Geo-Information Management for Agricultural High Value Product Supply Chains

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A major impediment to the development of agricultural production and the expansion of distribution and marketing is the organization and dissemination of information. Access to relevant information can aid farmers in improving their production and can help processors and distributors to expand their trade networks, bringing improved products to the consumer.

Significant changes on the agricultural products market concerning consumer health and product differentiation are requiring new business models. For differentiated high value, high quality products, the conventional spot market business model is replaced more and more by different relationship business models, where producers and buyers building up personal trade relations. These business models demand new means of communication, where close interaction between the supply chain partners is possible. Information technology plays therefore an increasingly important role in linking the members along a high quality product supply chain. Furthermore, the here presented communication and information management approach plays a vital role in fostering the co-learning and business evolution of a value chain. This is important in the light of dynamically changing preferences of consumers and market trends.

Product Tracking Example: The Coffee Product Track

The coffee product track runs from the field where coffee is grown to consumers all over the world. The main product tracking nodes through which coffee runs are:

- field (production)
- farm (harvesting and post harvest processing: de-pulping, washing, drying, cleaning)
- coffee cooperatives (further processing: sorting, quality check, peeling and others)
- exporters to importers (changing of ownership and transportation)
- roasters (roasting, blending, grinding)
- market
- consumer (general public or food industry)

Tracking product and processing data should help both to identify production quality and product characteristics (e.g. flavor) and to link this information to the end-point product through all levels of the product track.
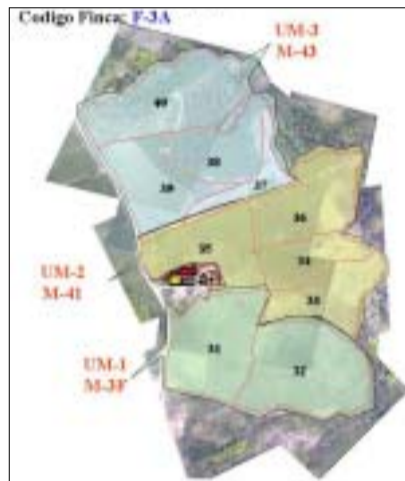

Figure 1: Geo-referenced farm map enables identification of management units
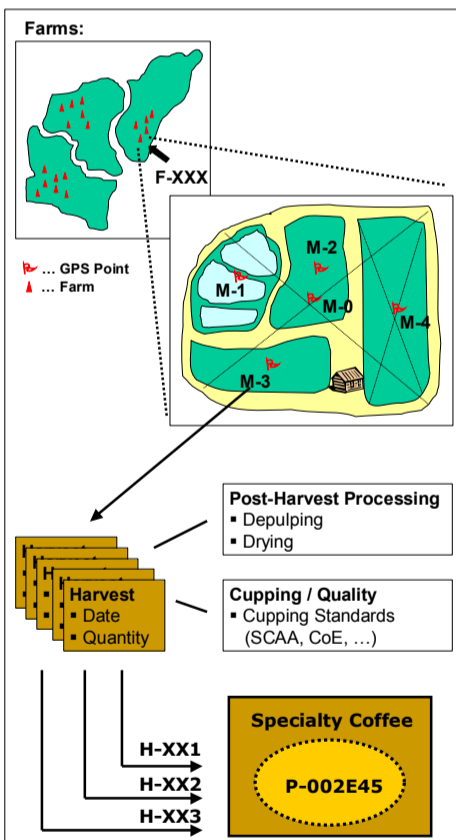
Tracking Code System

Figure 2: Basic code system enabling product tracking along the supply chain

Farm-Code:
[Example: **F-00B3A8**]
➤ Generated on farm registration (farm name, producer's name, contact information, location)
➤ Enables to link general farm information (e.g. images and farm maps) in database
Code users: All supply chain participants

Management-Unit-Code:
[Example: **M-0078F6**]
➤ Generated on management-unit registration in database.
➤ Enables to link site-information in database.
Code users: producers, coffee cooperations

Harvest-Code:
[Example: **H-0010B0**]
➤ Generated on harvest registration in database.
➤ Links harvest date and management-unit-code.
Code users: coffee cooperations, coffee quality laboratories, exporters, importers, roasters

Product-Code:
[Example: **P-00006F**]
➤ Generated from roaster on registering end-product in database.
➤ Links the different harvest-codes of one end-product.
Code users: roasters, traders, consumers

Content management and security system

The CinfO data access model (see figure 3) provides a highly flexible structure for managing the dynamic and sensitive content tailored to the user's demands. Every user is assigned to several use-cases depending on his/her role (data contribution and data demand) in the DAPA project.

The data access model is realized through a three level security scheme dividing the CinfO platform into a public, private and administration area.
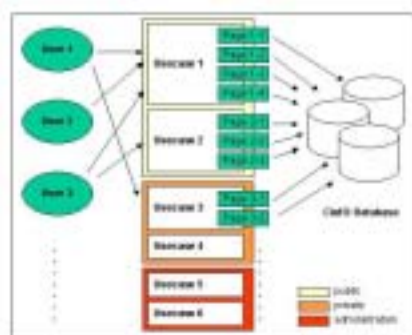

Figure 3: CinfO Data Access Model

Data Presentation

All information stored in the product tracking system is related to GIS data (geo-reference coordinates given as longitude and latitude). This feature enables interactive mapping of product and production data on digital maps on an online interface (Fig. 4 Section 2).

A special interface enables the consumer to receive coffee origin data (Fig. 4 Section 1). He/She may enter for example the product code shown on the coffee pack and receive a map showing all farms and all farm related information, where this coffee was produced (Fig. 4 Section 3).

Basic visual data analyses is also possible through this module. Data can be queried (selection of query items and input of threshold values) and visualized via this map module. The analyst can see certain trends in respect to e.g. coffee quality linked to spatial or environmental factors.

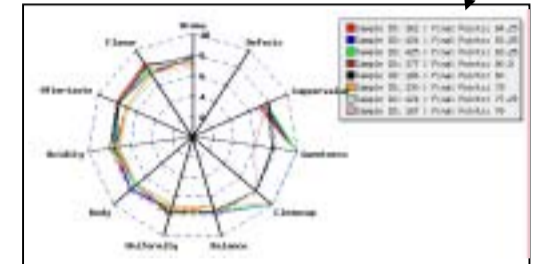

Figure 4: CinfO Online Map Interface

Fig. 5: Coffee Quality Module

Fig. 6: Exported CinfO Data can be used in Google-Earth®

Spatial Analyses and Data Export

By linking certain product characteristics (e.g. coffee quality) in real time to existing spatial models (altitude model, climate, political division) certain analyses will immediately discover specialty coffee production-niches

Any data stored in the central CinfO database is available as download-file in different formats: csv-file (comma seperated value, readable with any spreadsheet program), shape-file, Google-Earth® format (Fig. 6) and a special file format for Expector – a software program for statistical analyses.

Feedback Models

An intelligent feedback system provides the farmer with for example a quick overview over his productivity status. Automated processes doing complex data analyses (involving forecast models) producing easily understandable and powerful reports in different presentation. An example is shown in Figure 7: a farm map indicating the productivity status of different management units.

Linking the farmers in

Due to the fact that coffee producers in developing countries are almost never directly connected to information systems (e.g. internet), new ways of interchanging data between farmers and modern product supply chain information systems have to be found.

Newly designed and optimized human-computer interfaces will enable farmers to make use of portable computing devices such as PDAs. A field study was conducted to evaluate standard input controls (Fig. 8)

The key to all this system is to provide all its users with relevant and timely data. It is crucial to identify, what data has to be managed and how to transport this information most efficient along the supply chain.
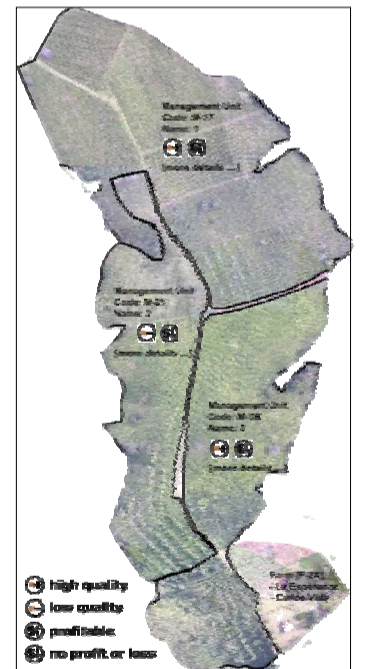

Figure 7: Aerial view image of farm management units and their rating in production and quality

Figure 8: Testing different PDA interfaces with farmers