Aston Business School

The SmartAgriFood project and the Integrated Linked Data Supply Web

Christopher Brewster
Aston University

Outline

- The SmartAgriFood Project
- Specific Challenges of Agri-Food sector
- The Linked Data Supply Web
- Some Core Ontologies

The SmartAgriFood Project

•The Food and Agriculture Domain

AGRIFOOD CLUSTER

• **AGRI-FOOD DOMAIN**

40 % of the EU's land area being farmed (Eurostat 2010)
Agriculture has a very important impact on the natural environment

The food and drink industry is representing 13% of EU manufacturing sector turnover (CIAA 2010, data 2007)

The EU is the world's largest food and drink exporter with a share of EU exports to world markets of 17.5% in 2008 (CIAA 2010)

Share of agri-food logistics in the EU road transport is about 20% (Eurostat/TLN 2008, data 2007)

11% share of agriculture-related products in total export value of EU countries in 2009 (Eurostat Comext trade data / Eurostat)

CHALLENGE

• **CHALLENGES TO BE MET**

- Increase of world population
- To reduce the effects of climate change
- Growing welfare in emerging economies
- Shift towards a bio-based economy
- Competing claims on land, fresh water and labour
- Etc.

The SMARTAGRIFOOD project aims to:

- Boost the application and use of future internet ICTs in Agri-Food
- Increase the competiveness and sustainability of Agri-Food
- Affect a huge number of Agri-Food SMEs throughout Europe

FUTURE INTERNET PPP

Smart Agri-Food

Aston Business School

Future Internet

- Aims to overcome limitations of the current internet, including:
  - a lack of data integrity, reliability, provenance and trust
  - a lack of data integration and federated storage solutions
  - lack of flexibility and adaptive control
  - segmentation of data and control
- “Developing the Future Internet” to combine several trends in internet development into an integrated approach
  - the on-going industrialization of IT
    - cloud computing
    - open service delivery platforms
  - new wireless networking technologies and the deployment of fibre
  - the breakthrough of the Internet of Things

Aston Business School

Accredited by Association of MBAs

FI-PPP programme approach

- Industry-led
- Creating internet innovation
- User-driven
- Integrated programme notion
- Overall FI-PPP budget:
  - 300 Million Euro EC contribution

Smart Agri-Food

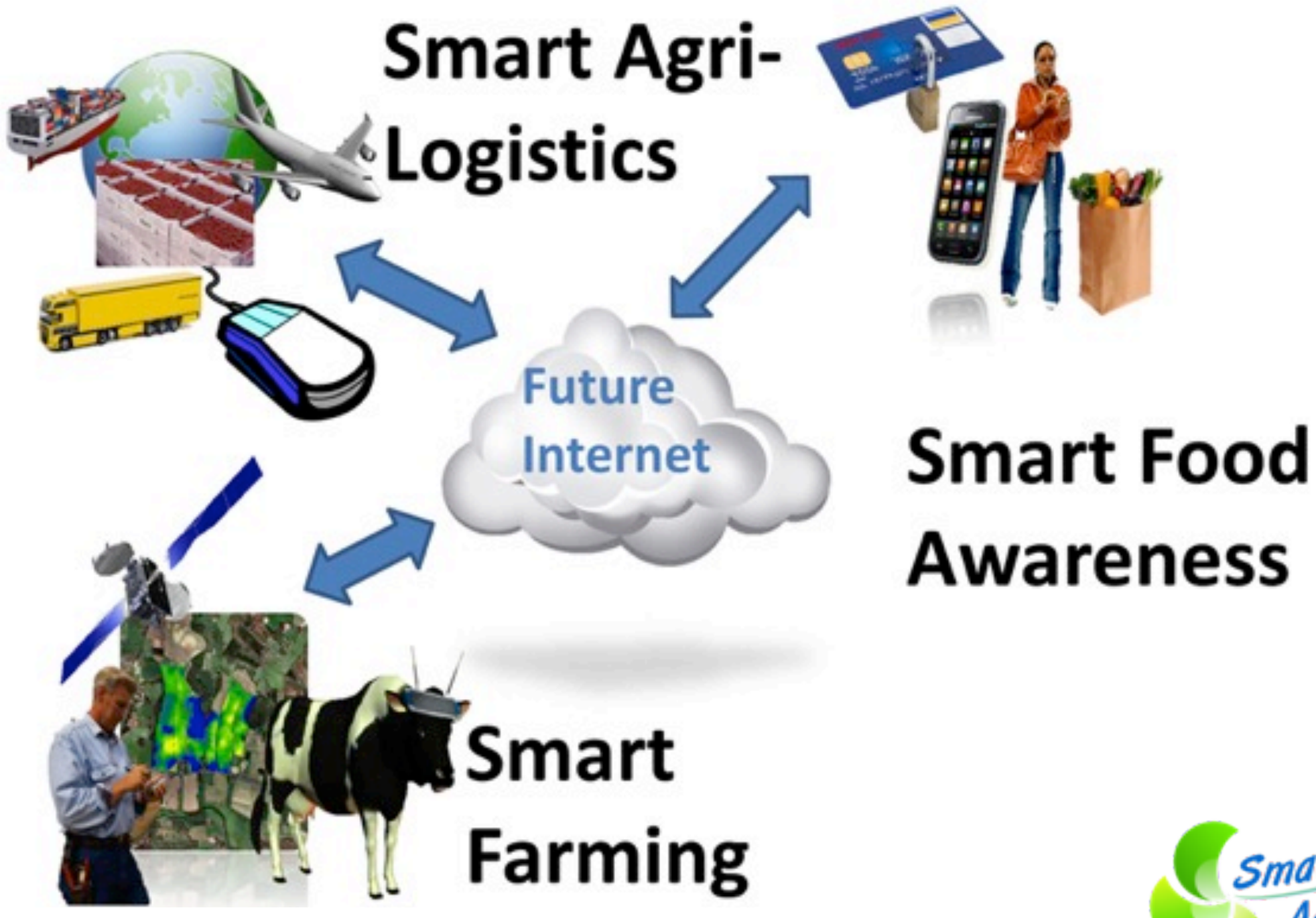
Aston Business School

Objectives of SmartAgriFood

Boost the application & use of future internet ICTs in the agri-food sector by:

- identifying and describing the technical, functional and non-functional **FI-specifications**
  - for experimentation in smart agri-food production as a whole system and
  - in particular for smart farming, smart agri-logistics and smart food awareness
- identifying and developing smart agri-food-specific **capabilities and conceptual prototypes**:
  - demonstrating critical technological solutions including feasibility,
  - to further develop them in large scale experimentation and validation
- identifying and describing existing **experimentation structures** and start **user community building**,
- resulting in an implementation plan for the next phase.

3 Use Case Scenario's: from Farm to Fork

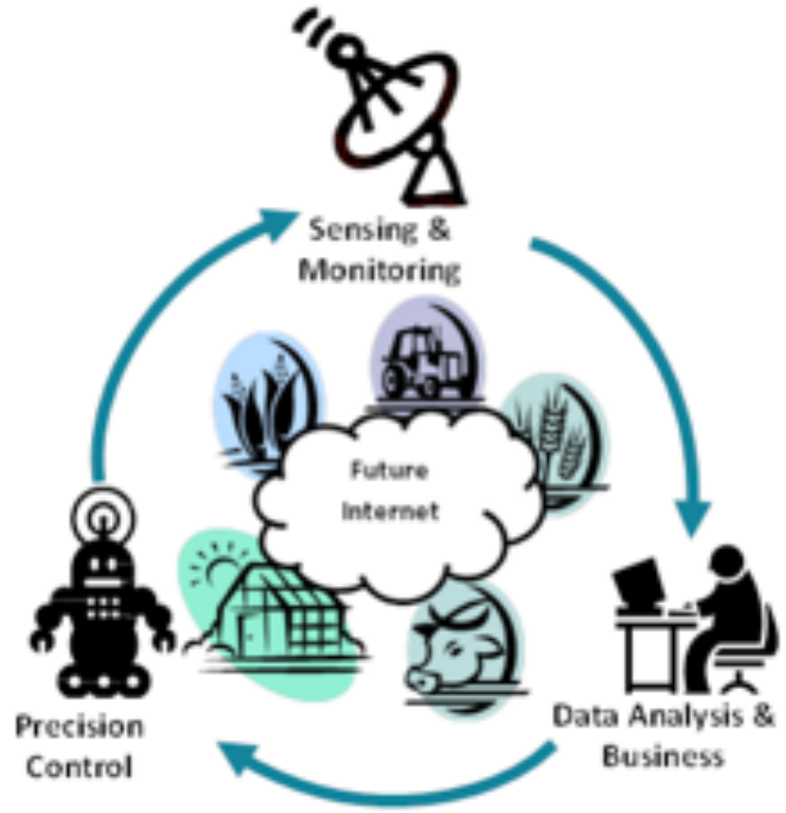


Smart Agri-Food

WP200 Smart Farming

- **Smart Farming**
  - sensors and traceability

➢concerns first the use of sensors and monitoring, decision support systems and precise input application so as to make the use of resources more efficient in food production, and secondly concerns ways to improve traceability and the flow of data along the food supply chain



WP300 Smart Agri-Logistics

- **Smart agri-logistics**

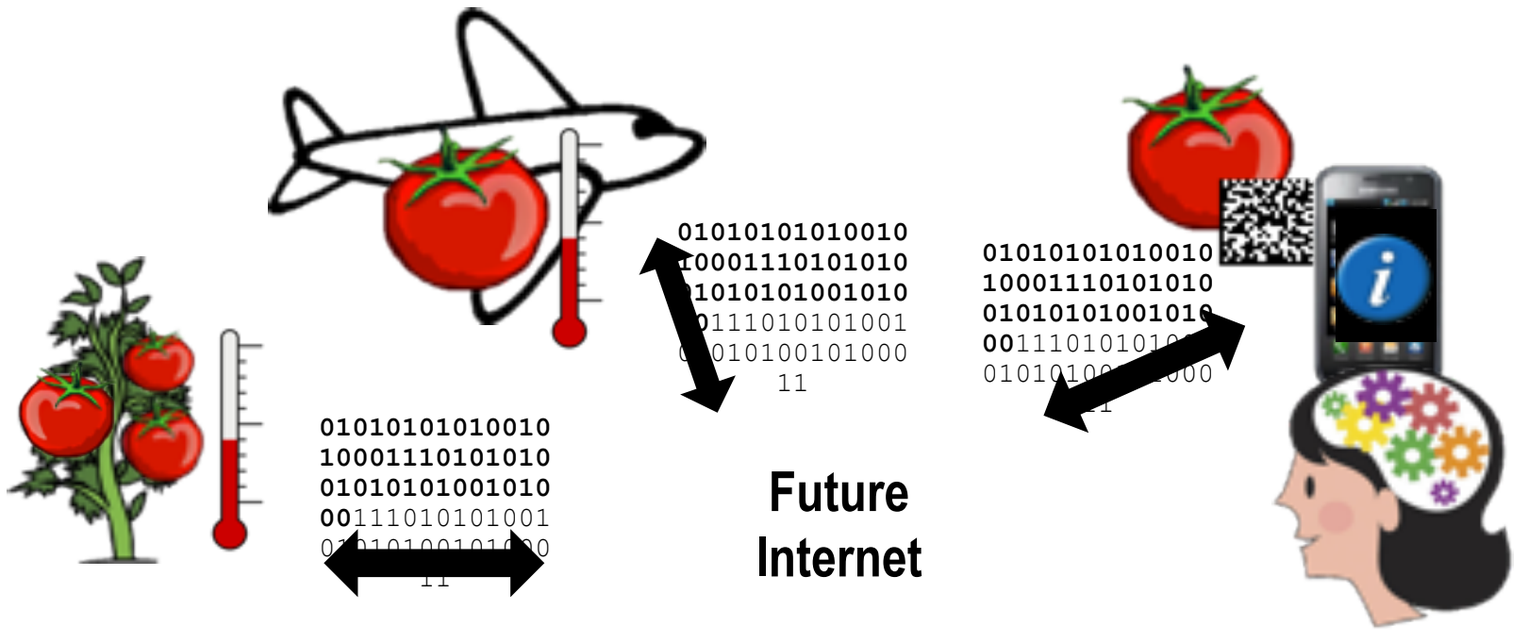
  - real-time virtualization, connectivity, logistics intelligence

  ➢ concerns the intelligent matching of supply and demand followed by smart transport and logistics of agri-food products by eg. tracking of food products, conditioned transport using sensors and control systems, remotely controlled early warning systems, and better predictions of food transportation needs

WP400 Smart Food Awareness

- **Smart food awareness**
  - transparency of data and knowledge representation

➢concerns enabling the consumer with relevant information eg. concerning safety, availability, health, environmental impact, and animal welfare, to make informed decision and to make the activities carried out in the entire food production chain transparent



Aston Business School

Consortium

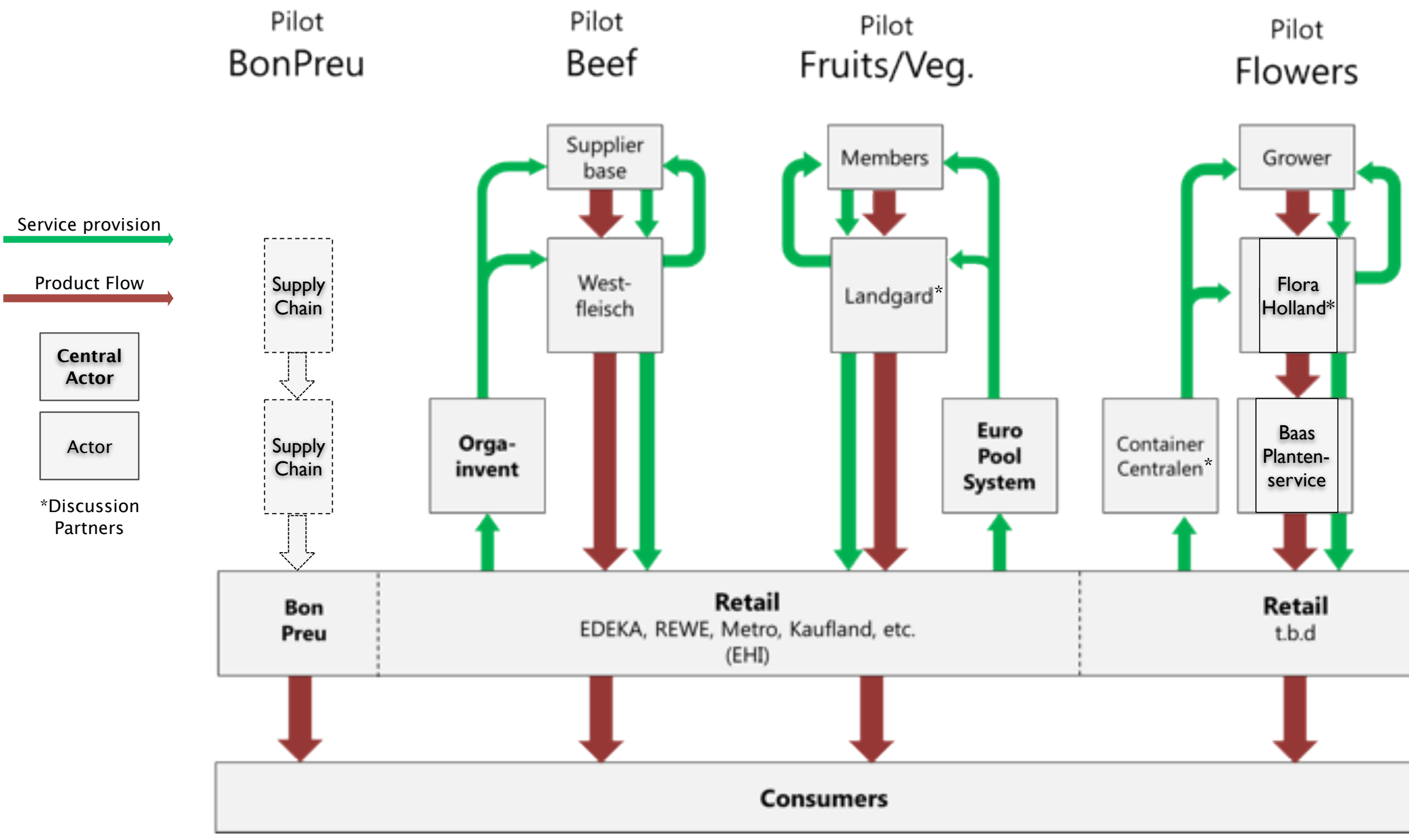
- **21** beneficiaries from **7** countries
- Balanced consortium
- Connected to
  - ETP Food for Life by CBHU
  - ETP Manufuture, subgroup Agricultural Engineering and Technology (AET) by John Deere
  - ETP EpoSS by VTT
  - ICT-agri ERANET by TNO/Wageningen University
  - IERC cluster by DLO/ATB
  - Network of EHI retail institute
  - Local industry platforms
  - Local governments
  - Euro Pool System

	Research		Industry/ end-users	
	Agri-food	ICT	Agri-food	ICT
DLO-WUR	++	+		
ATB	+	++		
TNO	+	++		
CENTMA	++	+		
ATOS				++
ASI				++
HWDU				++
MTT	++	+		
KTBL	++	+		
NKUA		++		
UPM		++		
Campden BHU			++	
Aston Uni.		++		
VTT	+	++		
OPEKEPE			++	
John Deere			++	+
Wageningen Uni.	++	+		
EHI Retail			++	
GS1			++	+
SGS			++	+
BonPreu			++	

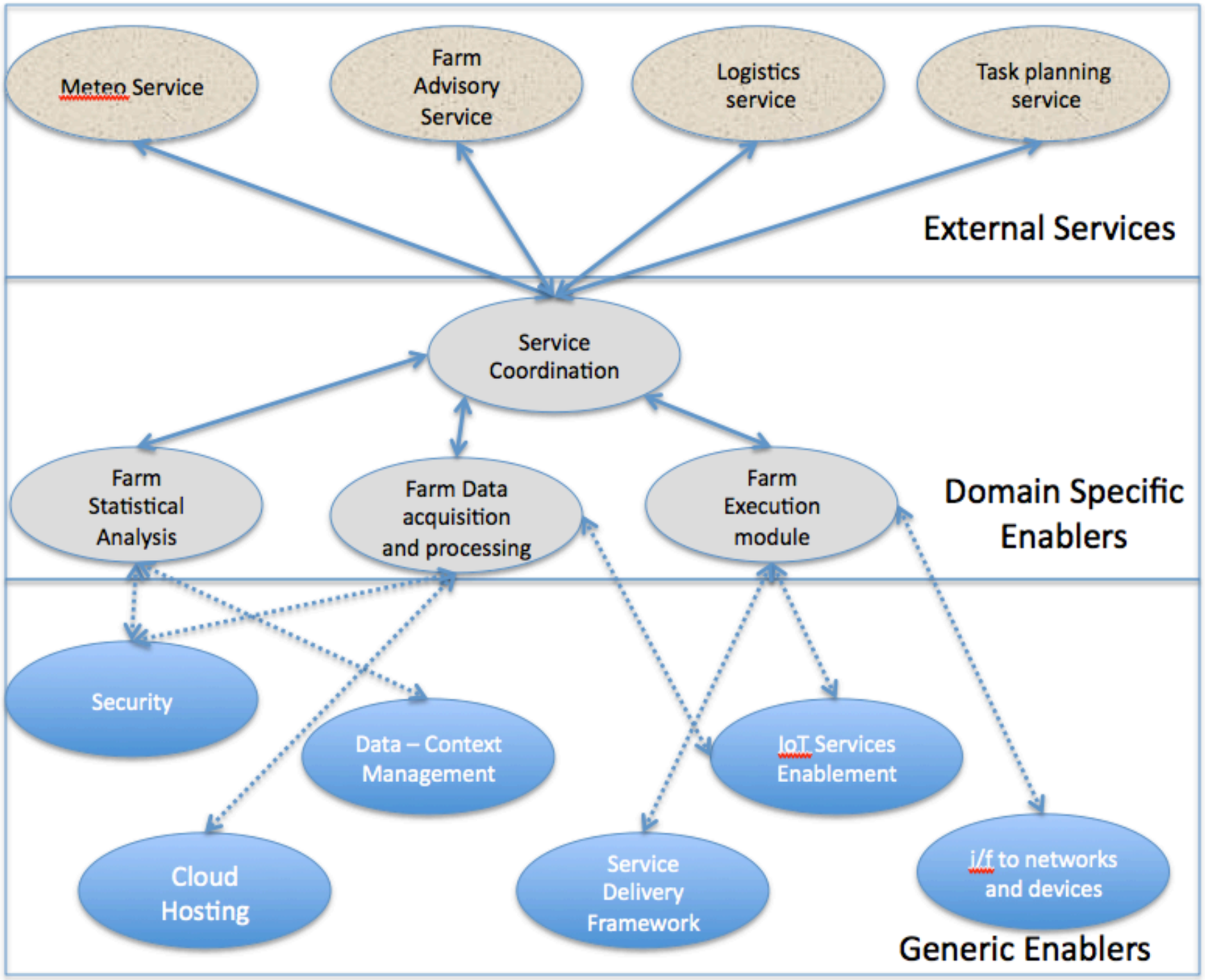
Aston Business School

Accredited by Association of MBAs · EFMD EQUIS ACCREDITED · AACSB ACCREDITED

Conceptual Prototypes – Focus of a Smart Agri-logistics



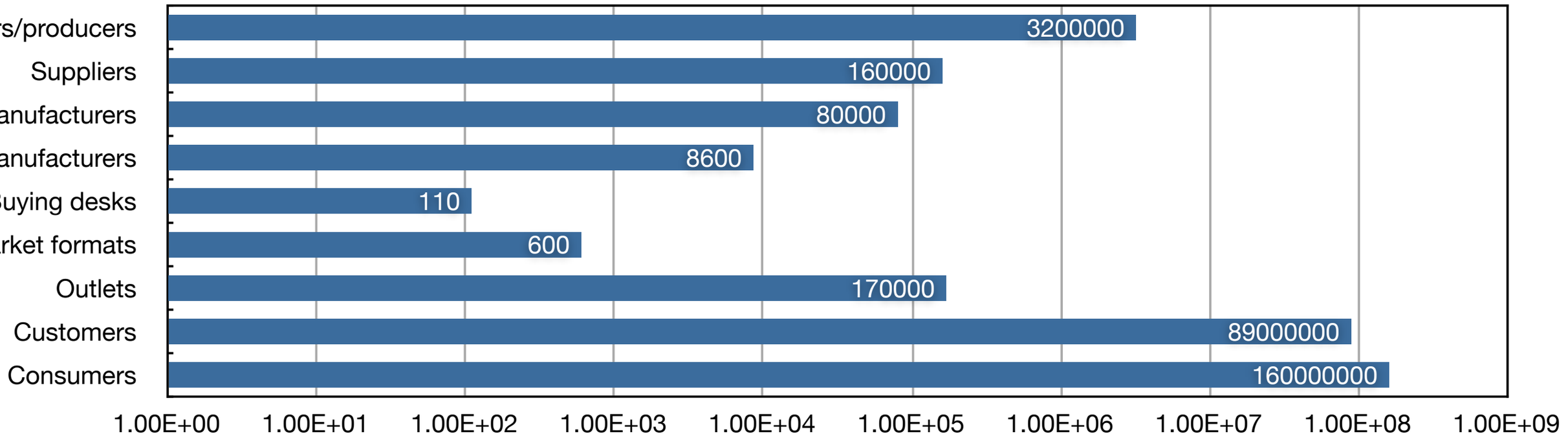
Future Internet for Agri-Food Architecture



Specific Challenges of Agri-Food sector

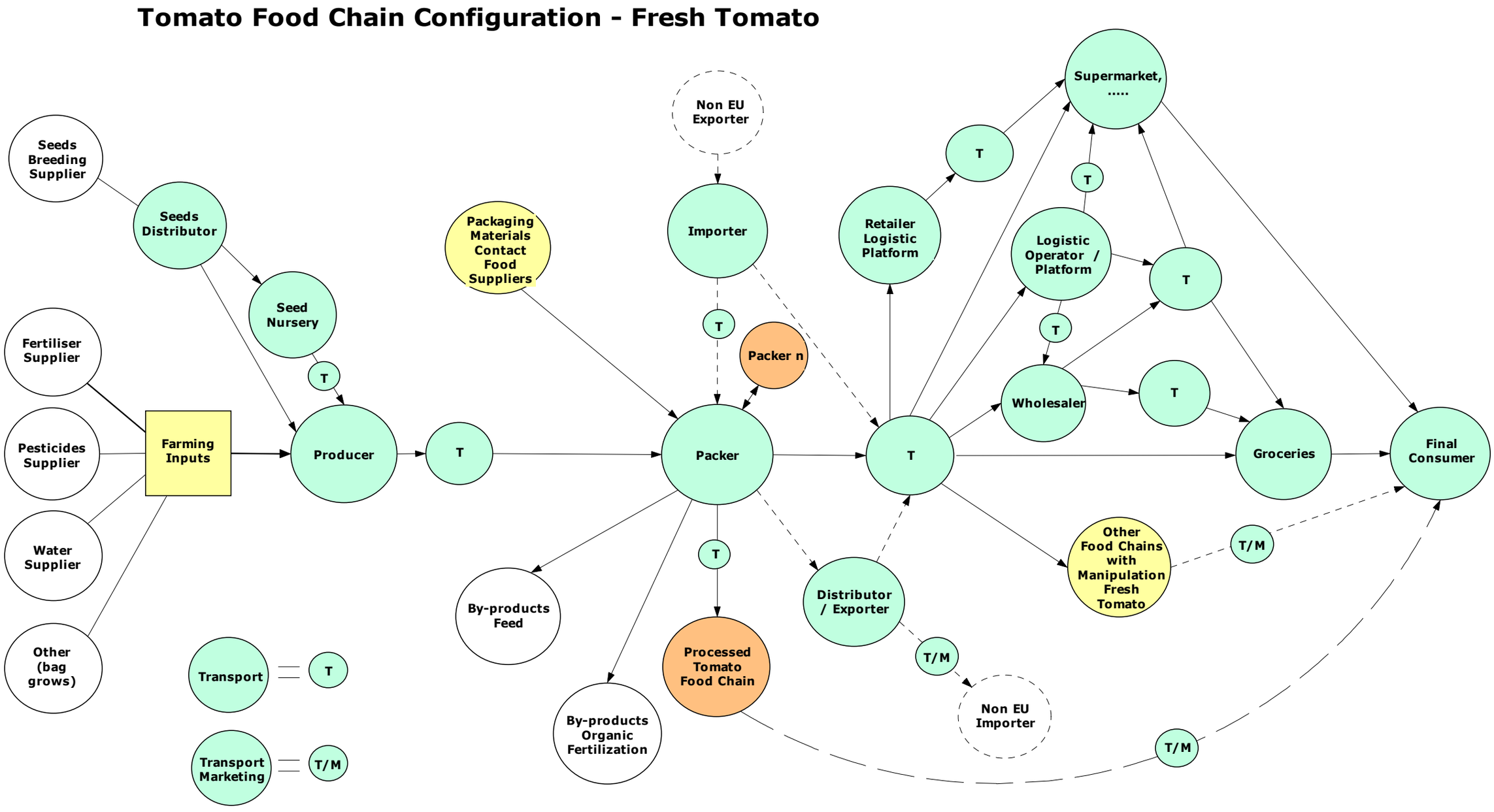
Aston Business School

The Agri-Food Supply Chain



- Agri-food sector has:
  - many actors
  - heterogeneous actors
  - loosely coupled
  - large scale
  - very poor information flow
  - great variability in communication and trust

Supply Chains look like this



The Linked Data Supply Web

Semantic Technologies and Linked Data

- There exists much work on **intra-enterprise** linked data and ST
- Much less on **inter-enterprise** systems
- Fundamental problems are the same:
  - common vocabularies
  - trust to use the technology

Web of Data for Agri-Food

- Every actor published Linked Data about:
  - themselves
  - the products they produce/process/transport/sell
- Some data static, some dynamic
- use of standards (vocabularies/ontologies) would ensure interoperability
- Web services provided by third parties - potential for an agri-data market

Advantages - 1

- Data available to both “next” and “previous” actor *and* other actors on the supply chain
- Use URIs for different granularities (shipment, pallet, package, individual can or tomato)
- Class hierarchies allow propagation of data through different levels
- External data providers (e.g. certification bodies) can publish relevant data and have that integrated

Advantages -2

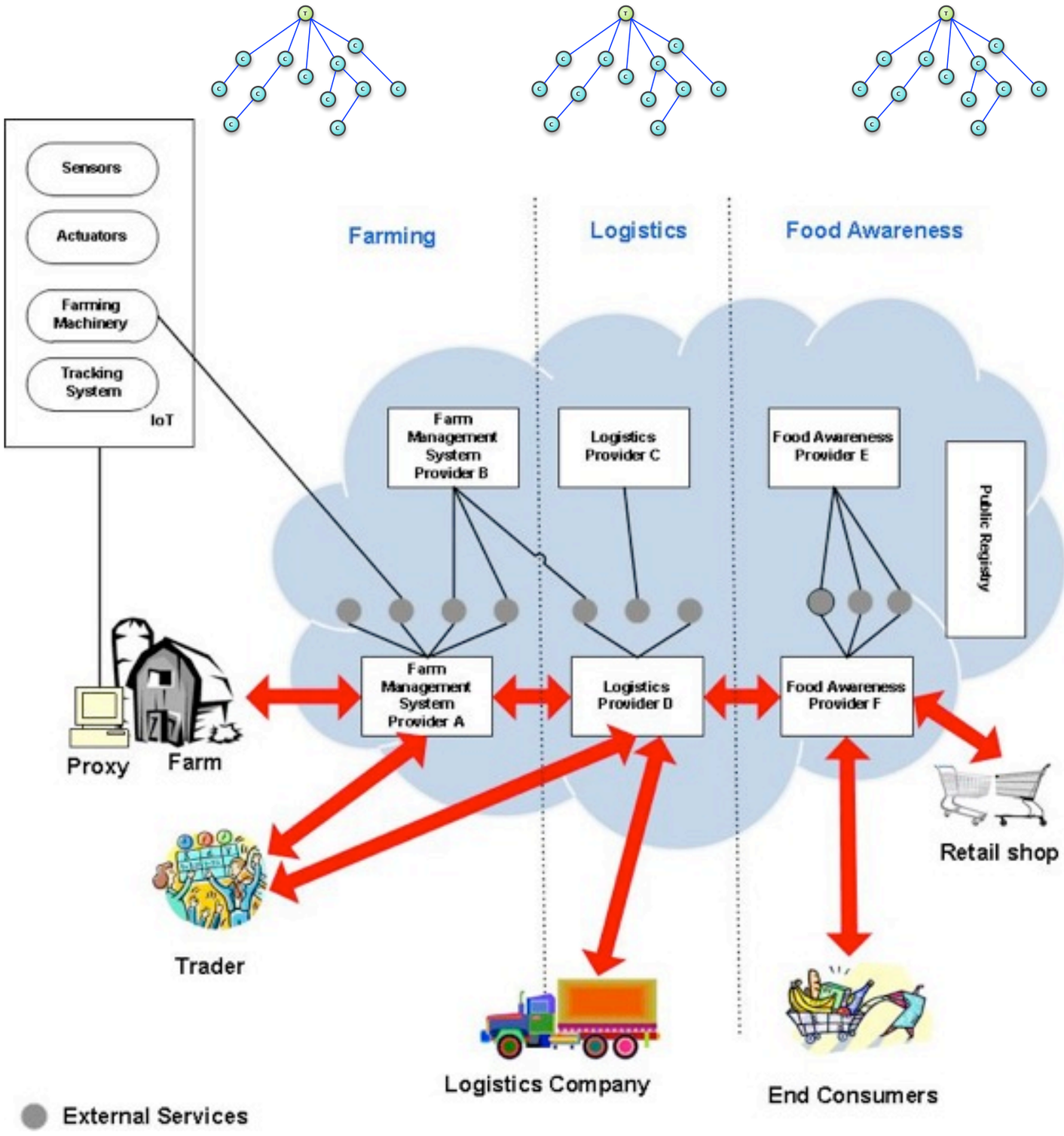
- Adding new data types becomes easy (important as food products in constant flux, plus data collected changes)
- Integration of crowd-sourced data becomes much easier

Linked Data Supply Web

- LDSW is both a **model** and an **architecture**
- Model of how integrated supply chains *could* work
- Architecture of how to build it

Some Core Ontologies

Modelling the domains



Key Ontologies: AgroXML

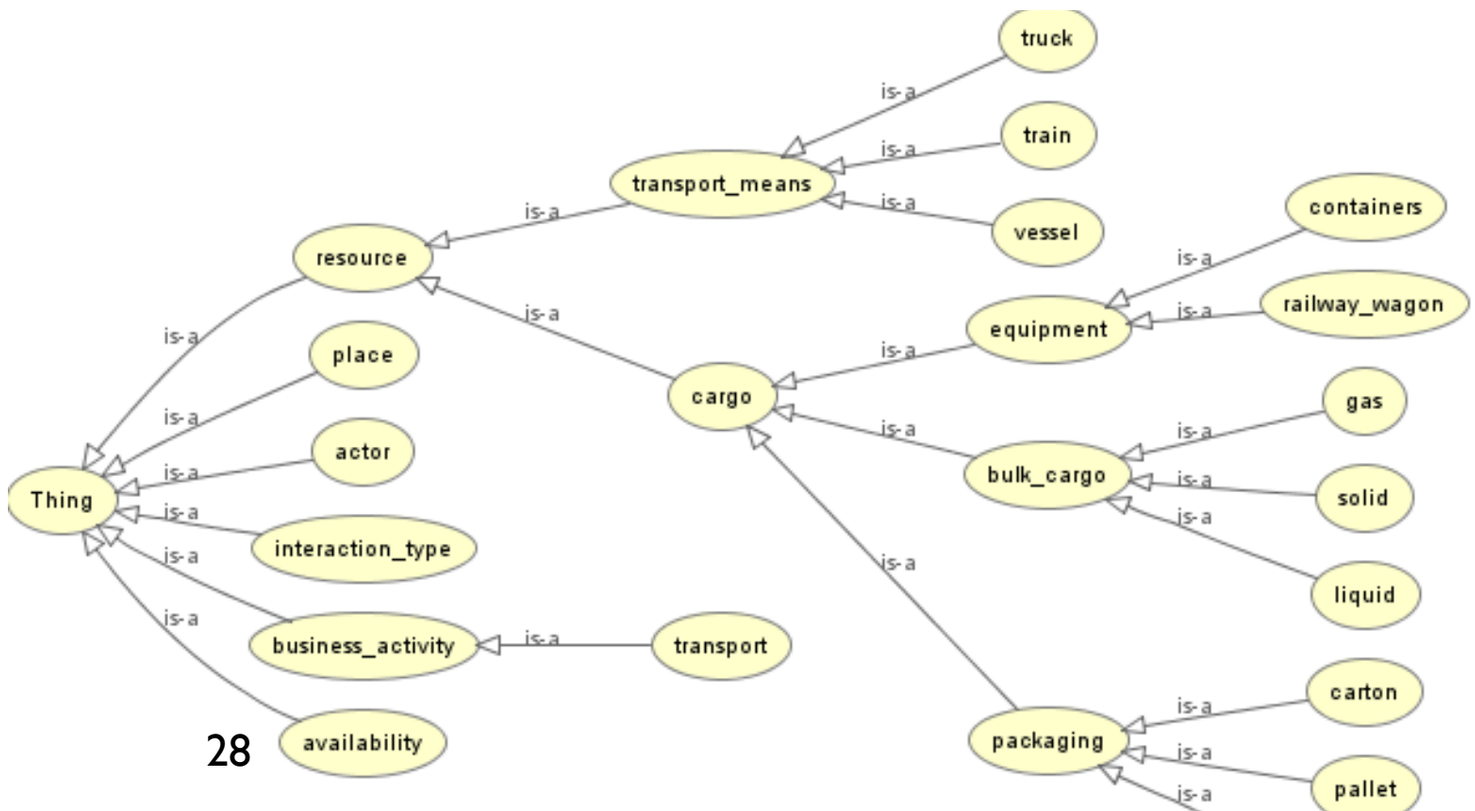
- Originally designed as an XML data exchange format for farmers (http://www.agroxml.de/)
- Exchange data between FMSs, suppliers, and administrative and certification bodies
- “model of the real-world processes in agricultural production”
- Domains covered include: soil types, machine types, fertiliser types, pesticides and plant variety names
- Originally envisaged for (e.g.) calculating farm machinery field work, exporting a farm’s data to GlobalGAP
- Currently RDFS version version --> AgroRDF
- Mappings now exist to AGROVOC

Key ontologies: AGROVOC

- Originally document management taxonomy for FAO (http://aims.fao.org/standards/agrovoc)
- 40,000 concepts in 20 languages covering all aspects of agriculture
- Now available as OWL and SKOS
- Part of LD cloud, extensive mappings have been undertaken
- Agrovoc was used in the Neon project for a fish stock depletion alert syste to integrated data from multiple source

Key Ontologies: Common Framework

- Common Framework for ICT in Transport and Logistics: best known catalogue of logistics concepts
- e.g. logistic service provider, transport network manager, sender party, multimodal transport, environmental emission
- Number of initiatives trying to develop ontologies for logistics (Casandra, iCargo)
- Work in progress



Key Ontologies: GoodRelations

- Very successful ontology for e-retailing designed to describe “the relationship between (1) Web resources, (2) offerings made by means of those Web resources, (3) legal entities, (4) prices, (5) terms and conditions, and [...] products and services (6)”
- Initiative of Martin Hepp (http://www.heppnetz.de/projects/goodrelations/)
- Complex, relatively flat model of offers in retailing
- Successful uptake in US (bestbuy.com) and Germany (volkswagen).
- Used also for local areas e.g. Ravensburg experiment

Conclusions

- Linked Data Supply Web is realisable technically
- Strong economic, social and political forced to support this
- Challenges:
  - Technical: consuming the data effectively
  - Socially: Persuading people to publish data
- Future Work:
  - designing the right architecture for easy publishing, easy consumption