



An updated generic architecture describing compliance in Agri-Food Supply Chains

(D1.2.3)

J.W. Kruize, R.M. Robbmond and T. Verwaart

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In this report a generic architecture is presented comprising an inventory of the most important actors, roles, processes and information that are relevant in the processes of standardisation, certification and compliance in Agri-Food Supply Chains. This architecture becomes part of an architectural framework. The architectural framework aims to reduce the paper-based administration by improving digitalisation of compliance processes and to enable a more efficient and effective data exchange in the field of compliance.

Key words: Compliance, Agri-Food Supply Chains, Data Exchange, Open Information Architecture

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Contents

	Summary	5
1	Introduction	6
	1.1 Context	6
	1.2 Aim	6
	1.3 Scope	7
	1.4 Overview of work	7
2	Approach	8
3	The Generic Architecture for compliance in Agri-Food Supply Chains	9
	3.1 The roles related to compliance processes	9
	3.2 Overview of compliance processes	10
	3.2.1 Processes that provide information	10
	3.2.2 Compliance overview	10
	3.2.3 Logistics overview	11
	3.3 Set standards and norms	12
	3.4 Provide resource information	13
	3.5 Prove certification compliance	14
	3.6 Audit compliance to standard	15
	3.7 Issue certificate	16
	3.8 Negotiate contract	17
	3.9 Prove product compliance	18
	3.10 Track & trace products	19
	3.11 Quality Control	20
4	Conclusions	21

Summary

Compliance programmes in Agri-Food Supply Chains are important to ensure food safety and sustainability of agricultural production. However, the administration within compliance programmes is time consuming and mostly paper-based. Hence, the merits of digitalisation of information are not fully exploited. Therefore, within the FarmDigital project an architectural framework is in development that aims to reduce the paper-based administration by improving digitalisation of compliance processes and to enable a more efficient and effective data exchange in the field of compliance. This architectural framework includes standardised messages, a guideline for implementing these standardised messages in software applications and a generic architecture comprising an inventory of the most important actors, roles, processes and information that are relevant in the processes of standardisation, certification and compliance in Agri-Food Supply Chains. This generic architecture is presented in this deliverable.

This generic architecture is used to describe 'as-is' architectures of the use cases for potatoes, grapes, and melons. With the insights gained from these use cases the architecture was updated in the current version. This version of the generic architecture forms the basis for an architectural framework that will be presented in a following deliverable.

1 Introduction

1.1 Context

Farmers in (international) Agri-Food Supply Chains participate in food safety and sustainability compliance programmes. These programmes require farmers to share information about their farm, buildings, practices and used inputs. In some countries the collection and sharing of this information is supported by (administrative) software systems to monitor and safeguard compliance regarding sustainability and food safety. In other countries such software systems are not used to support administrative processes and the sharing of information is carried out manually. Still, even in countries in which software systems are prevalent, a significant part of the administration is paper-based and the merits of digitalisation of information are not fully exploited.

This current situation is suboptimal, because it leads to unnecessary efforts for farmers and their customers within Agri-Food Supply Chains in terms of time and financial costs. In the processes of registering and sharing compliance-related information, activities cost more time than necessary and often certain information has to be gathered and shared multiple times for different purposes. Additionally, there are farmers in developing countries who cannot participate in certain agri-food supply chains as they do not meet specific administrative requirements.

Following this observation, the FarmDigital programme contributes to these problems with an Open Information Architecture¹ that enables a more efficient and effective data exchange in the field of compliance within Agri-Food Supply Chains. The main deliverables of this programme are an information model for compliance, a prototype software implementation and analyses of business models and governance issues. The resulting Open Information Architecture will be used to guide the development of a prototype software platform, which will support farmers in their compliance registration and facilitate compliance-related data exchange.

This deliverable is part of the FarmDigital Work Package 1 and presents an updated architectural framework, based on use cases.

1.2 Aim

The FarmDigital programme aims to contribute an Open Information Architecture that enables a more efficient and effective data exchange in the field of compliance within Agri-Food Supply Chains. As part of this objective this deliverable presents a generic architecture for compliance in Agri-Food Supply Chains. The generic architecture describes actors, processes and information exchange related to compliance in agri-food supply chains that should provide insight into this matter.

¹ An open information architecture is an abstract description of an IT architecture that allows information (messages) to flow easily between different software systems. It describes the information exchange across more or less independent software systems on the syntactical and technical levels, against common background knowledge of the business processes to be supported. In the FarmDigital Deliverable D1.5.1 more information regarding the open information architecture is provided.

1.3 Scope

This research focuses on the exchange of compliance information between Agri-Food Supply Chain Actors and in particular on the exchange of data between farmers and their customers. Based on the description of the melon, grape and potato uses cases, an earlier version of the generic architecture for compliance in Agri-Food Supply Chains is adapted. The new version of the generic architecture is presented in this deliverable.

1.4 Overview of work

This report is a deliverable of Work Package 1 of the FarmDigital Project (Deliverable: D1.2.3). In Figure 1 an overview of the work and deliverables is presented. As described in this figure, we have completed a preliminary architecture for compliance in Agri-Food Supply Chains (D1.2.1). This deliverable is used to develop D1.2.2 in which we formulate first architectural recommendations for a software prototype based on functional requirements. The architecture developed in these deliverables is updated based on use-cases describing compliance in potato, melon and grape supply chains. In this deliverable D1.2.3 an updated generic architecture is presented. More details about the approach realising this deliverable can be found in Section 2. The final deliverable (D1.2.5) will summarise the earlier deliverables and form an architectural framework. In this framework the architecture is presented including standardised messages, an information model and guideline for implementing standardised messages.

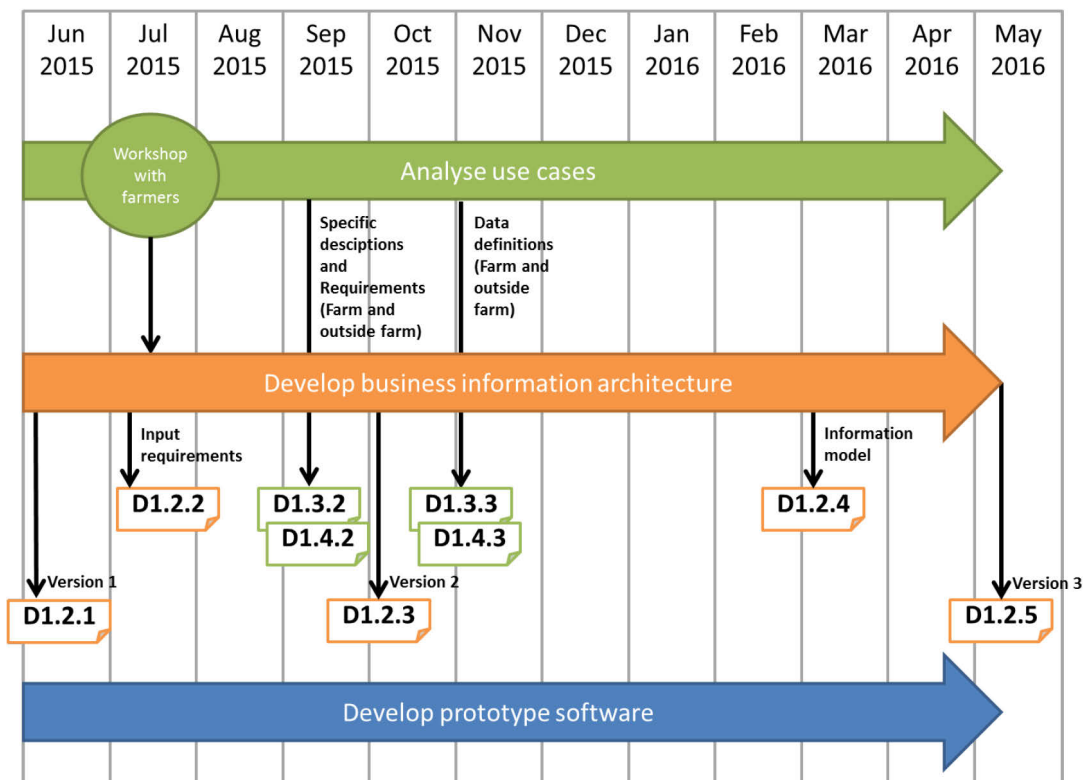


Figure 1 Overview of deliverables that lead to the Business Information Architecture regarding compliance (D1.2.5)

2 Approach

This chapter describes the approach to formulate the generic architecture for compliance in Agri-Food Supply Chains. The generic architecture has been developed in three steps.

First, a version of the architecture was based on desk research and information provided by stakeholders (in documents and in meetings). This was represented as an Archimate model in the Archi tool. The first design was presented for feedback to an expert committee. Based on this work a first version of the architectural framework was presented in D1.2.1.

Second, based on this design, recommendations for a prototype platform were drafted based on semi-structured interviews with stakeholders in the project consortium (AgriPlace, certification bodies and supply chain actors). That work extended the current architectural model with more detailed descriptions of data, services and infrastructural aspects.

Third, this generic architecture was used to describe 'as-is' architectures of the use cases for potatoes, grapes, and melons. These use case descriptions were based on workshops with farmers and semi-structured interviews with other supply chain actors. This step resulted in the 'as-is' description of:

- The specific actors and their roles in the specification of norms and requirements to products, processes, record keeping, and data exchange
- Business processes and current bottlenecks in record keeping, data exchange, and compliance reporting
- Data exchanged and services delivered with respect to compliance
- Current infrastructure to support record keeping, data exchange, service delivery, and compliance reporting

On the basis of these use case descriptions the presented general architectural framework for compliance was elaborated. This general architecture framework was validated in a workshop session with stakeholders from the project consortium.

3 The Generic Architecture for compliance in Agri-Food Supply Chains

This chapter explores the different dimensions of compliance at farm level and presents a revised architectural framework. The framework comprises an inventory of the most important actors, roles, processes and information that are relevant in the processes of standardisation, certification and compliance in the current situation. The chosen definition of compliance according to Oxford Dictionaries is:

'The action or fact of complying with a wish or command'²

In agri-food supply chains this wish or command can be requested and complied to by different actors performing various roles. To provide content to this definition, firstly business actors and roles are identified.

3.1 The roles related to compliance processes

This section provides the roles (in the diagrams labelled with a cylinder in the upper right corner, see Figure 2) related to compliance processes. Furthermore, actors participating in the FarmDigital Project (in the figures labelled with a stick man in the upper right corner) are linked to roles that deal with compliance, see Figure 2.

The supply chain partners consist of Farmers, Retail, Contractors, Farm Assurers, Farmers Organisations, Farm Input Suppliers and Traders. Each supply chain partner can take up the role of supplier (of products and information) and as customer (purchasing products and information). The farmers are represented by Kees Kamer, Thijs Geerse, and Douwe Monsma. The traders by OTC, Agrico, Levarht, Gourmet BV, Staay Food Group. Retail is represented by Jumbo. For the role Contractor, Farm Input Provider, Farmers Organisations and Farm Assurer no Actors are present in the FarmDigital project. Agrico provides both a trader's role and an input supplier's role (for seeds potatoes).

The Regulatory authorities include the local Ministry of Agriculture and Supervisory Agencies which in this project are represented by NVWA and RVO. The Supervisory Agencies can also take on the role of Audit Organisation, hence the aggregation relation in the diagram.

The Audit Organisations are represented by ISACert NAK AGRO, NSF, Control Union Certifications and SKAL. SKAL is a specific example of an organisation that, besides taking the role of audit organisation, takes on the role of an organic certification body that defines standards.

Other standardisation organisations are GS1 and GLOBALG.A.P, which are in the business of private standardisation. Usually these global standardisation organisations have local standardisation committees that specify the general standard to local markets. The Standardisation organisation AgroConnect and UNcefact are not present in this figure as they focus on developing and maintaining data standards and not (yet) on compliance standards.

² <http://www.oxforddictionaries.com/definition/english/compliance>

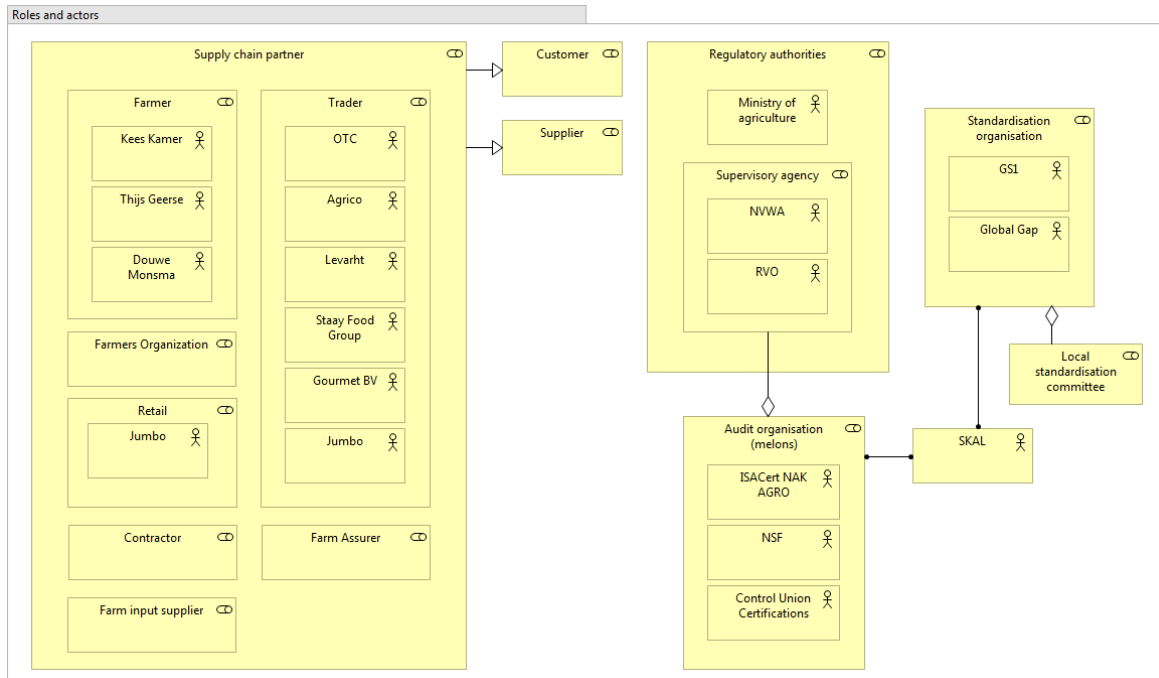


Figure 2 Roles and actors in compliance activities

3.2 Overview of compliance processes

Figure 3 gives an overview of main processes and information flows related to compliance. In this figure there are two groups that contain processes that have been identified (logistics overview and compliance overview) and processes that provide input to the groups of processes. We elaborate on all these processes in the next sections.

3.2.1 Processes that provide information

There are three groups of processes described that provide information; 'negotiate contract', 'Set standards and norms' and 'Provide resource information'.

In 'negotiate contract', the processes are included that are related to the contract negotiations between the different actors in the supply chain. The processes result in a contract that describes norms and accounting rules for 'prove product compliance', 'quality control', and 'track & trace products' that are end-customer specific.

'Set standards and norms' also provides input in the form of norms and accounting rules, but focuses on the primary production of agricultural produce. In this case the norms and accounting rules are specific for a certain certification standard the actors must comply to.

'Provide resource information' are the processes in which supply chain partners, prior to production on the farm (agricultural inputs), supply information about it to the other actors.

3.2.2 Compliance overview

The processes in the compliance overview group are related to certification. 'Prove certification compliance' is a process in which actors that apply for certification gather the needed compliance documentation. This 'Prove certification compliance' process can be performed by a farmer, farm assurer or farmers' organisation. Subsequently this compliance documentation serves as input for the process 'Audit compliance to standard' in which the audit organisation checks compliance resulting in an audit report. If positive, this audit report leads to a certificate in the 'Issue certificate' process.

3.2.3 Logistics overview

The logistics overview contains process groups that relate to production, transport, intermediate(s) and buying. The processes groups can be performed by farmers, farmers' organisations, processors and traders.

In 'Prove product compliance' actors prove their compliance to norms and accounting rules regarding product deliveries. Inputs are the certificate, norms and accounting rules, resource information and the contract. The norms and rules are set by customers and defined in a contract. To prove product compliance sometimes proof of certification of the farmer and resource information of other supply chain actors is needed.

In 'Track and trace products' the product information from the process 'Prove product compliance' is linked to the relevant products as they travel through the supply chain. These processes ensure the connection of the physical product with the correct product information. Implementation measures for product identification may be physical such as equipping the products with barcodes for identification during packaging or they may involve information management activities like product information aggregation and provision. Its output is product information that can be linked to product deliveries so that in the process 'Quality control' customers of a product can verify the product's compliance to the required norms that are drawn up in the contract.

In the case of subcontracting or other dependencies on third party suppliers (e.g. contractors), resource information from the process 'Provide resource information' is an input for the processes 'Prove compliance certification' and 'Prove product compliance'.

The remainder of this chapter presents specific views with detailed descriptions of each of the above introduced processes.

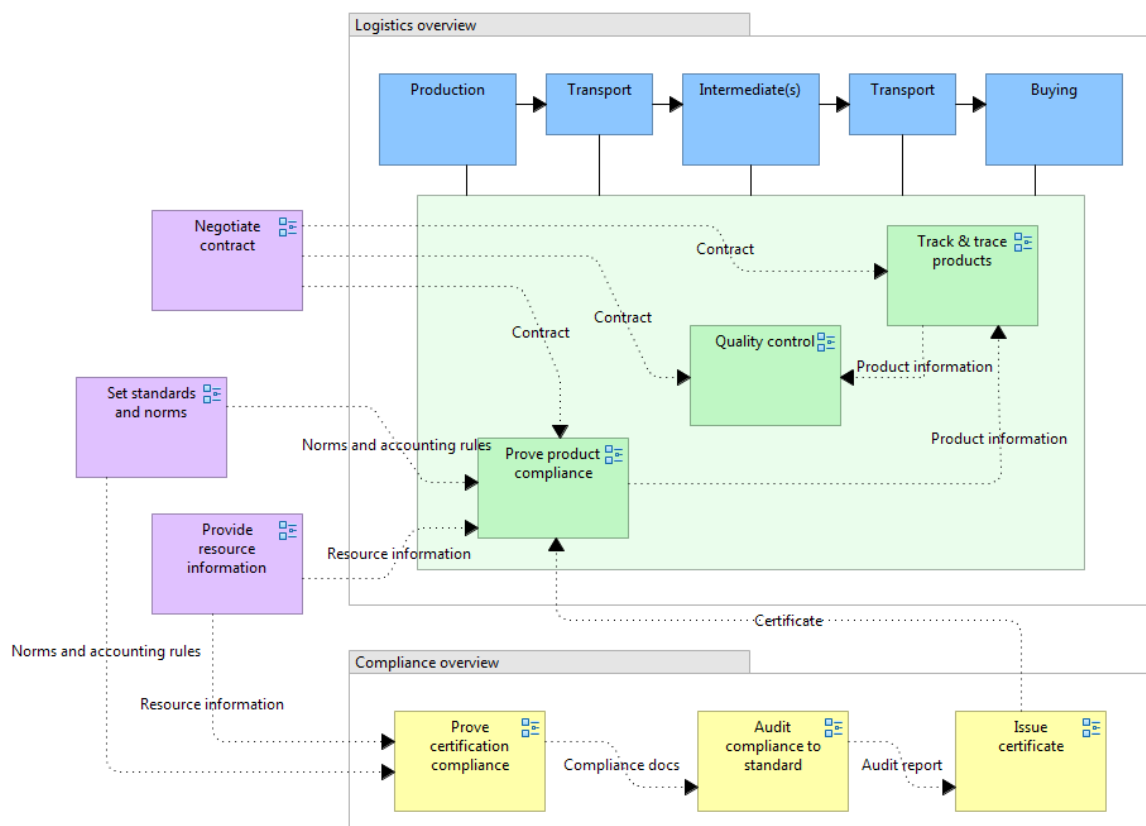


Figure 3 Overview of main processes and information flows

3.3 Set standards and norms

The view 'Set Standard and Norms' comprises the processes 'Set Norms' and 'Set Standard' as can be seen in Figure 4.

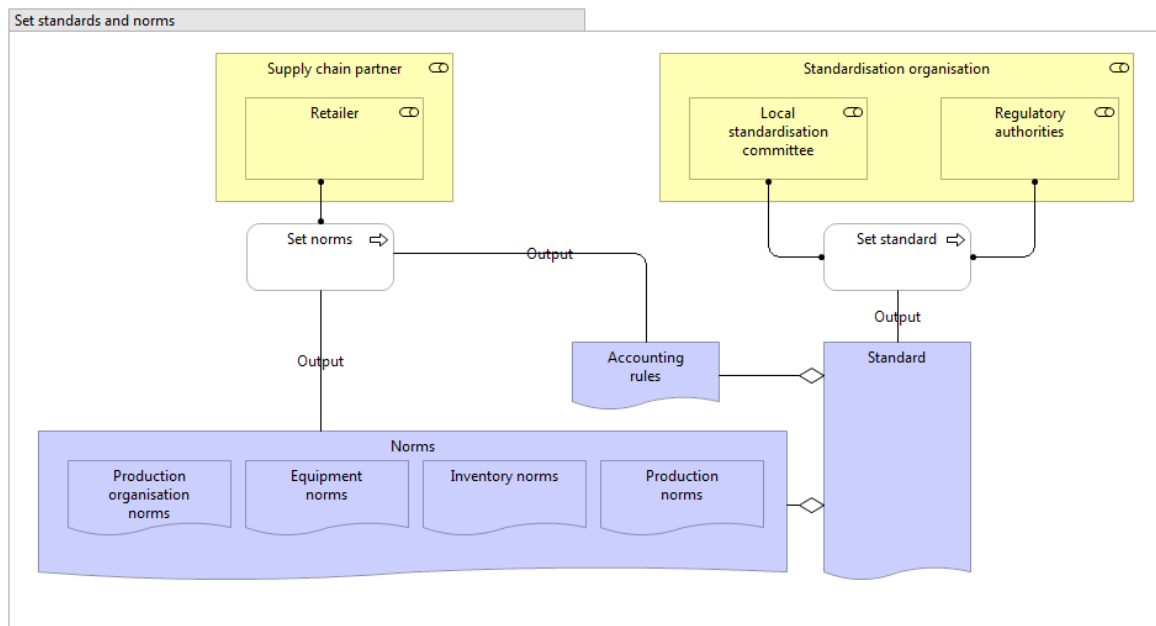


Figure 4 The roles, processes and information associated with 'Set standards and norms'

Standards are sets of norms and accounting rules. The accounting rules define the data and its units to be recorded in order to prove compliance, for instance to deliver tracking and tracing information with the product or to deliver information about the conditions under which the product was produced, handled and stored. Norms may relate to an acceptable quantity of the measured unit. These can be norms regarding the production organisation itself, the equipment used, the organisation's inventory, and the production. The definite standards that farmers must comply with are set by the local committees of standardisation organisations (e.g. by setting the norms) or the local regulatory authorities for legal standards, but the latter standards are considered to be out of scope for this project. Setting the standard effectively means defining the accounting rules and norms which a particular standard comprises. Retailers may require compliance with specific standards, but sometimes they require producers to comply with norms which they set themselves and which are not part of a standard (e.g. residue levels on a product). The process of defining these norms is covered by 'Set norms'. Setting standards and norms consists of processes that are internal to the organisations that make the definitions, but the resulting norms and standards are output for a wider audience.

3.4 Provide resource information

Figure 5 visualises the process 'Provide resource information' in which supply chain partners supply other supply chain partners with resource information.

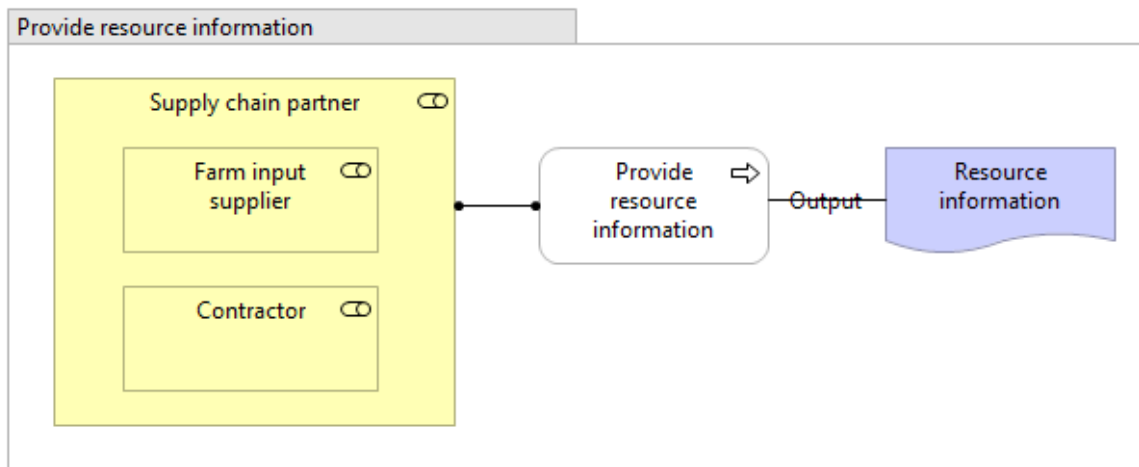


Figure 5 Roles, processes and information associated with 'Provide resource information'

Certain information pieces that are used in the process of proving compliance may depend on information that originates from supply chain partners outside the farm. This may occur when it concerns specific information about certain resources, for example in the case of specific crop-protection information. This kind of information will have to be provided by the supplier of the resources, if this information is not retrievable at the farm.

3.5 Prove certification compliance

The process 'Prove certification compliance' is the process in which applicants for certification prove their compliance to the standard's norms and accounting rules and record it in the compliance documentation, as depicted in Figure 6.

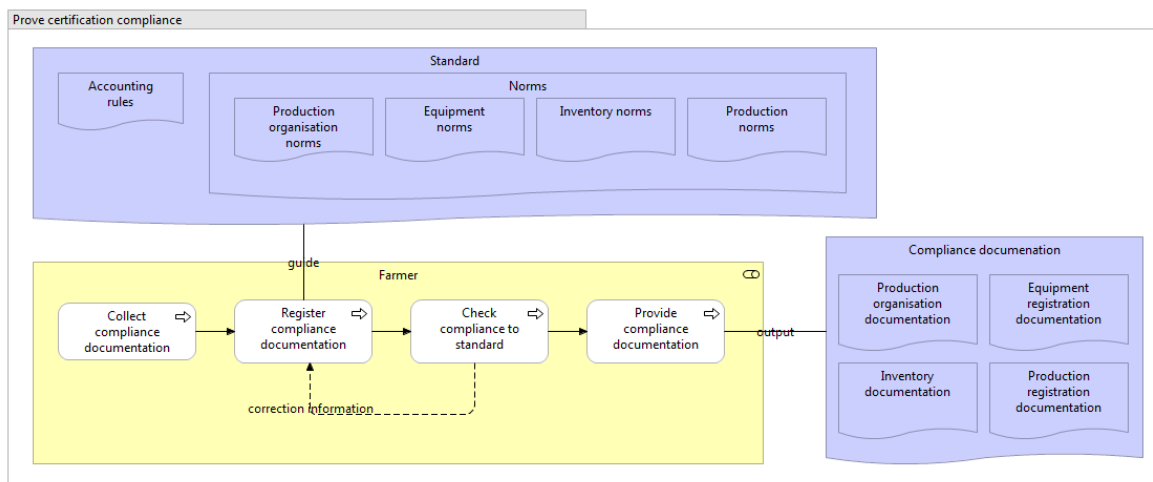


Figure 6 The roles, processes and information associated with 'Prove compliance (certification)'

Private standards are not legally mandatory but often are required to be able to produce for and deliver to certain customers. Proving compliance with the requested norms of the standard that is set by the standard setting organisation is a process that contains several steps. It starts with the process 'Collect compliance documentation' in which the farmer, farm assurer or farmer organisation collects all documents that are needed. Compliance information is a collection of information that may be related to or originate in many different business functions on the farm. The second process is 'Register compliance documentation'. In the registration step this information is combined according to the requirements of the requested standard, the so-called accounting rules. Accordingly, a check is carried out to verify if the registered and gathered information complies to the set norms and rules. In this process 'Check compliance to standard', questionnaires are filled in and documents gathered to prove compliance to the norms. If this step gives rise to deviations then corrections are required. The correction instructions flow back to the business function where the corrective actions are carried out. This can mean that certain business processes are changed within the organisation in order to comply to a certain standard. In other cases a certain farm or farm product might not fulfil the compliance criteria at that moment. If all corrections are accounted for, then the next step is the process 'Provide compliance documentation', in which the compliance documentation provides the final output of the process.

3.6 Audit compliance to standard

The process 'Audit compliance to standard' is about formally checking the compliance documentation with the norms and standards by an audit organisation. The details of the process are presented in Figure 7. This process depicts a Farmer taking the initiative to plan an audit for the first time. After a first audit the Audit Organisation normally takes initiative to schedule an audit that follows up the previous one.

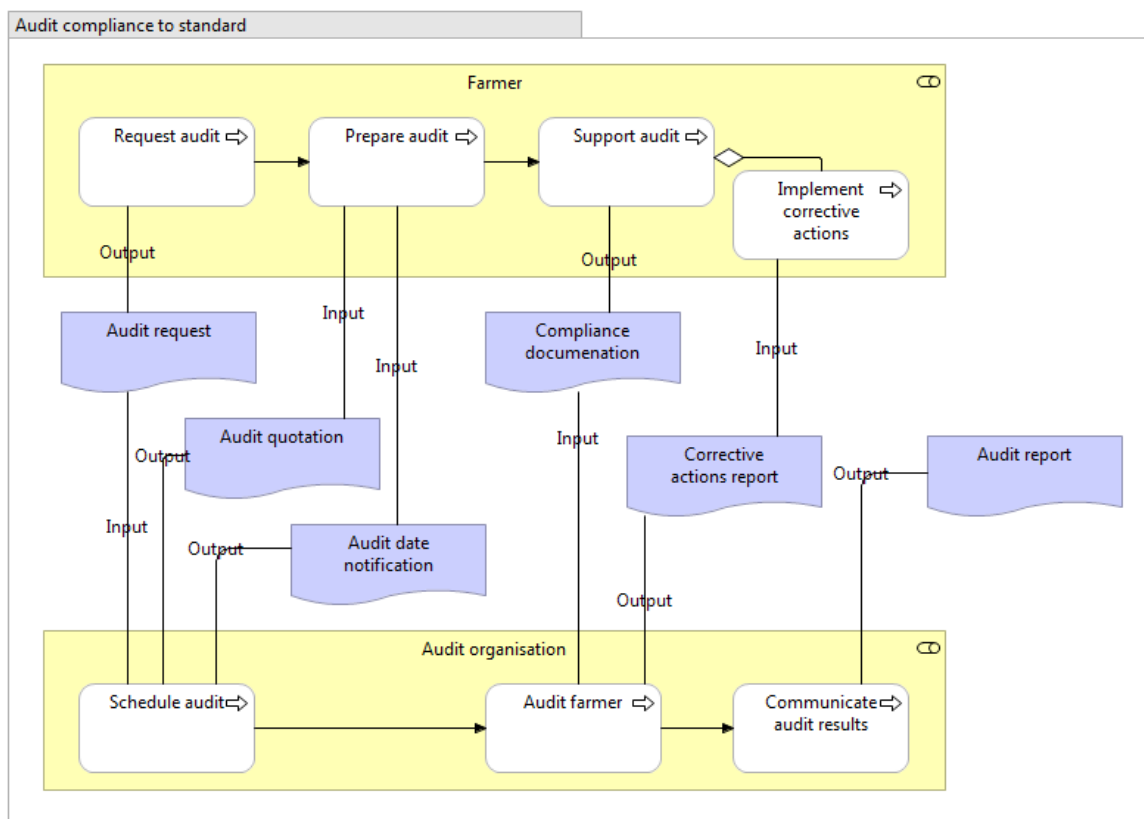


Figure 7 The roles, processes and information associated with 'Audit compliance to standard'

Audit organisations can be public audit organisations that check compliance with legal norms and private audit organisations that assess compliance with different norms and standards. Certifications like GLOBALG.A.P. are audited by private audit organisations or certification bodies. For an audit with a private audit organisation the process starts with a 'Request audit' process that is sent to the audit organisation. Then an audit is scheduled and an 'audit quotation' is sent to the farmer. At the audit date the farmer is audited, during which it is checked if the farmer's compliance documentation complies with the standard. Based on this audit, a corrective report can be written. After this step, the audit report is communicated with the farmer. Based on this, corrective actions report the farmer is able to implement these corrections. After this the farmer can be audited additionally. The outcome of the process is an audit report that the audit organisation provides to the certificate issuing organisation.

3.7 Issue certificate

In the process 'Issue certificate', the standard setting organisation issues the certificate to applicants based on the audit report as visualised in Figure 8.

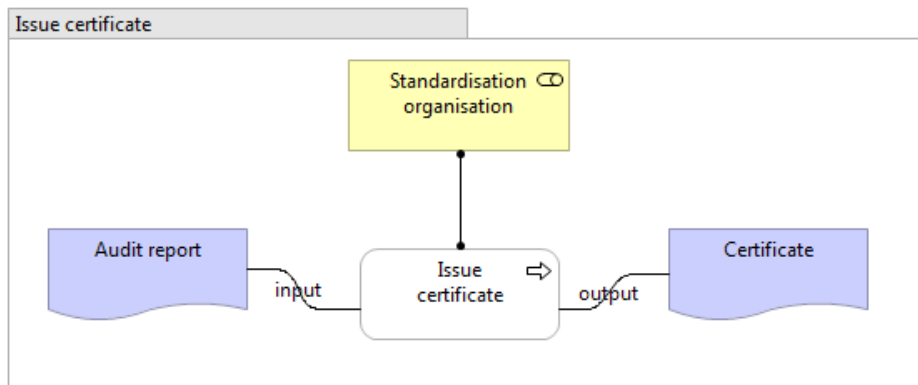


Figure 8 The roles, processes and information associated with 'Issue certificate'

Certificates can be issued for processes and for product lots. In the case of process certification, particular sets of processes are certified for particular farms, e.g., all processes involved in growing, storing and handling of a particular product type on the farm. A process certificate guarantees that the products delivered by the farm are produced according to a particular standard.

A certificate issued for a particular product lot, such as an export certificate, guarantees that the product lot satisfies particular conditions, e.g., that it is free of particular pests.

3.8 Negotiate contract

'Negotiate contract' is the process in which the agreements about product deliveries between customer and supplier are formalised in a contract. The details of this process can be found in Figure 9.

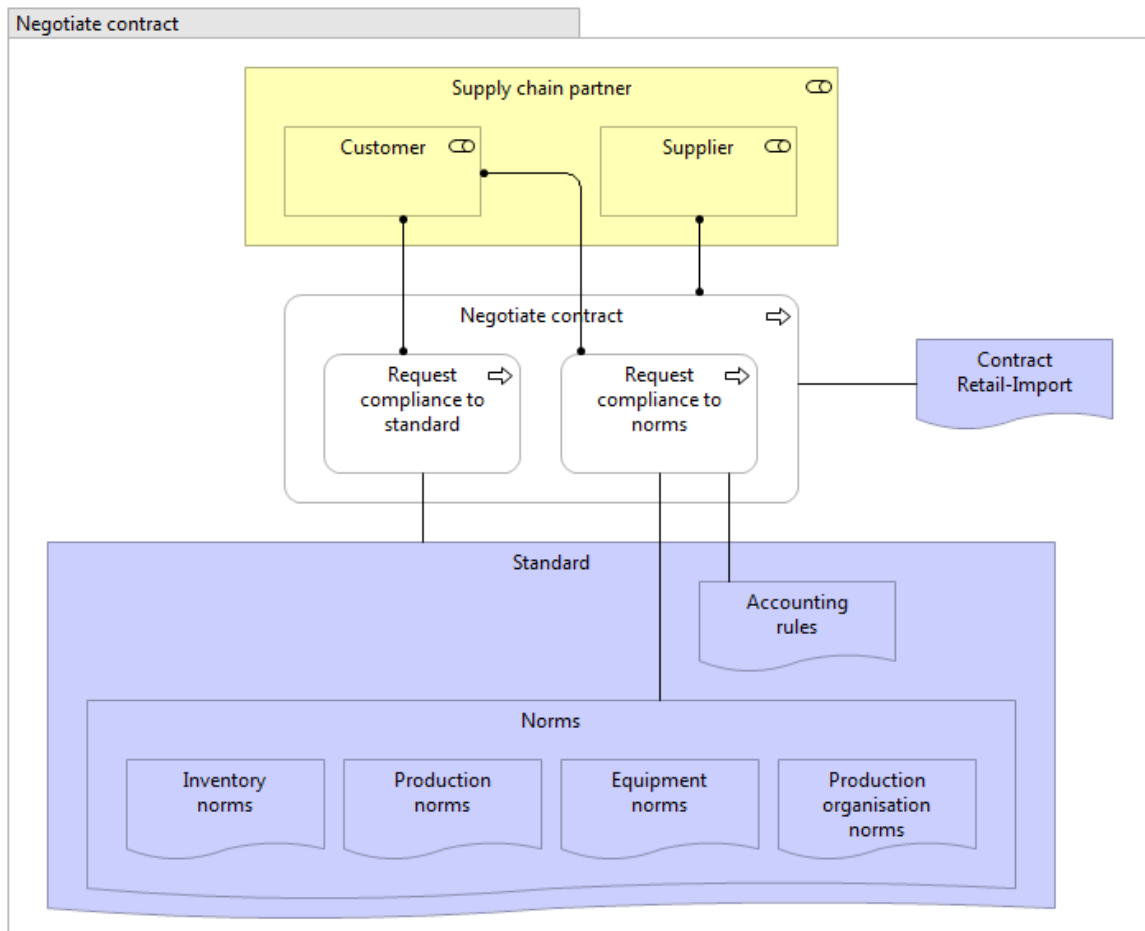


Figure 9 The roles, processes and information associated with 'Negotiate contract'

Customers can require the suppliers of products to comply with existing standards ('Request compliance to standards'), for example compliance to GLOBALG.A.P., and to comply with additional customer-specific requirements ('Request compliance to norms'), for example Retail-specific Maximum Residue Limit (MRL) norms. In the contract all compliance topics to which the customer and supplier agree that the product deliveries have to comply to, are formally recorded. Therefore, the requirements for the compliance information can be derived from it.

3.9 Prove product compliance

'Prove product compliance' is the process in which an information supplier provides product information (e.g. Farmers, Farmers Organisations). The details of the process are visualised in Figure 10.

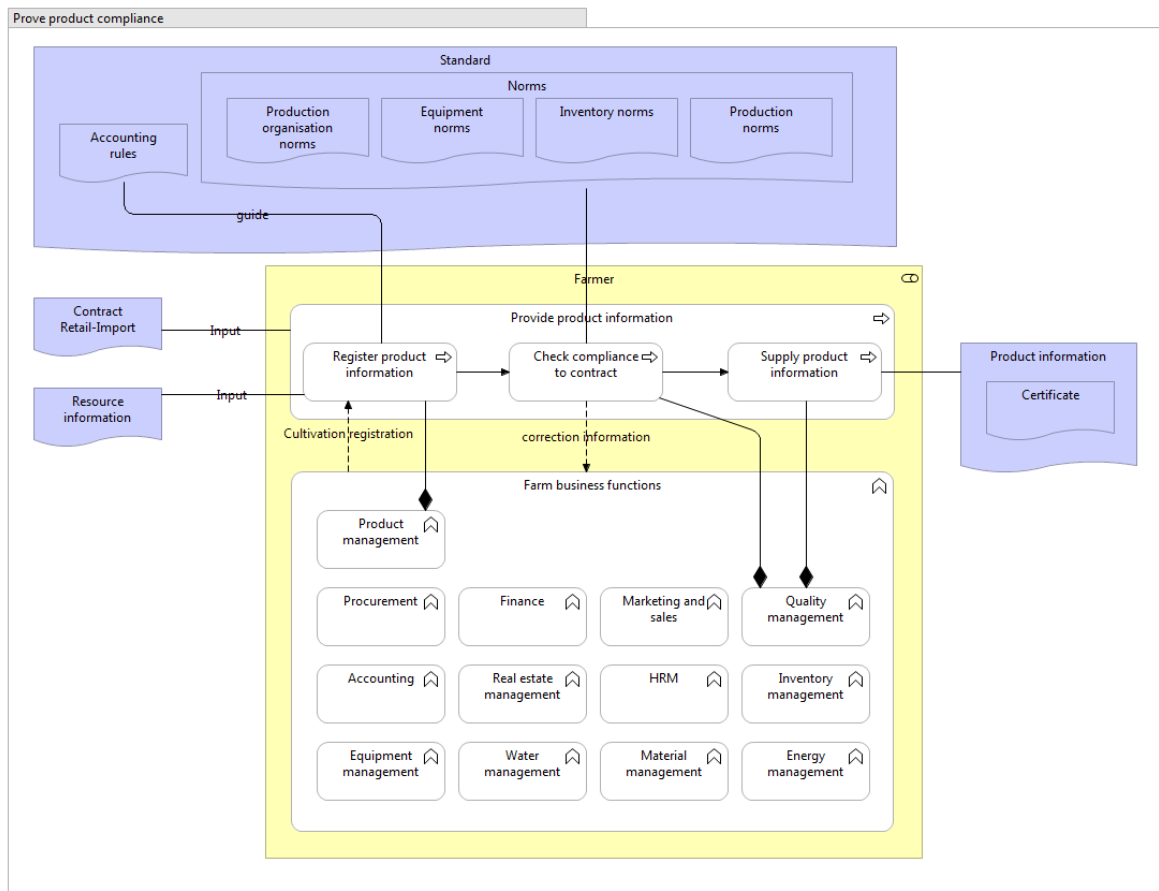


Figure 10 The roles, processes and information associated with 'Prove product compliance (product information)'

The main steps are 'Register product information', 'Check compliance to contract', and 'Supply product information'. The contract is an input for all these steps because it describes the requirements for the information. In the registration step the registration of cultivation information takes place, for example registering the crop protection activities. Resource information may be an input when third party suppliers play a role or when sub-contracting takes place in activities in which registration information is generated. After registering the information, it is checked against the requirements of the contract. If this does not comply with the standard, corrections can be made, the information on how to correct the deviations is provided to the appropriate person or department and corrections are applied. When complete and OK, the product information can be provided to the customer, including the required certificates, if relevant.

3.10 Track & trace products

In the process 'Track & trace products', the link between products and product information is guaranteed. A supplier (e.g. Farmer, Processor, Trader) provides products and its information. The Customer (e.g. Processor, Trader, Retailer) receives a shipment, the accompanied information and checks the compliance to the standard. More details are described in Figure 11.

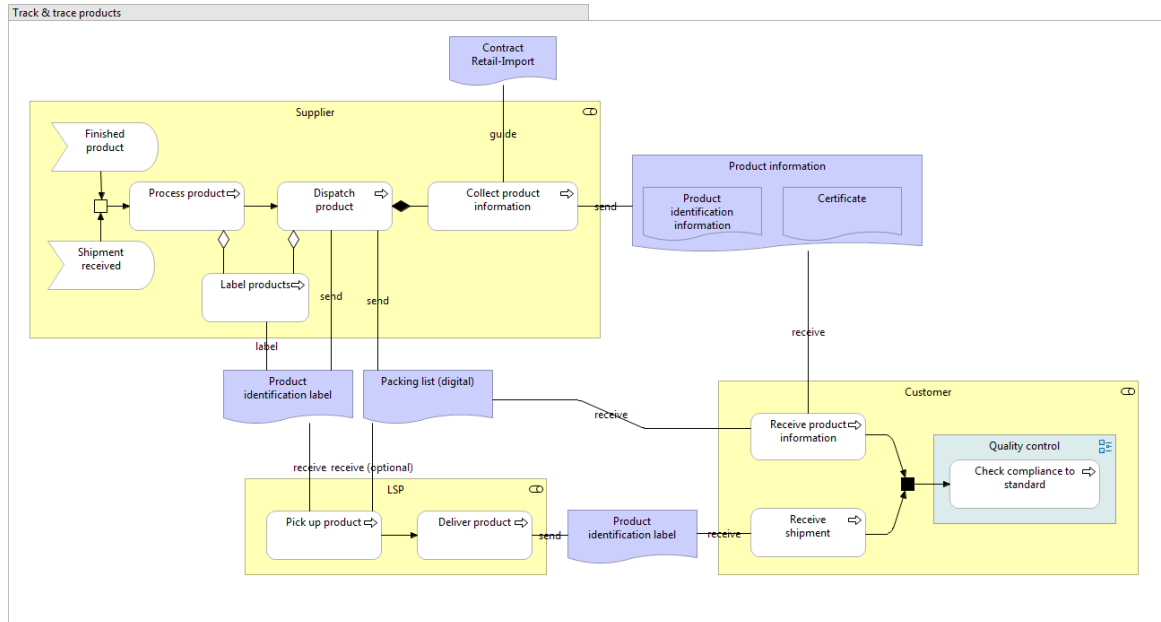


Figure 11 The roles, processes and information associated with 'Track & trace products'

Implementation measures for product identification may be physical like equipping the products with barcodes for identification during packaging or they may involve information management activities like product information aggregation and provision. The process starts with either a finished product when it involves primary production or a received shipment if it involves an intermediate supply chain partner. First step is to process (e.g. package or repackage the product), then the product is dispatched. During the processing or dispatching the product can be labelled. To label the product information might be required and sent to the customer. The customer is then able to evaluate the product information prior or after receiving the shipment. Next, the product's compliance to standards can be checked, which is a process of 'Quality Control'.

3.11 Quality Control

'Quality Control' is the process in which customers check if deliveries comply with the norms and certifications as agreed to in the contract. The details of the process are visualised in Figure 12.

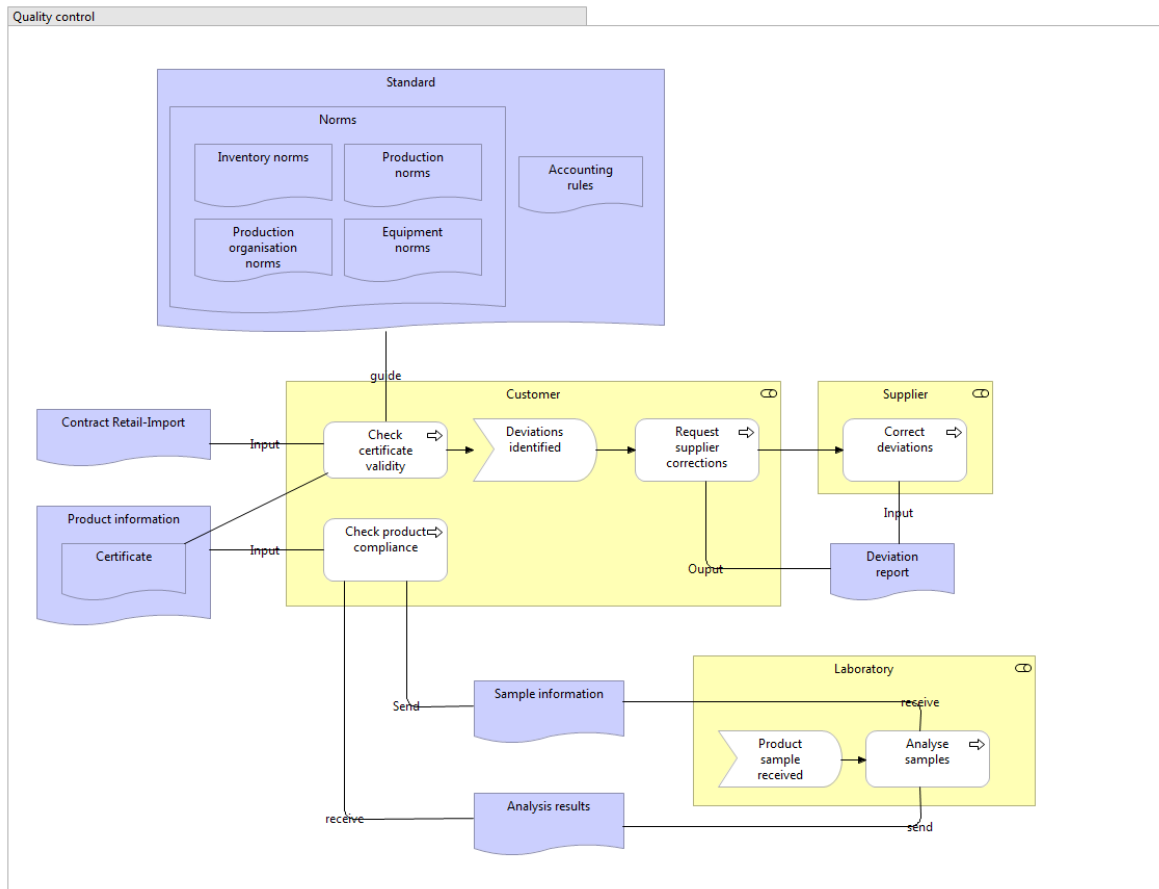


Figure 12 The roles, processes and information associated with 'Check compliance'

The contract and product information provided by the supplier are inputs for this process. The customer checks if the certificate is valid. Parallel to this, a sample can be taken to check the product compliance. For example, an MRL's test can be performed. If the deliveries comply, no further actions are taken. If deviations are identified that can be corrected, then the customer will send the deviation report to the supplier who is then expected to correct the deviations.

4 Conclusions

The FarmDigital programme contributes to an Open Information Architecture that enables a more efficient and effective data exchange in the field of compliance within Agri-Food Supply Chains. As part of this objective this deliverable presents a generic architecture describing compliance in Agri-Food Supply Chains.

This generic architecture provides insight into the most important actors, roles, processes and information which are relevant in the processes of standardisation, certification and compliance. This generic architecture is based on models describing the fresh potatoes, melons, and grapes use cases. This generic architecture provides more insight into compliance and will be used to develop a prototype platform supporting compliance processes.

Furthermore, this generic architecture will be used to develop an architectural framework. In this framework the generic architecture is presented including standardised messages, an information model and guideline for implementing standardised messages. With this architectural framework efficient data exchange for compliance in Agri-Food Supply Chains is stimulated.

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