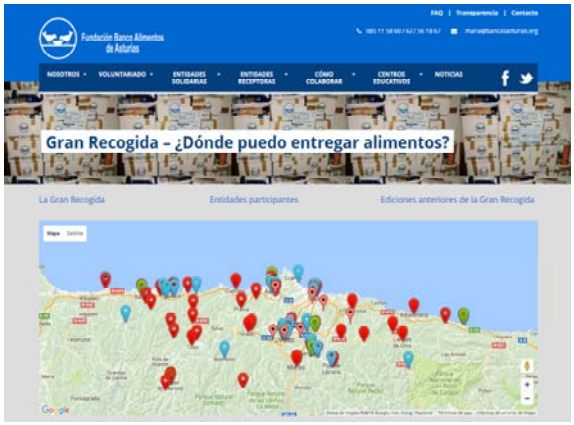
¿La donación coincide con la necesidad?

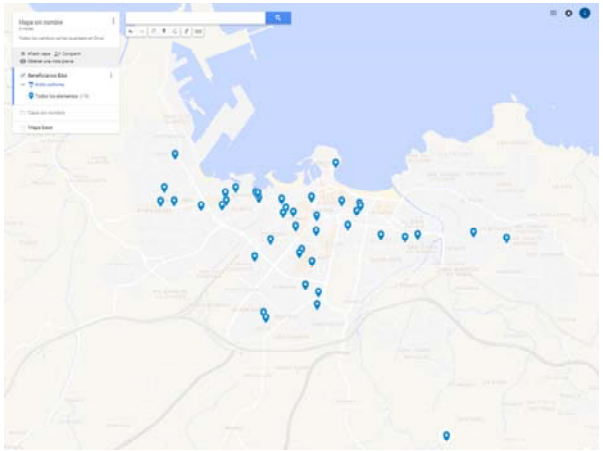
¿Conocen/conocéis COOMIDA?

¿Conocen/conocéis otros que puedan donar o que tengan necesidad?

¿ES PROBABLE LA CONEXIÓN?

¿Es relevante y reproducible aunque esa conexión haya?





Escenario propuesto

¿Se conocen entre sí? Sí, varios

¿Están cerca o lejos el uno del otro? Algunos cerca de otros
¿Alguno puede donar? Seguro que sí

¿Alguno necesita alimentos? Seguro que también

¿La donación coincide con la necesidad? Seguramente en más casos

¿Conocen COOMIDA? Sí, son miembros
¿Conocen otros que puedan donar o que tengan necesidad? Sí, y tratan de incorporarlos a COOMIDA
¿ES PROBABLE LA CONEXIÓN? Con COOMIDA y masa crítica, sí
¿Es relevante y reproducible aunque haya esa conexión? Con COOMIDA y masa crítica, sí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cooperamos para no tirar comida
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COGERSA
Sadim
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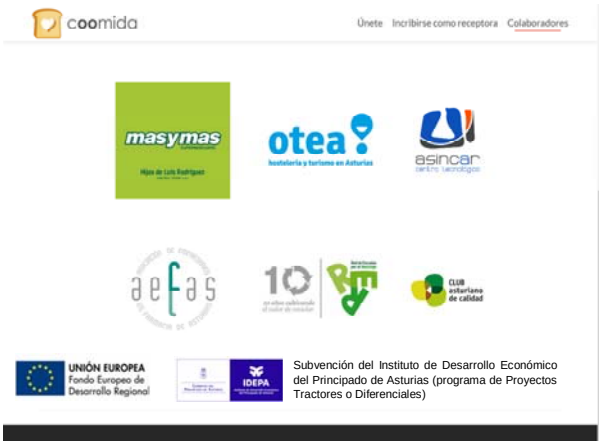
coomida
Únete
Incribirse como receptora
Colaboradores
masymas
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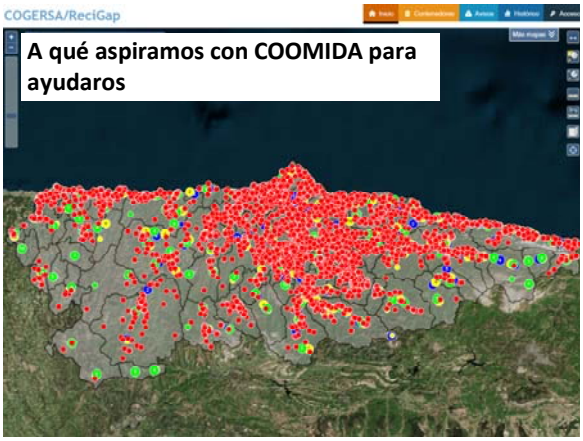
CLUB asturiano de calidad
UNIÓN EUROPEA
Fondo Europeo de Desarrollo Regional
IDEPA
Subvención del Instituto de Desarrollo Económico del Principado de Asturias (programa de Proyectos Tractores o Diferenciales)


coomida
Únete
Incribirse como receptora
Colaboradores
EL HAMBRE NO SE VE. NO TIRES LA COMIDA, NECESITAMOS ALIMENTOS. ¡AYÚDANOS A CONSEGUIRLOS!


coomida
Únete
Incribirse como receptora
Colaboradores
¿COMO FUNCIONA?
APÚNTATE
DESCARGA LA APP
DONA COMIDA
OBTÉN RECONOCIMIENTO


¿COMO FUNCIONA?


COGERSA/ReciGap
Tenemos la tecnología para ayudar al ecosistema del BAA


COGERSA/ReciGap
A qué aspiramos con COOMIDA para ayudaros

Pero no llegaremos a ningún sitio sin vuestra participación