2ND INTERNATIONAL CONFERENCE ON
ENTREPRENEURSHIP, INNOVATION AND REGIONAL DEVELOPMENT
THEME:
Entrepreneurship and Innovation Crossroads: Triggers, Catalysts and Accelerators for Sustainable Regional Development

Design and development of a web platform for supporting liquid food monitoring and traceability

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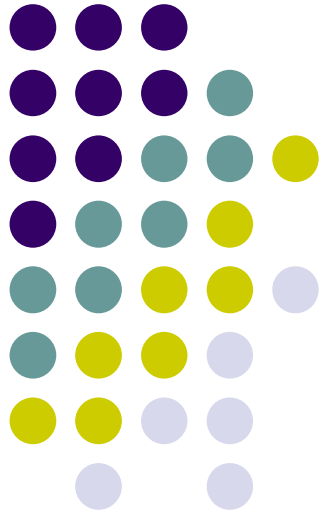
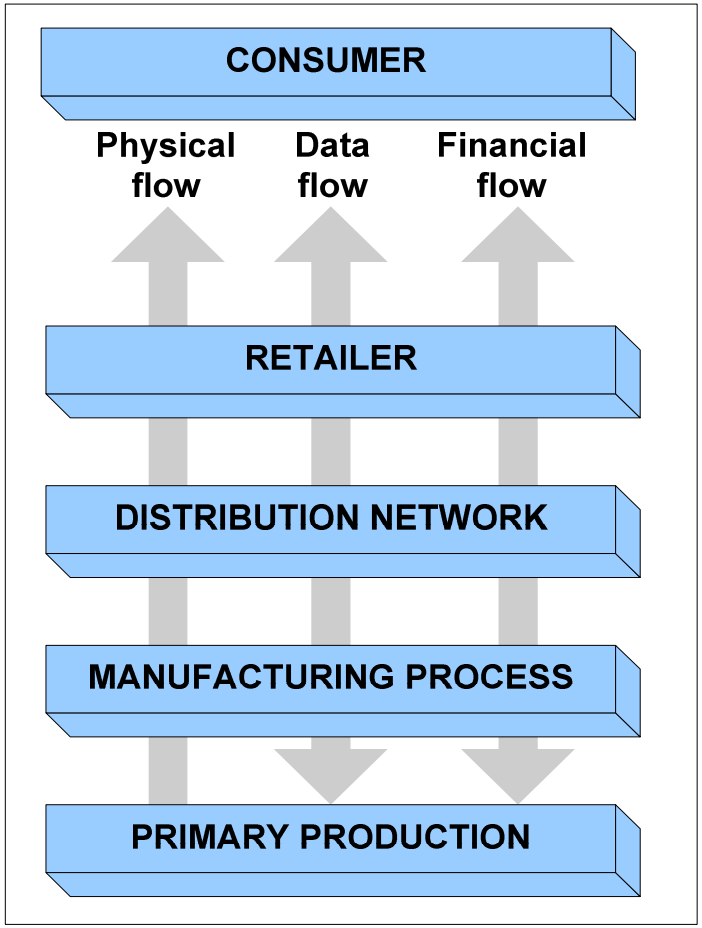


Introduction

- The E.U. Regulation 178/2002 regarding the establishment of the European Food Safety Agency set the foundations towards more strict traceability requirements in the food sector and paved the way for further legal requirements at a national level assuring information flow transparency and efficient traceability
- Traceability: "*the ability to trace the history, application or location of an entity by means of recorded information*" (ISO)
- In the food chain, traceability means "*the ability to trace and follow a food, feed, food producing animal or substance through all stages of production and distribution*"



Introduction

- The efficiency of a traceability system depends on the ability to collect safety and quality related information
- Many models have been proposed for supporting traceability information, each viewing the issue from a different perspective
- A reference model for liquid food supply chain and the identification of data required for a traceability system is presented
- First deliverable of a national project that aims to develop an electronic platform able to support food traceability

Project

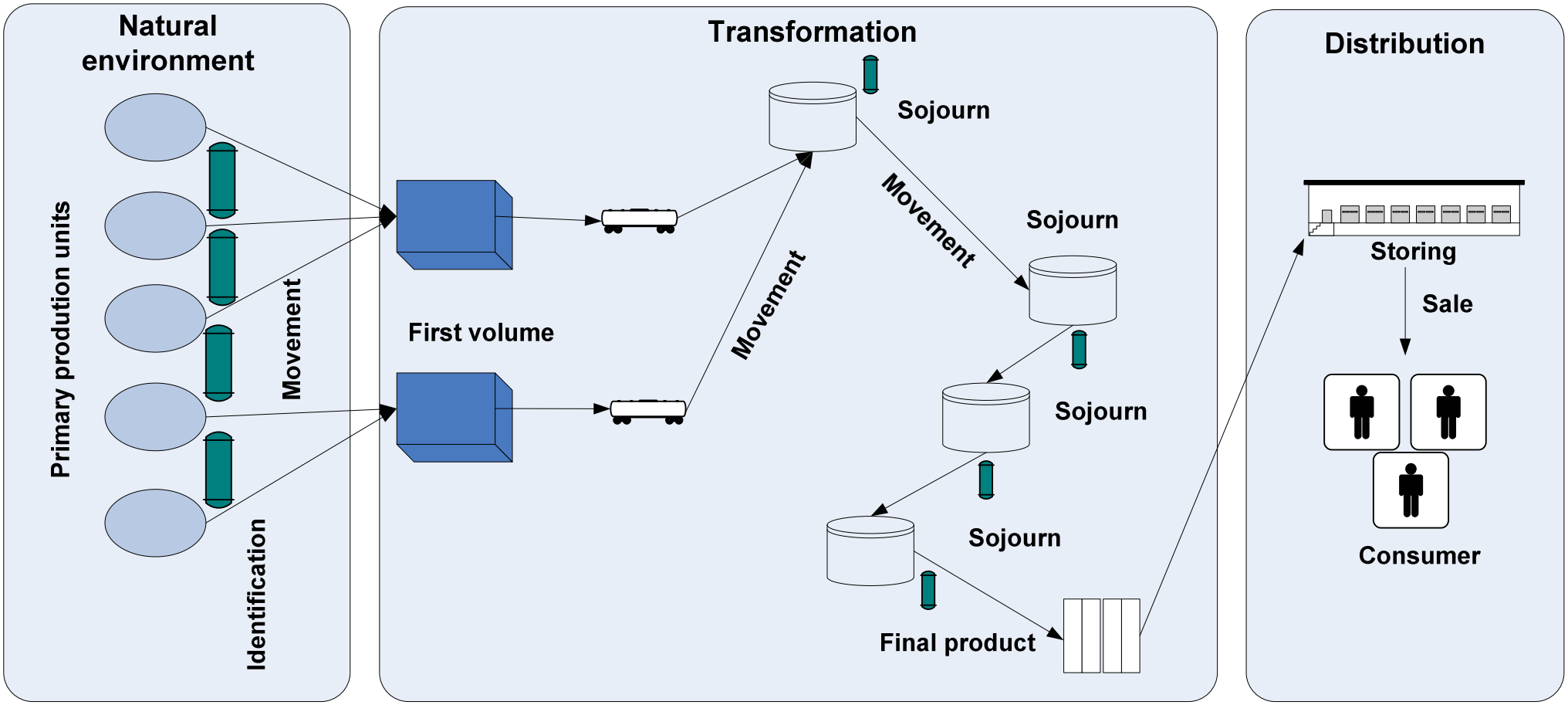
- National project titled: “Design and development of an integrated traceability web platform for the food industry”
- Funded by the National Program of the Development of Industrial Research and Technology” (Call: 4.3, Action: 4.3.1), under the Third Community Support Program coordinated by the Ministry of Development
- Involves two participants
  - MIK3 Integrated Information Systems SA (a software house company)
  - Department of Agricultural Economics (AE) of the School of Agriculture, Aristotle University of Thessaloniki

- It will last 18 months and the total budget is 210,000 €

Aims

- The main objective of the project is to develop a web platform that supports traceability in the food industry and especially in liquid products: milk, wine and olive oil
- This platform aims to follow and register the production and distribution processes of the raw materials, semi-finals and final products that are used in the examined industry

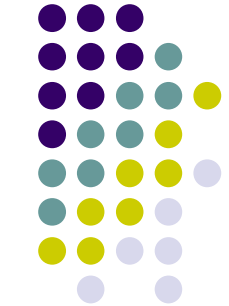
Reference model



Basic concepts

- Phase
  - Each phase includes stages which link together with actions which are initiated by events
- Stage
  - Refers to the process taking place in limited space defined by a container of standard capacity in terms of product. According to the process type, the product properties can be altered in an extended (sterilization, fermentation, etc.) or limited degree (the product is simply stored into the container, such as storing, distribution, etc.)
- Event
  - An event indicates the time when one or more actions should initiate. The event is realized instantly and triggers a respective action
- Entity
  - A distinguished real world object

Basic concepts (cont.)

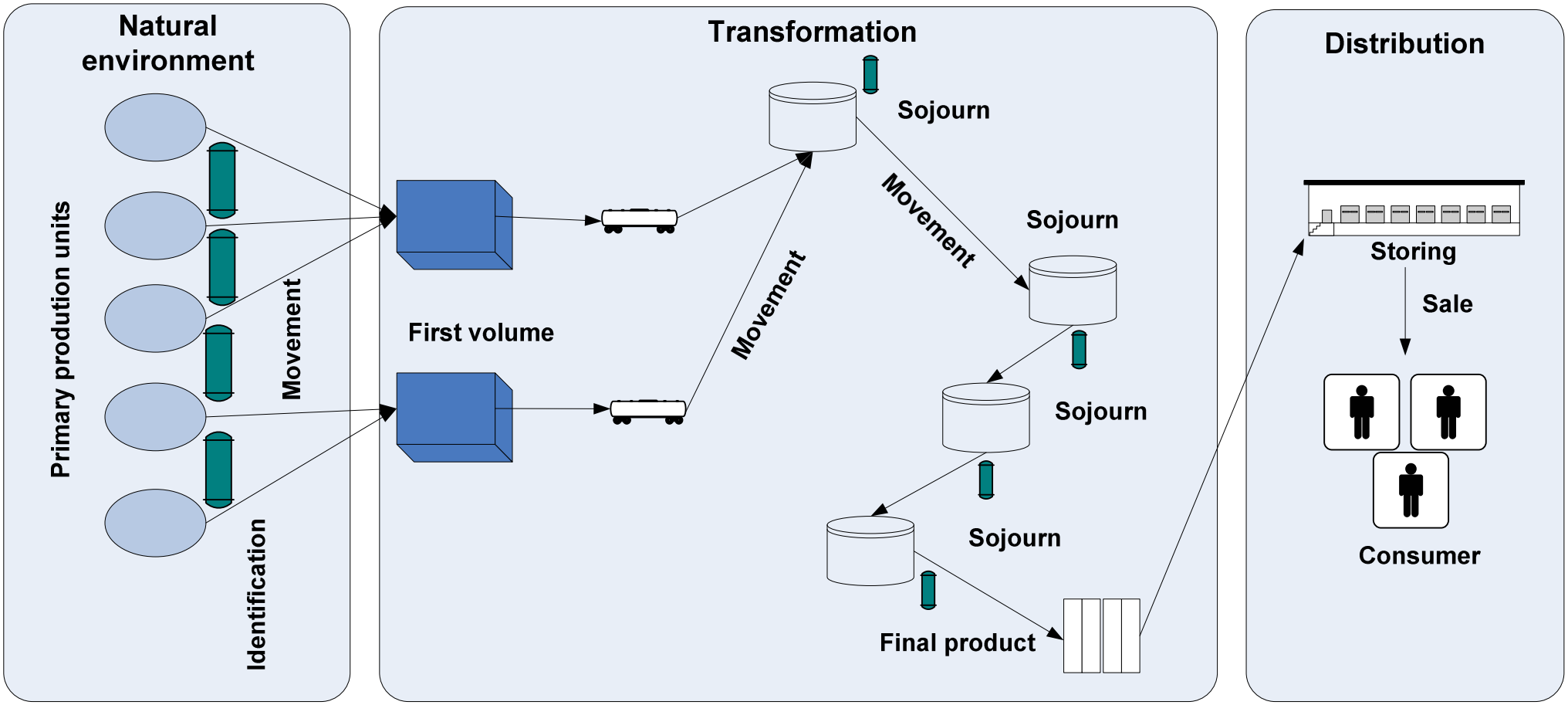


- Entities categories:
  - Container: refers to the entity that confines and carries the product, defining its volume, size and features that differentiate it from other volumes of the same product with similar features and adding value of shape, time, area and procurement. The added value is given to the product by the container through the main processes realized in it: transportation, storing, transformation and distribution
  - Actor: refers to all persons, natural or legal, that contribute by any means to any of the processes of the supply chain (roles: food handler, trader, auditor, consumer)
  - Material: refers to all materials introduced in any of the stages of the modeled supply chain (categories: products and supplementary materials)

Basic concepts (cont.)

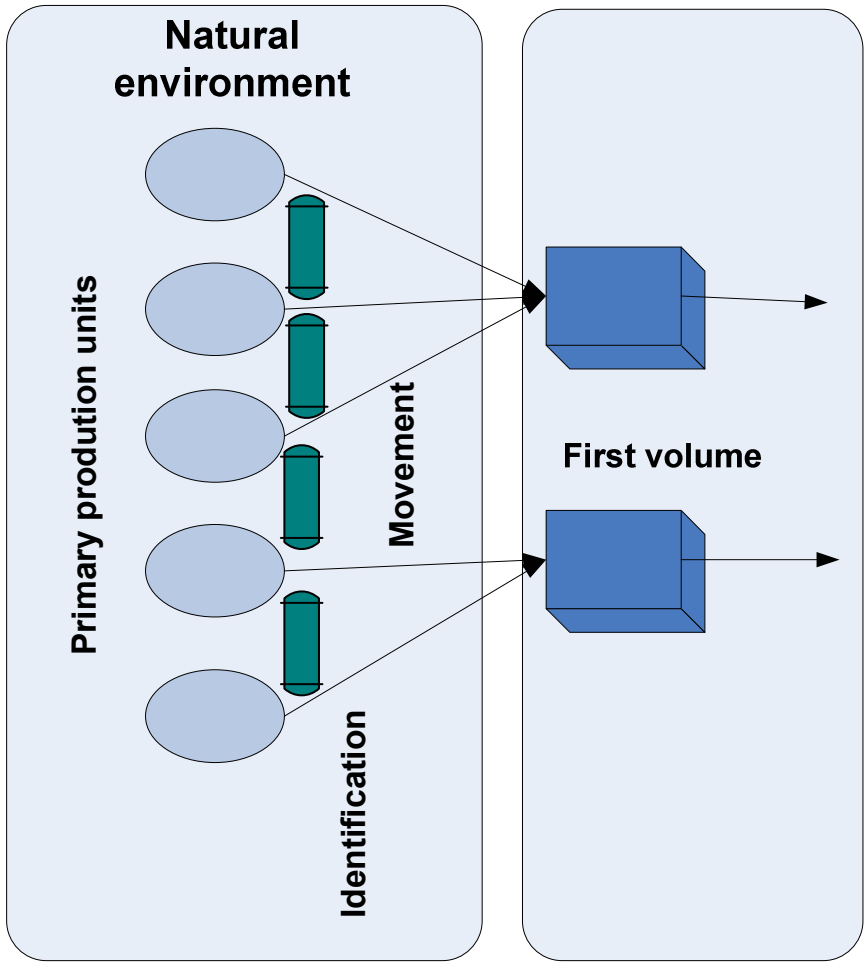
- Entities categories (cont.):
  - Sample: The sample entity refers to a standard volume of product with such size that allows conduction of quality tests on it. Each sample represents a bigger volume of product with the same attributes as the sample
  - Document: Certified or not certified documented information required for the realization of all the supply chain processes (invoices, shipping notes, etc.)
  - Primary production unit: refers to all natural entities, such as plants and animals, that produce the primary product (primary volume), as a result of processes realized during their natural life cycle
  - Primary production support area: refers to all natural and artificial installations that support the natural life cycle and satisfy all the needs of the primary production units

Reference model



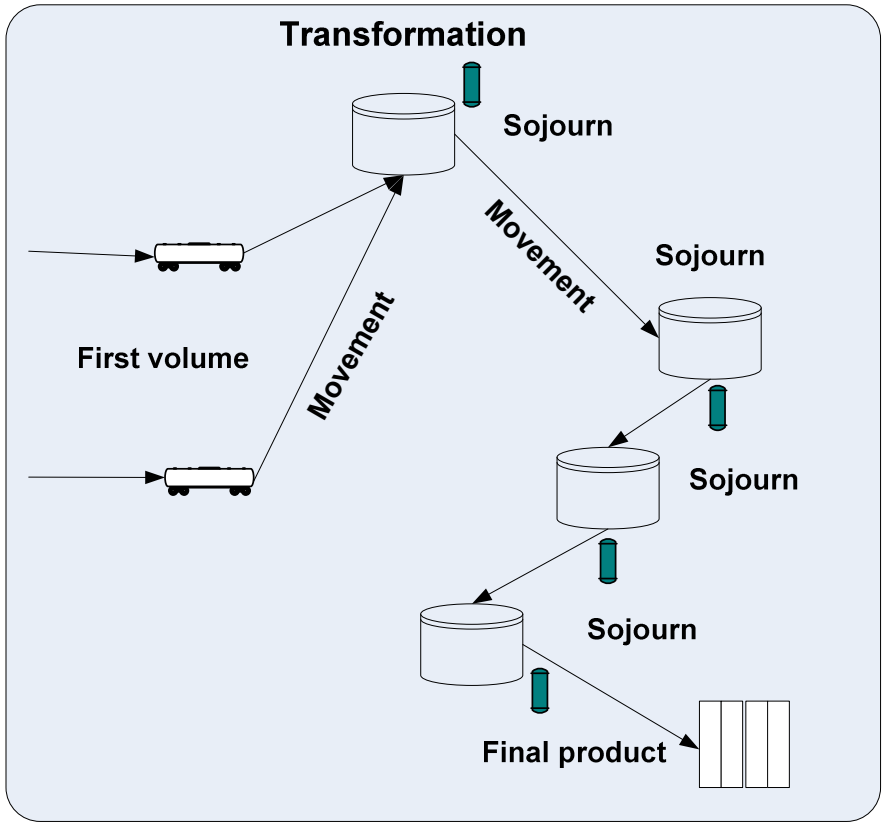
Natural environment

- Consists of the primary production unit (vineyard, olive tree, milk producing animal) and the primary production support area (farm, field, and stable)
- The stage of creation refers to the production of the primary product (first volume) from the primary production unit (raw milk, olive, or grape)
- With the event of sale, the ownership of the primary product is being passed to the next level of the supply chain
- Transition to the next stage is initiated by the event of identification that triggers the process of induction, while the primary product is being removed from the natural environment under proofed conditions and enters the phase of transformation



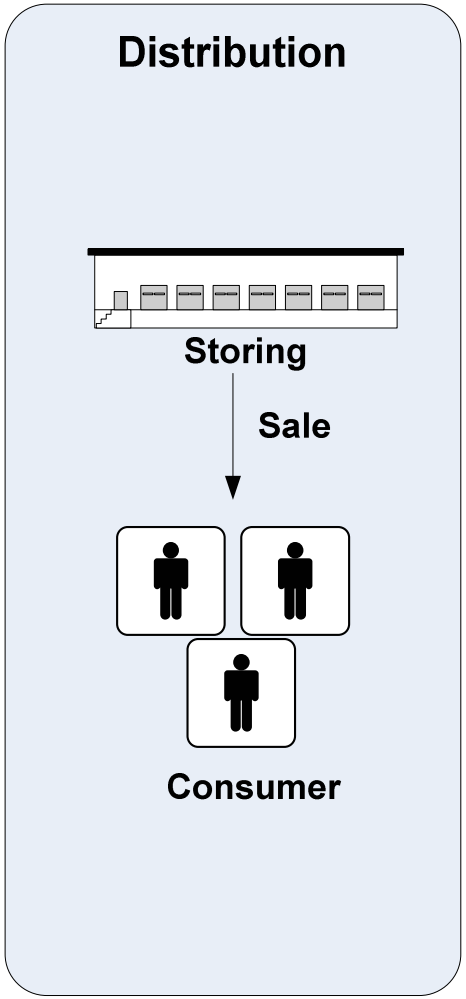
Transformation

- The transformation phase includes all stages, events and processes that lead in the production of the final product, as this is disposed in retail
- Starts with the stage of storing/transformation of the primary product and ends with the packaging of the final product into retail units
- The stages of sojourn build the process line that lead in the production of the final product
- The movement of the product from one stage to another is being initiated by the event of identification, which includes homogenization of the product volume, sampling, analysis and decision for movement
- The direction of movement depends on the results of the sample assessment and the production needs, business rules and other events related to the production process



Distribution

- Includes the storing of the final product to retailer warehousing facilities or to interceded stakeholders facilities such as 3PL's or distribution centers
- Movements are triggered by identification and sale events leading to the final event of retail sale
- The final sale event disengages the product from the modeled supply chain, and passes the ownership of the product to the consumer who is charged with a price that quantifies the modeled value chain per product unit



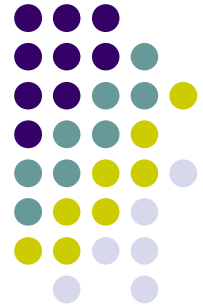
Phases

1. Identification and categorization of the required data for an effective traceability
2. Modeling of business processes of the Agribusiness Supply Chain
3. Modeling traceability data in Physical Markup Language (PML) format
4. Traceability web platform development

Phases

1. **Identification and categorization of the required data for an effective traceability**

Phases



1. **Identification and categorization of the required data for an effective traceability**

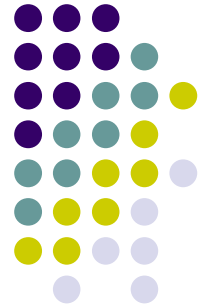
A detailed research has been conducted, scrutinizing all national and EU regulations that define production methods, and safety requirements for inputs regarding cultivation, feedstuffs, regulations regarding packaging materials, and storage and distribution methods

Traceability data

Linking traceability data with the model main entities

Main entities	Data categories	Entities attributes
Container	Descriptive data	Description Volume/mass
	Technical data	Technical properties
	Functional data	Optimal operation properties
Actor	Descriptive data	Natural/legal person or virtual entity, name, trade name, tax details, addresses, organization chart
	Functional data	Quittance methods, distinctive roles (handler, auditor, consumer, trader)
Materials	Descriptive data	Description (short and extensive), scientific term, pragmatic term, tax category, value, measure
	Quality data	Acceptable specifications and admissible deviations
	Functional data	Class (product, supportive material)
Samples	Descriptive data	Measure
	Quality data	Acceptable specifications and admissible deviations

Phases



1. **Identification and categorization of the required data for an effective traceability**

2. **Modeling of business processes of the Agribusiness Supply Chain**

Phases

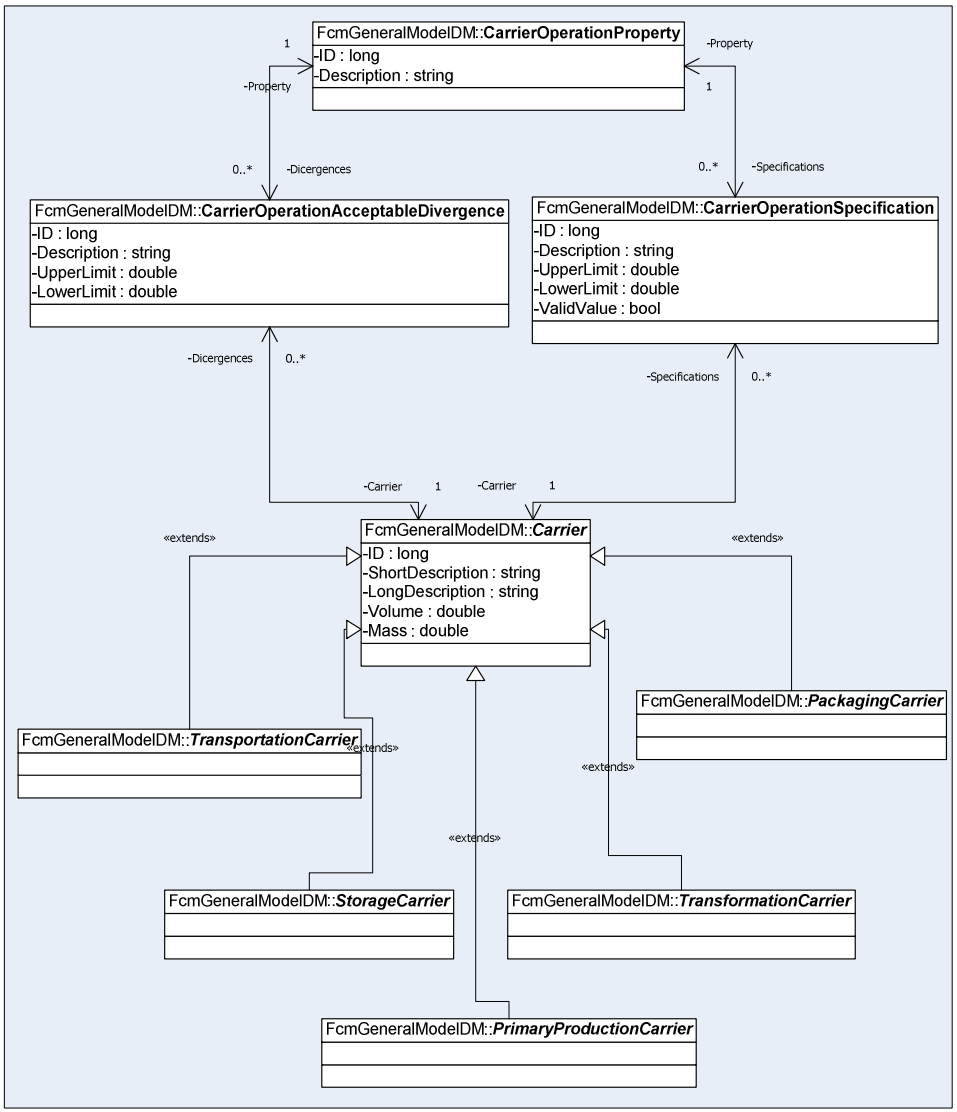
1. **Identification and categorization of the required data for an effective traceability**

2. **Modeling of business processes of the Agribusiness Supply Chain**

The outcome of this package is the development of a reference supply chain business model for supporting traceability in the examined sector

Static modeling with Unified Modeling Language (UML) Class Diagrams and dynamic modeling with UML Activity Diagrams is taken place. The next step is the development of eXtensible Markup Language (XML) Schemas

Diagrams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-Description : string
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-Property
-Property
1
0..*
-Dicergences
0..*
-Specifications
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-Description : string
-UpperLimit : double
-LowerLimit : double
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-ID : long
-Description : string
-UpperLimit : double
-LowerLimit : double
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0..*
-Specifications
0..*
-Carrier
1
-Carrier
1
«extends»
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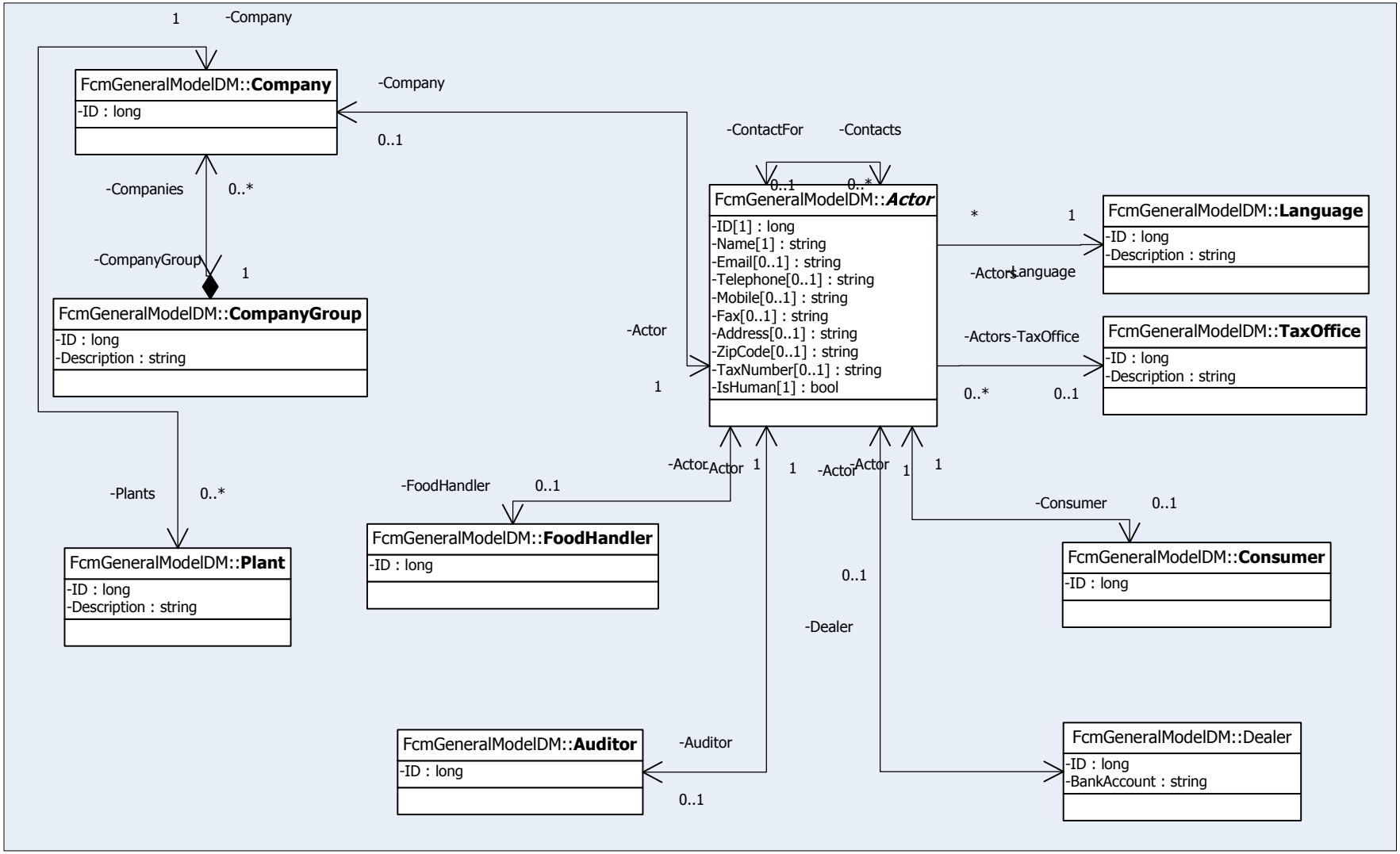
-ShortDescription : string
-LongDescription : string
-Volume : double
-Mass : double
«extends»
FcmGeneralModelDM::PackagingCarrier
FcmGeneralModelDM::TransportationCarrier
«extends»
«extends»
«extends»
FcmGeneralModelDM::StorageCarrier
FcmGeneralModelDM::TransformationCarrier
FcmGeneralModelDM::PrimaryProductionCarrier

Diagrams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FcmGeneralModelDM::CompanyGroup
-ID : long
-Description : string
FcmGeneralModelDM::Actor
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-Name[1] : string
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-Telephone[0..1] : string
-Mobile[0..1] : string
-Fax[0..1] : string
-Address[0..1] : string
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-TaxNumber[0..1] : string
-IsHuman[1] : bool
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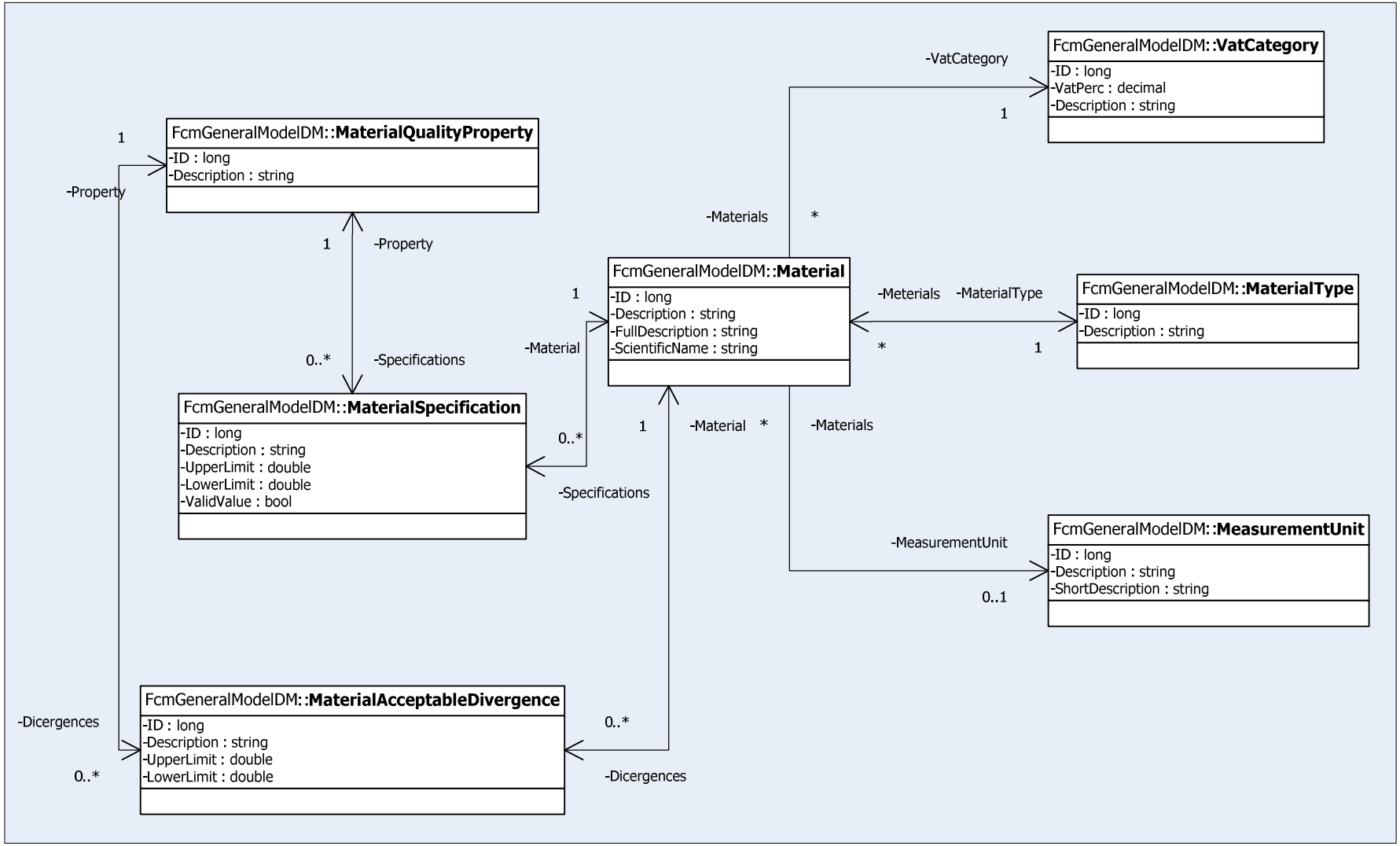
-ID : long
-Description : string
FcmGeneralModelDM::Plant
-ID : long
-Description : string
FcmGeneralModelDM::FoodHandler
-ID : long
FcmGeneralModelDM::Consumer
-ID : long
FcmGeneralModelDM::Auditor
-ID : long
FcmGeneralModelDM::Dealer
-ID : long
-BankAccount : string
-Company
-Companies
-CompanyGroup
-ContactFor
-Contacts
-Actor
-Actors-Language
-Actors-TaxOffice
-Plants
-FoodHandler
-Consumer
-Auditor
-Dealer

Diagrams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-VatCategory
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-Description : string
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-Materials
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-Description : string
-FullDescription : string
-ScientificName : string
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-Specifications
-Material
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-Materials
-Specifications
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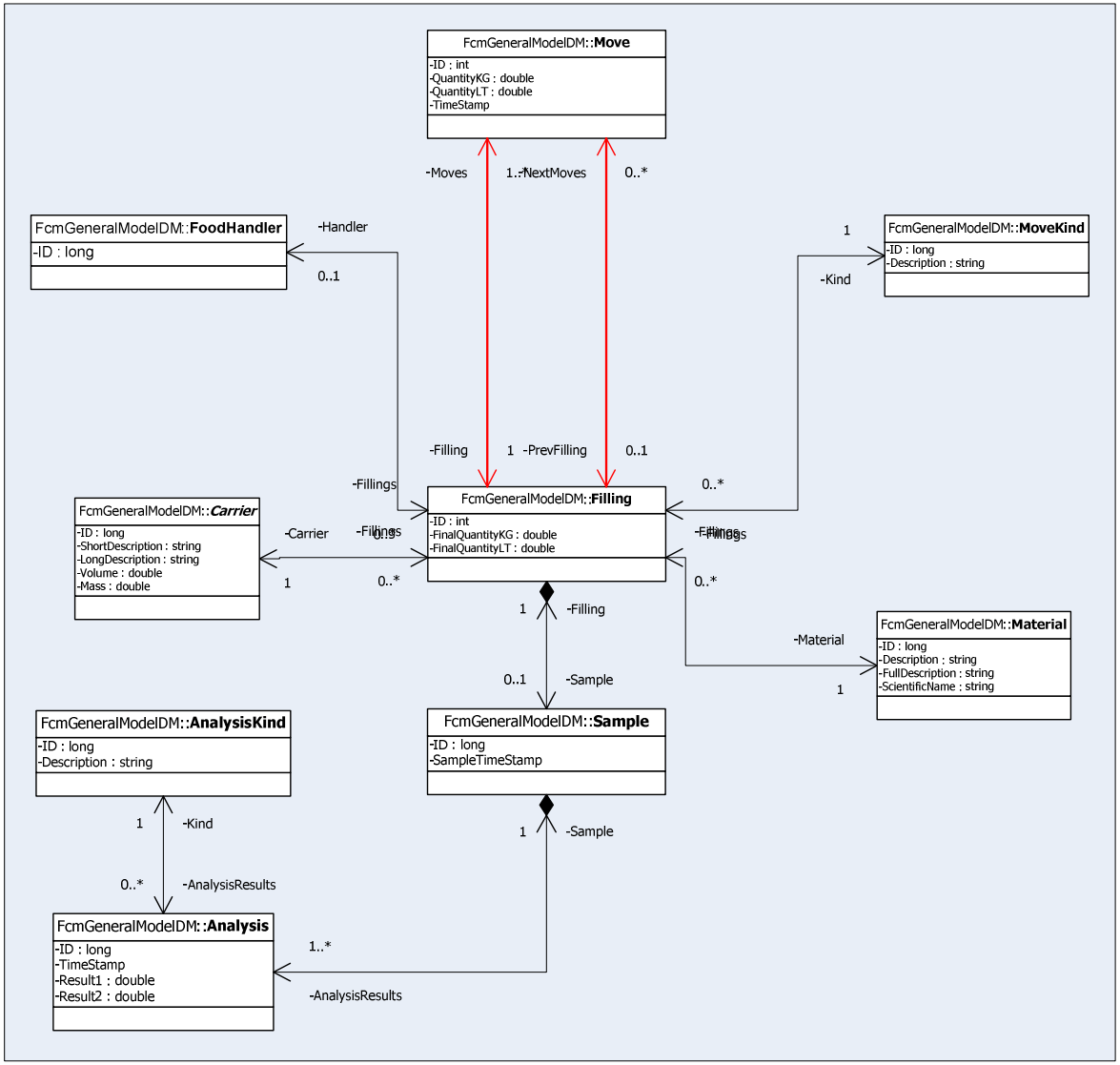
0..*
-Dicergences

Diagrams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-QuantityLT : double
-TimeStamp
-Moves
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-NextMoves
0..*
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-PrevFilling
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-Fillings
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0..1
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-TimeStamp
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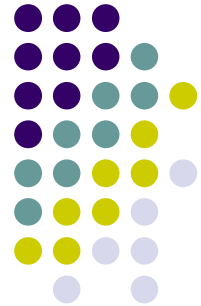
-AnalysisResults

Phases



1. **Identification and categorization of the required data for an effective traceability**
2. **Modeling of business processes of the Agribusiness Supply Chain**
3. **Modeling traceability data in Physical Markup Language (PML) format**

Phases

1. **Identification and categorization of the required data for an effective traceability**

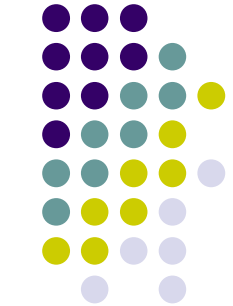
2. **Modeling of business processes of the Agribusiness Supply Chain**

3. **Modeling traceability data in Physical Markup Language (PML) format**

Model the extracted and transformed data, so as to allow their uniform management and utilization

Physical Markup Language (PML) is proposed to be the common “language” for describing physical objects / products in the supply chains

PML



- Physical Markup Language
  - XML-based technology
  - Intended to be a general, standard means for describing the physical world, by describing physical objects for use in remote monitoring and control of the physical environment
  - Proposed to model the traceability data that were identified and classified in the first phase of the framework and to provide information about various parameters / elements such as:
    - product properties
    - process properties
    - tracing properties
    - business entities properties
    - properties of means of production used on the product
    - data measurement properties

Phases

1. Identification and categorization of the required data for an effective traceability
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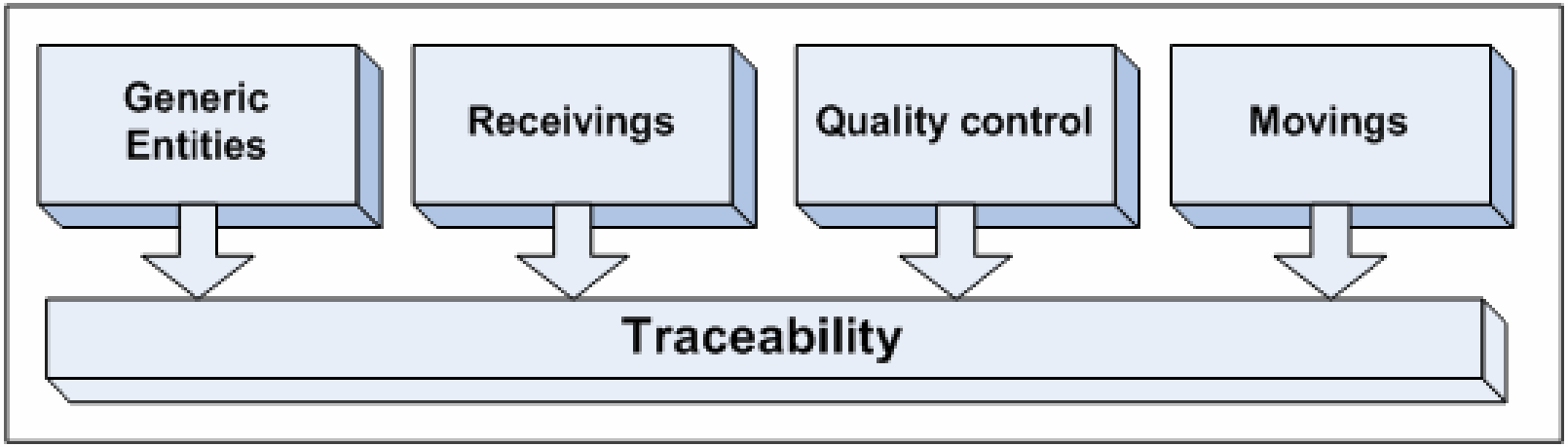
4. Traceability web platform development

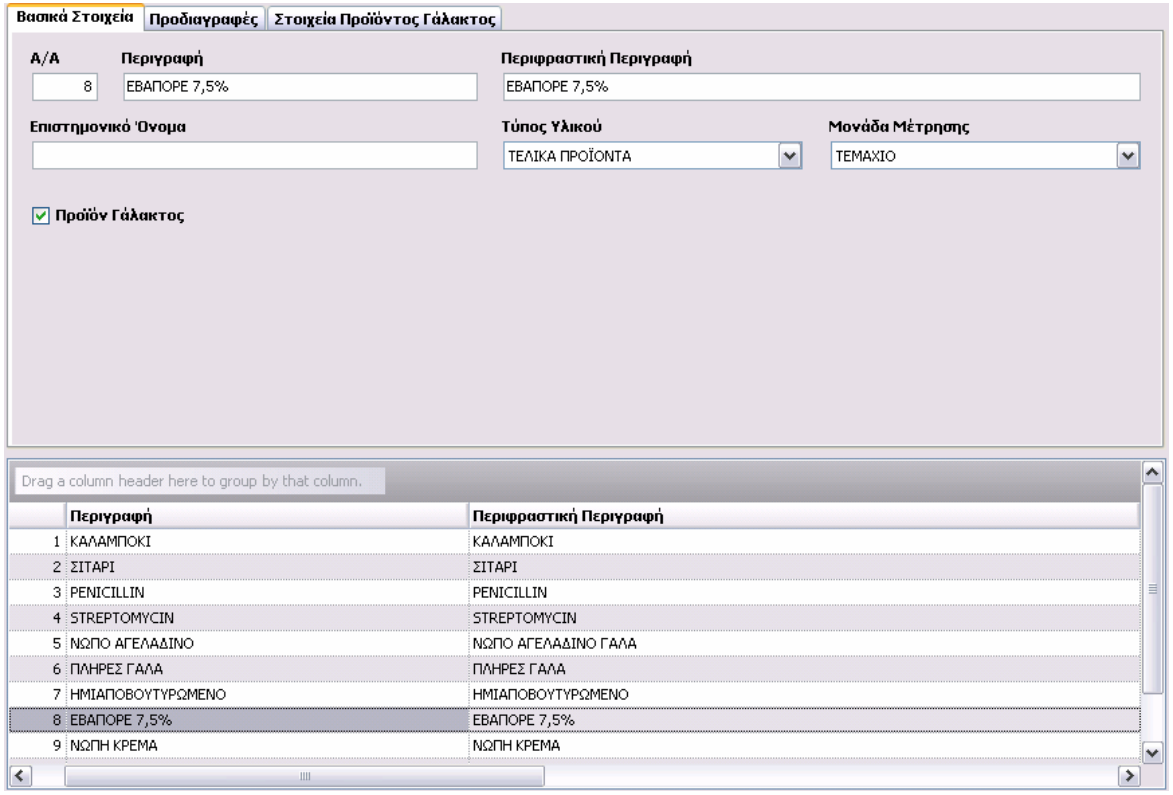
Web platform

- The final phase of the project was the design and development of the web-platform that supports traceability in the food sector
- Developed with Microsoft.NET environment, based on 3-tier architecture
- Consists of four (4) modules based on the proposed generic traceability framework



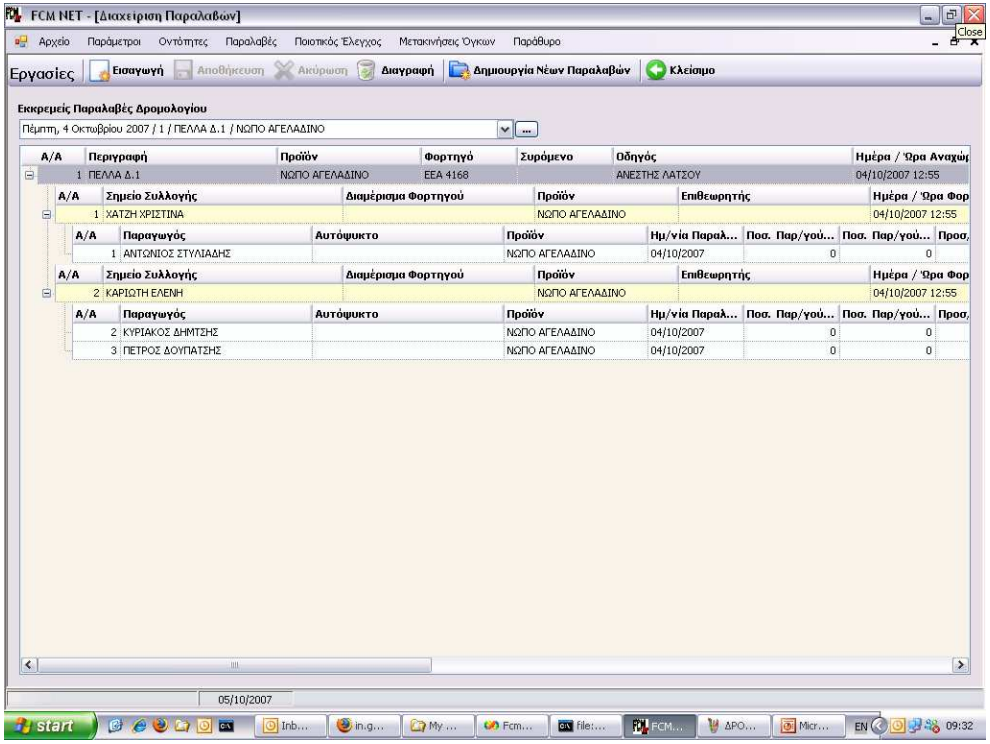
Web platform

- Generic entities: This is the main module of the application. It allows the management of the basic entities that were described in the proposed traceability model. With this module the final user can add a new entity, modify or delete an existed one, or present it in various views



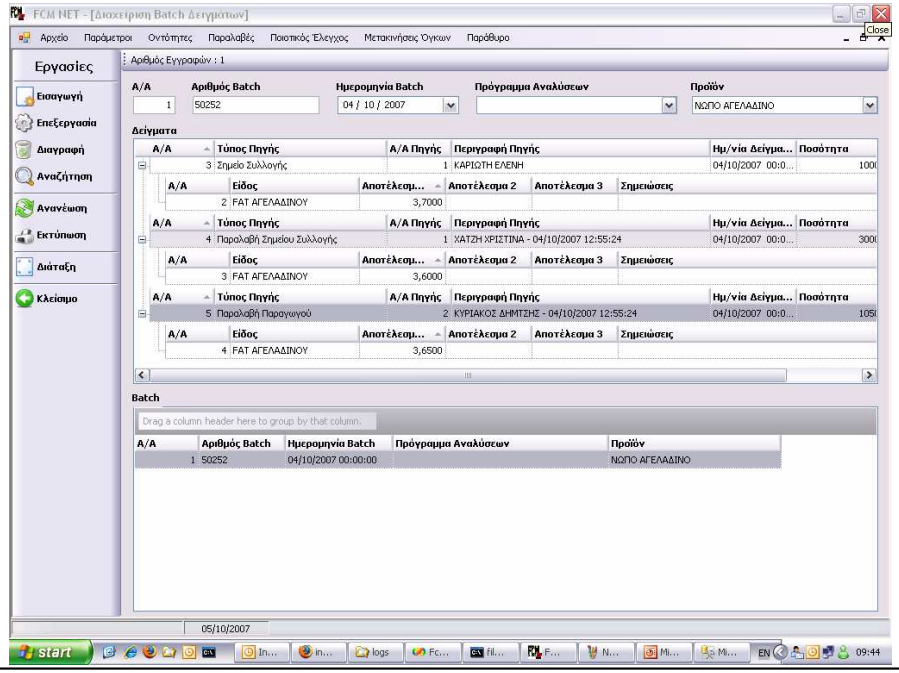
Web platform

- Receiving: The main objective of this module is to monitor the receiving process of the raw milk (first volume). What it follows are the steps of the: Collection of the first volume and its storing into a specialized container, Collection of the raw milk from the various collection points, Moving to central milk processing unit

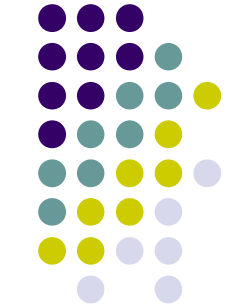


Web platform

- Quality control: This module allows the qualitative identification of a specific quantity of products in every stage of their processing. It provides the following capabilities: Management of the entities that refer with the quality control, such as the findings / results of quality analysis process, Management of the samples that are taken from specific quantities of the products, Management of the results from the samples' analysis



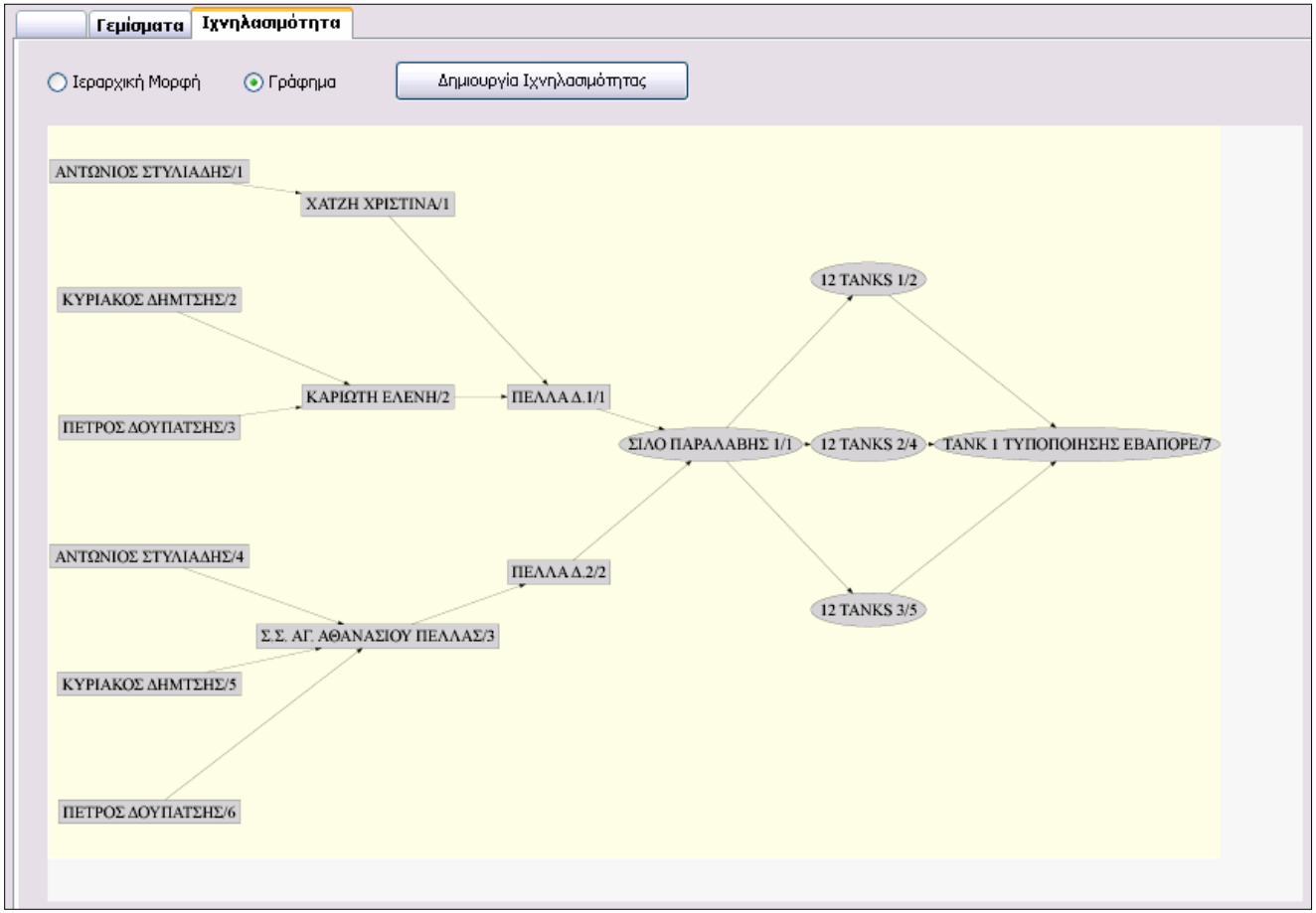
Web platform



- Moving of volumes: This module allows the examination of milk products inside the process unit

Web platform

- Traceability module: utilizes data of the previous modules in order to present backwards traceability of the final milk product



Conclusions

- An efficient traceability system must follow some rules that define which data must be gathered and stored in each stage of the supply chain
- Standardization of the gathered data achieve this
- The data utilized in the model already exist in databases that support HACCP and ISO standards, while data communication tools (RFID, EPC) are based in EAN-UCC standards
- By establishing and modeling these basic concepts we facilitate the development of systems and applications that support traceability in the food supply chain
- The proposed reference model is the base for the development of a web application for traceability management for liquid food

Conclusions (cont.)

- The proposed web platform will be able to support efficiently food traceability by monitoring and administering the data gathered and recorded in a central database
- This application main feature is the simplicity in use and the ability of communicating information through commonly accessible means such as the Internet, e-mail, and cell phones
- This makes it particularly easy to use, even when it comes to the base of the supply chains