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Business Analytics in Performance Assessment of Food Manufacturing System

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Abstract: Transparency is a jargon in the food industry particularly driven by regulators and consumers. Though its a common term, understanding and applying it is still unclear to the food industry specifically what transparency means, why to pursue it, what it involves, or how to improve it (http://www.streetdirectory.com, 2017). The realities of todays competitive food manufacturing industry, along with pressure from stakeholders, require business leaders to be more aggressive and creative with cost reduction initiatives (corepractice.com, 2017). This led to the development of a system that will enable food production line to automate inventory and product production monitoring. This will enable transparencies in terms of viewing available raw materials vis-á-vis the production order. This paper will provide architecture of a food manufacturing system that could lead to transparencies.

Keywords: Food production, Manufacturing transparency, Bill of materials

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INTRODUCTION

The delivery of product designed for quality is a service experience designed for value on top of what's being expected in the global marketplace. Your service delivery dictates the response of your clients, its either you delight them or you disappoint them. The higher the service opportunity, the higher the risk. In this age of increasing product commoditization, how well you prepare to leverage services for your products may be your company's clearest path to a competitive edge. If thoroughly and effectively planning for service isn't one of your highest priorities, it can and should be (http://www.ptc.com, 2017).

In a recent study, an estimated 30,940 establishments that make up the $564 billion annual wholesale food and beverage processing industry demand the utmost attention to safety and quality. While niche industries such as craft beer, organic vegetables, or gluten-free offerings have risen in popularity, Food Manufacturing research has found that 82% of all production occurs at 23% of all locations. Furthermore, 19% of all establishments have 50 or more employees and control 89.4% of the market ($504 billion).

This leads to a production environment focused on larger quantities in order to offset smaller margins at most larger processing facilities. On the plant floor, solutions to lowering equipment down-time, improving line change-over rates, and avoiding disastrous quality control situations like recalls are all essential to long-term success and enterprise viability (Advantage Business Media, 2017).

These reasons led to the development of a Business Analytics in Performance Assessment System in Food Manufacturing. This paper shows the possibility of automating the bill of materials in a food manufacturing entity. This paper aims to classify products to determine expiry dates from raw materials to end of production, as well as predict trends on sales and stocks' status.

RELATED WORKS

Data innovation (IT) has turned into an imperative and essential piece of each strategy for success. From multi-national companies who keep up centralized computer frameworks and databases to private ventures that possess a solitary PC, IT assumes a part. The purposes behind the inescapable utilization

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of PC innovation in business can best be controlled by taking a gander at how it is being utilized over the business world (MacKechnie, 2013).

There are distinctive reviews directed to decide the significance of data innovation in deals, stock, and bookkeeping process. A viable data framework helps the distinctive divisions inside an organization cooperate. For instance, administration can set up deals objectives for which staff can then request the proper measure of stock (Hsu & Utami, 2016; Taechaubol, 2017).

Nonstop change of business procedures is a testing assignment that requires mind-boggling and hearty supporting frameworks. Utilizing progressed examination techniques and developing advancements -, for example, business knowledge frameworks, business movement checking, prescient investigation, behavioral example acknowledgment, and "sort reproductions"- - can help business clients ceaselessly enhance their procedures. Notwithstanding, the high volumes of occasion information delivered by the execution of procedures amid the business lifetime keep business clients from productively getting to opportune investigation information. This article shows a mechanical arrangement utilizing a major information way to deal with giving business experts permeability on a disseminated process and business execution. The proposed design gives clients a chance to break down business execution in very dispersed conditions with a brief timeframe reaction. This article is a piece of a unique issue on utilizing enormous information and business examination (Vera-Baquero, Colomo-Palacios & Molloy, 2013).

METHODOLOGY

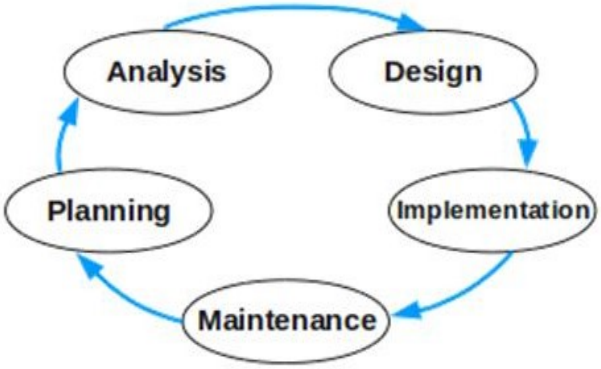

Figure 1. Software development life cycle

This paper followed the System Development Life Cycle. It has five different phases namely; planning, analysis, design, implementation and maintenance. Each phase plays a vital role in the success of the development of the system. The proponent will conduct interview with the supervisors and manager to identify the problems and difficulties they encounter using manual system. Observation to production transactions will also be conducted to gain knowledge to the problems and to acquire the possible solutions.

During the pre-investigation process using interview and observation as medium, all users were identified, identifying users should be considered since the production flow was involved. People from the warehouse and production area, as well as the delivery section were considered. Types of users such as supervisors of production department and warehouses are identified as the valid users of the system as well as the manager as the admin of the system. The system was designed to have modules for the requisition of raw materials, adding new product and recipe, production report, and viewing of suggested production date based on the delivery date which are included in production department module and to be used by the production supervisor. The module designed for raw materials warehouse includes inventory of raw materials on hand, viewing and printing the requested raw materials from the production section, incoming raw materials could also be recorded, viewing of raw materials available and finished products can also be accessed in the system, as well as viewing of delivered products.

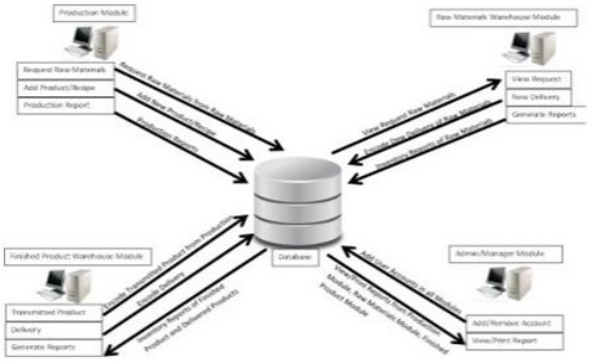

Figure 2. System architecture

Figure 2 shows the system architecture of the developed system. A central database was designed to serve as the central repository of data. The system consists of four modules, the first module is for user administration and reports generation. Production module is capable of requesting raw materials to raw materials warehouse, recording, generating and printing production report. The finished product warehouse module is capable of viewing the request from production module, inventory of raw materials, the module can inform the user if the raw materials are out of stock or in critical point, and the module is also capable of generating and printing raw materials report. The finished product module is capable of identifying which products are mostly delivered, the module can also generate and print inventory reports of finished products.

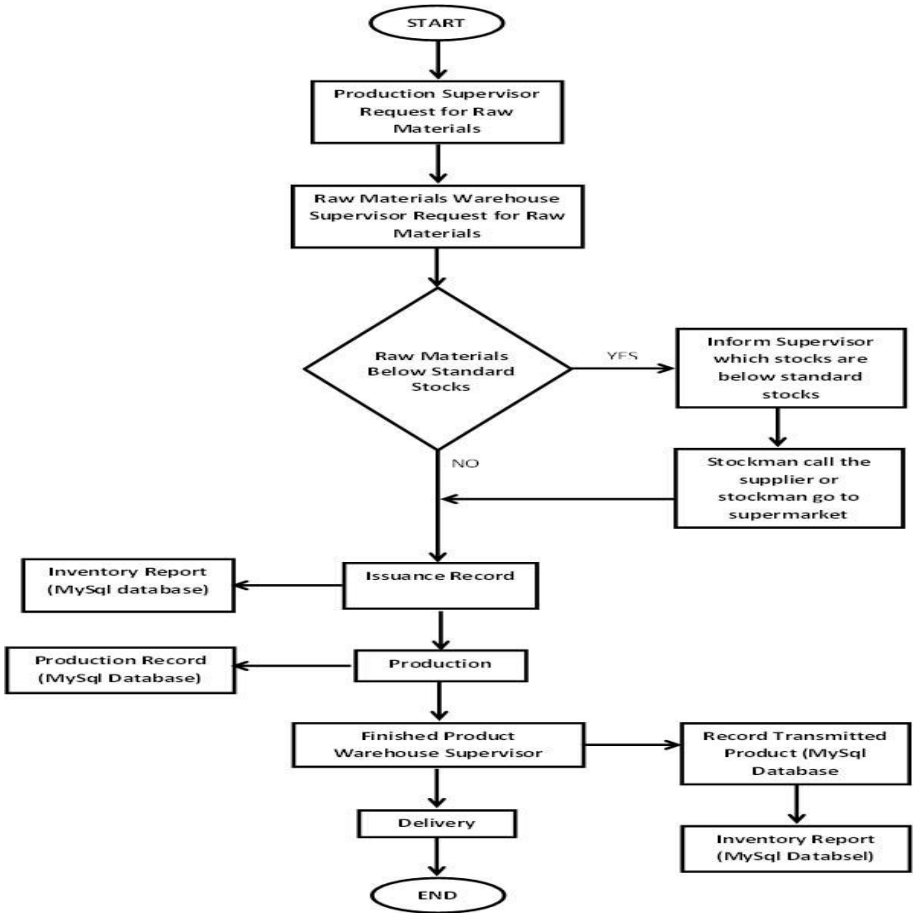

Figure 3. Proposed production flow

Figure 3 shows the production flow of the proposed system. Like in the existing system the supervisor will request raw materials to raw materials warehouse but instead of using pen and paper, the supervisor will use the system and will automatically send to the raw materials warehouse. At the raw materials warehouse supervisor module, the system will automatically inform the supervisor or the user if there is/are raw materials which are below the average stocks, unlike the existing system, the stockman will manually check if there is/are available stock. In terms of storage, the records will be stored in the database once issued and encoded. Production reports will also be stored in the database for fast and easy retrieval of records. At the finished product warehouse, the transmitted finished product will automatically add to the current stock and deduct the delivered products once encoded.

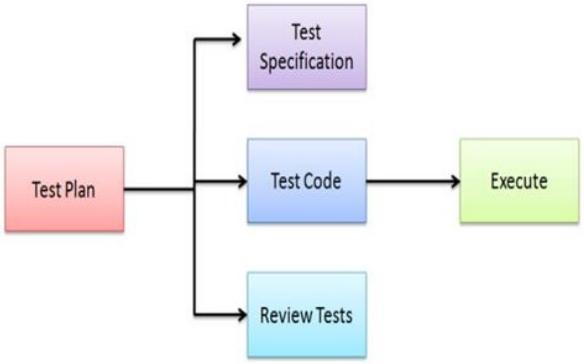

Figure 4. Software test plan

Figure 4 shows the test plan that the proponents used in implementing the system.

The system was tested in the actual food production operation. Each module was carefully tested in order to determine if it behaves the way how it is supposed to respond to user's requests. The system was tested in terms of functionality, reliability, usability, efficiency, and maintainability.

Adoption of the system could result in better planning of food manufacturing in terms of production, analysis of raw materials that needs to control and raw materials that need additional stocks for production on the following month. Food manufacturer can easily generate inventory reports in pdf file format of raw materials and finished product, along with the production report.

RESULTS AND DISCUSSION

As the result of the system development, the objective of developing an application that will automate the bill of materials in a food manufacturing entity was performed. The bill of materials stores the information required for manufacturing activities. Raw materials of a particular product can be generated together with its availability in the raw warehouse.

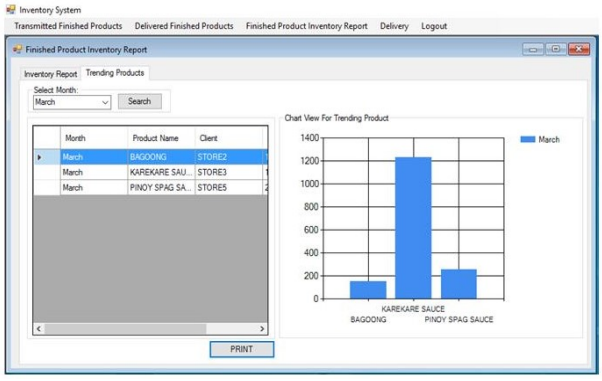

Figure 5. Trending products' sample screen shot

Figure 5 shows the graph of the products that are in demand in a particular month. Months can be selected in the system which could help users identify raw materials that should be prepared in advance.

Automation of the bill of materials is shown in figure 6. The screenshot of the availability of raw materials can be viewed in the production line to determine the feasibility of the production of a particular product. The expiry date of each product is also identified in the report to notify user of the details of the product's expiry date. The figure includes the issued raw materials tabs which show the issued raw materials and total issued weight. Clicking the print button will generate a pdf report of raw materials and current stocks.

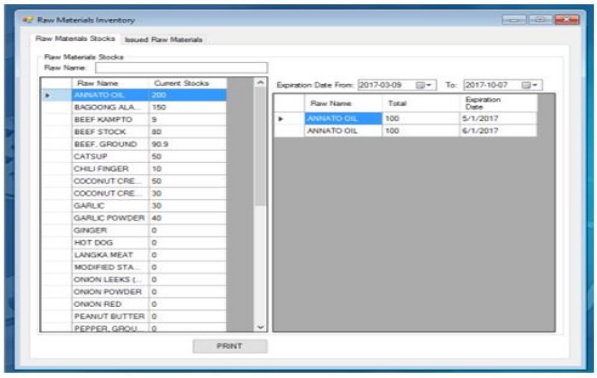

Figure 6. Availability of raw materials' sample screen shot

Application of Business Analytics was performed by providing reports of products that have high request in a particular month, through this report, the purchases for the succeeding month that shows trending product can be adjusted. The trends on sales can also be viewed through the reports available in the system.

Figure 7. Trending product inventory report screen shot

Table 1: Summary of software evaluation overall mean scores

Criteria	Overall Mean	Descriptive Meaning
Functionality	4.8	Excellent
Reliability	4.4	Very Good
Usability	4.5	Excellent
Efficiency	4.9	Excellent
Maintainability	4.7	Excellent
Overall Mean	4.66	Excellent

Table 1 shows the summary of software evaluation overall mean scores. This was achieved by conducting a system testing to ensure if the application achieved its goal. All quality indicators using ISO9126 Software Evaluation criteria such as functionality, reliability, usability, efficiency, and maintainability all garnered an excellent rating. This shows that the developed system conforms to the need of the subject entity and could also be applied to the same industries catering food production.

CONCLUSION

In consideration of the objectives of the study and the results of the evaluation, the following conclusions were drawn:

Developing a system for a food production form is possible in order to be transparent on some of its operations such as inventory of raw materials, bill of materials for a specific product as well as monitoring of sales trend to prepare the production and warehouse for a sales trend in the coming months. A food production system should have several modules such as user administration, production module, raw materials warehouse module, and finished product module. These modules consist of reports available to managers to view status of raw and finished materials as well as the trending products.

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