Design of integrated database of smart coffee enterprise support system for coffee small medium enterprise

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Abstract. Coffee has great potential to improve the quality of life of farmers in Indonesia. In the business sector, demand for Indonesian coffee is suitable for the needs of both the local and the world market. However, the rising demand for world coffee and the high purchase prices have not been able to prosper farmers. Governance and trade procedure for the coffee industry, considering the simplification of the supply chain concept and information technology approach is necessary to be introduced. Coop Coffee stands for the Cooperative for the Indonesian Coffee is the business program from the Ministry of Co-operative & Small Medium Enterprises (SMEs) Of Republic of Indonesia, aims to improve the coffee farmers’ wealth in co-operative bases as well as promote the Indonesian best coffee to the world. As a backbone, a Smart Coffee Enterprise Support System (SCESS) was developed to accompany the data transactions. The objective of this study was to design an integrated database of SCESS for coffee SME management. The database designed using relational database concept and visualized in the Entity Relationship Diagram with 14 entities and 15 relations, from the on-farm, off-farm, and market. The developed system was implemented to manage the coffee SME in Pelaga, Badung, Bali province. The SME has 24 Subak with 127 farmers, 168,924 hectares of area, and about 57,320 coffee tress. The integrated database system recorded the farmer name, address, their coffee farming facilities, and estimated yield, and finance loan from the government under the KUR (Kredit Usaha Rakyat).

1. Introduction
In fact, coffee is one of the five most important commodities in the world market according to studies [1,2] in [3]. Coffee has great potential to improve the quality of life of a coffee farmer in Indonesia. In the business sector, demand for Indonesian coffee is suitable for the needs of both the local and the world market in the past five years. As external initiatives from the top of the value chain, these channelled downward to the bottom of the chain as new conditions for production [4]. At the bottom of the chain, the producers need to make sense of the standards, decide to how to respond, and handle them given local socio-economic circumstances following the studies [5–9] in [10]. Participation in these market-based initiatives is a voluntary-based, but it has gradually become a prerequisite for access to part of the global market in general.
The cooperative by the ministry of cooperatives, Coop Coffee stands for the Co-operative for the Indonesian Coffee is the business program for the coffee farmer from the Ministry of Co-operative & Small Medium Enterprise (SMEs) of Republic of Indonesia. Two aims of the business are to improve the coffee farmer’s wealth in cooperative bases and to promote the Indonesian best coffee to the world. The program started in 2015, the Coop Coffee has worked to find the best way to bring out the hidden potential of the Indonesian coffee farmer for their better life and better Indonesian economy through digital technology. Accordingly, the framework of enterprise support system paradigm as the backbone technology for the Coop Coffee is necessary to be introduced. As an initial approach, an integrated database system will be initiated as the foundation of the smart coffee enterprise support system.

The objective of this study was to design an integrated database of Smart Coffee Enterprise Support System (SCES) for coffee Small Medium Enterprise (SME) management. The database was developed as a web application to support the flexible and scalable access and further development towards completed SCES. The concept of SCES, database development, and its testing and implementation will be explained carefully.

2. Materials and Method

2.1. Smart Coffee Enterprise Support System (SCES)

The concept of enterprise support system and its position among the other support system can be seen at figure 1. (a). The pyramid composed of four layers with basic foundation is transaction processing system, handling the basic data repository. The upper layer is information support system which focusing on handling the information, transformation from data to information by analytical and statistical model. The next layer is decision support system which handle the explicit knowledge for the needs of decision-making process. The top is enterprise support which focuses on the tacit knowledge handling. The amount or size of data is bigger in bottom part following the pyramid shape, but the risk and value is getting higher when it goes up following the inverted pyramid. The pyramid also shows the level of system and its degree of difficulties for handling the object, the higher the level, the more difficult the handling. The Smart Coffee Enterprise Support System (SCES) will be developed as Enterprise Support System.

Figure 1. Pyramid tier of support system (left), and Milestone of development of Smart Coffee Enterprise Support System (right)

The development of Enterprise Support System (ESS) requires a procedure that must be completed in each stage. For the SCES, the system developed based on Information Technology as the core, composed of software, hardware, database, and network, and the milestone can be seen in Figure 1. (b). The milestone consists of several modules working together in supporting the completed SCES. At present proposed modules are: 1) Human resource management, 2) Supply-chain management, 3)
Enterprise Resource Planning (ERP) module, 4) Sales management, 5) Account payable/receivable module, and 6) Other modules will be added according to the system needs at the future. The modules then connected as SCESS for the completed system as Enterprise Support System scheme. As the foundation of the overall system, the Integrated database is the entry point on the adoption of ESS. The following process will explain the procedure on the development of an integrated database of SCESS.

2.2. Design of Integrated Database

The process design of integrated database of SCESS can be drawn in figure 2. The procedure of the development composed of five main procedure: a) preparation and field survey, b) System design, c) Discussion and revision of the design, d) Programming and d) Testing and improvement. During the preparation and survey, the current existing system and business process on coffee production and business were mapped and documented. The method was field survey, literature study, and interview with coffee farmer facilitated by the Ministry of Cooperatives and SME’s RI. The design process following the system requirement, systems architecture, and implementation strategy of the SCESS for real application. The designed system then discussed with the principal government or policymaker for the provident and revision if required before the programming. The programming stage consists of the development of web-application, debugging, and laboratory testing. The last step is testing and implementation of the SCESS. During the testing, if there are any bugs or mistake will be fixed and enhanced while implementing in the actual condition.

As a technical aspect, the database was created using MySQL, and the programming language was PHP using the Code Igniter framework for flexible and scalable development. The use of PHP framework facilitates modular development and collaborative improvement by implementing the MVC concept, Model, Views, Controller to divide the logic on the programming process.

![Figure 2. Procedure of development of Smart Coffee Enterprise Support System](image-url)
2.3. System Testing and Implementation
The developed system was tested and implemented to manage the coffee Small Medium Enterprise (SME) farm management in Pelaga village, Petang Sub-district, Badung District, Bali province. The SME has 24 Subak (farmer group) with 127 coffee farmers, 168,924 hectares of area, and about 57,320 coffee trees. The integrated database system recorded the farmer name, address, their coffee farming facilities, and estimated yield. Accordingly, it also used to manage the finance loan from the government under the KUR (Kredit Usaha Rakyat) scheme.

3. Results and Discussion

3.1. Coffee Supply chain and Business Process
The concept and implementation of the supply chain is an integral component of industrial activity according to Ibrahim [11], and the concept and its mechanism commonly defined as supply chain management, firstly introduced by Oliver and Webber [12]. Dealing with coffee supply chain, the previous study explained the complexity and it differs from country to country, however, in general, it is composed of the grower, intermediaries, processors, government agencies, exporters, dealers/brokers, roasters and retailers [3]. The schematic illustration of the coffee supply chain can be seen in figure 3. From the identified chain flow, the simplified process will be adopted in SCESS for tracking the commodities availability and record the material process.

![Figure 3. Global Supply chain on coffee distribution on local and foreign market [3].](image)

3.2. Designed Database
Designed database of SCESS can be visualized on the Entity-Relationship Diagram (ERD) as displayed in figure 4. The main entity representing the modules related to activities in the coffee business process. For SCESS at present development, there were 14 main entities with 15 relationships and 6 modules. The entities and relationship support the modules of SCESS are a) User management, b) Farmer group management, c) Finance management, d) On-Farm and off-farm management, e)
Human knowledge – capacity building management and f) Analysis and Market management. Each main entity will be breaking down into detail attributes for the completed database of SCESS.

Figure 4. Entity Relationship diagram of Smart Coffee Enterprise Support System (SCESS)

Figure 5. Dashboard of the developed Smart Coffee Enterprise Support System (SCESS)
3.3. Developed System

The user interface of SCESS main dashboard can be seen in figure 5. The main dashboard shows whole information regarding the activities of the enterprise system, such as distribution map, statistics of registered user and farm, loan performance, and loan statistics. At the present situation, the map only shows one province, Bali, as the initial implementation of the developed system. Through the main dashboard, user or policymaker could assess the present situation of the business, especially regarding the financial management under the Kredit Usaha Rakyat (KUR) schemes. The main menu bar shows several modules that can be accessed easily based on the designed ERD. The main menu is Kelompok Tani (Farmer Group), Petani (Farmer), Lahan (Field), Kegiatan (Activities), KUR (Kredit Usaha Rakyat), Wilayah (Area), and Setelan (configuration). The user management used to manage three levels of the user group with specific privilege according to the system requirement, such as Administrator, Operator, and User.

User flow of the system operation is displayed in the schematic diagram in figure 6. At first, the user accesses the main domain and reach the user login page. By entering the login information (username and password), user reached the user main dashboard as explained in figure 5, through the main menu, user can access the page of modules: Farmer management, Farm management, Kur management, Activity management, and so on. Each page supports the CRUD operation (Create, Read, Update, and Delete) according to user group and privilege.

![Figure 6. System flow of Smart Coffee Enterprise Support System (SCESS)](image)

The system was tested and implemented to manage the business process on coffee production in Pelaga, Badung, Bali province. The SME has 24 Subak (farmer group) with 127 coffee farmers, 168,924 hectares of area, and about 57,320 coffee trees. The integrated database system recorded the farmer name, address, their coffee farming facilities, and estimated yield. Accordingly, it also successfully used to manage the finance loan from the government under the KUR (Kredit Usaha Rakyat). The basic data and information regarding loan and activity were systematically recorded and will be utilized for further development of the enterprise support system, The SCESS.
4. Conclusion and Future Works
The Integrated database of Smart Coffee Enterprise Support System has been developed as an initial stage on the adoption of Big-data approach for Small Medium Enterprise Management. The application formed as a Web-Application, developed using Code Igniter PHP framework for flexible and scalable development following the milestone towards completed SCESS. As the implementation result, the system could help to manage the coffee SME in Pelaga, Badung, Bali province. Managing 24 Subak (farmer group) with 127 coffee farmers, 168,924 hectares of area, and handling the government loan under KUR scheme.

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