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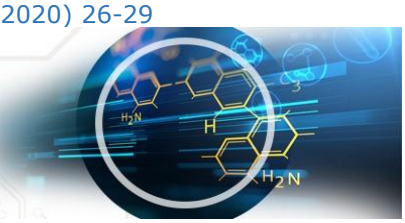

Integration of Laboratory Information Management Systems with SAP in an Iron-Steel company

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Today, with the developing technology, enterprises manage many processes such as order taking, human resources, production, quality control and planning integrated with the ERP software SAP. Laboratories of production facilities often use software such as Labware, My-Lab and Enlab to manage their own data. In their study, Krzysztof Żaba1a and Bartosz Gałda applied the laboratory data management system in the SAP standard module and identified some disadvantageous aspects in this application [1]. By the help of this study, some of these disadvantages identified by the researchers were solved with the software developed apart from the standard module in SAP, thus eliminating the need for a different software, providing a fast and secure data flow, reducing the need for labor in reporting and eliminating personnel errors. Most importantly, laboratory data is made available to departments that use SAP extensively, such as quality control, planning and operation.

Keywords: SAP, QM, Laboratory Information Management Systems, Iron-Steel

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1. Introduction

Laboratory analyzes are very sensitive and must be maintained safely. However, no matter how sensitive the analyzes are performed, issues such as storage, reporting and confidentiality of the results of the analysis may be at risk if appropriate tools are not used. Because of this sensitivity, there are solutions that include many manually created measures and control mechanisms. These can cause serious workload and time losses hence work inefficiencies [2].

In order to avoid these situations, a data management system is required in laboratories. In addition, laboratories wishing to be accredited must comply with data information security and management procedures in terms of accreditation processes [3].

Laboratory data management system is a complex of hardware and software components that support the management of collection, processing, storage, distribution and information presentation procedures used with the information obtained as a result of laboratory activities [4].

Today, laboratories use software such as Labware, my-Lab, EnLab to manage their data. There are companies that use these software separately from ERP systems, as well as companies that integrate only the results reports into ERP systems.

ERP, which means enterprise resource planning, refers to the product set that companies use to carry out processes such as finance, accounting, supply chain operations, sales, maintenance, quality and laboratory, procurement, project management and risk management. ERP systems define a large number of business processes within this integrity and provide data flow between business processes. SAP, which is an ERP system, plays an important role in the management of thousands of companies from every sector today [5].

K.Żabala and B.Gałda's study, they analyzed the laboratory management system based on the standard functionality of SAP's QM module. In

addition to the advantages in their studies, they identified some disadvantages. As disadvantages, they determined that there is no specific business plan for the tests to be carried out, these tests can only be analysed by batch number and the information workflow is lacking [1].

2. Studies

In this study, besides the SAP-QM standard structure, all operational operations from sample acceptance to delivery of the result report to the relevant person were combined into one system (SAP), avoiding workload such as managing different systems, integration problems between systems and maintenance costs of different systems.

Laboratory unit operating in MMK Metalurji, which is designated as the site of study, is grouped as follows.

a- Raw Material Input Control Analysis :
Raw material input control analyzes are the analyzes performed to check whether the raw materials and materials purchased meet the specifications required for production.

b- Process / Routine Analysis:
Control analyzes are performed to test the intermaediate/end products during production, to control the targeted product process and to help the chemicals used during production to meet the process requirements.

c- Non-Routine Analysis (Internal/External Customer):
It covers sample analyses that do not come in a specific order and are specifically requested. (Except for the 'Analysis Frequency List' prepared for process/routine analysis and/or come from third party analyzes)[6].

Work flow charts have been prepared for each of these identified study areas. SAP-QM standard module for Raw material Input Control has been configured and made available. Since the standard module for the other two work areas could not meet the demands, the control of all work areas was gathered under the roof of SAP with additional improvements.

2.1. QM Modul

Raw material input controls are carried out by the Coordination of many units (stock control, Production Planning, Purchasing, operation, Quality Control and laboratory) based on the technical specifications prepared. Compliance checks are carried out according to the technical specifications prepared.

For each specification, a control plan was created within the SAP-QM module and material numbers were defined according to these control plans. The purchase of the materials requested by the production lines is carried out according to the material numbers. The SAP-QM module determines the relevant raw material according to the material number and transmits the raw material information (raw material name, company, parameters to be checked with the specification, location of raw material and amount of raw material) to the laboratory unit via e-mail. In accordance with this information, the laboratory unit starts the analysis by taking samples from the incoming raw material.

After the end of the analysis, the results are entered in the analysis results section in the SAP-QM module. SAP-QM automatically sends the analysis results to the e-mail addresses of the previously defined contact persons for each specification. Notification of raw materials whose analysis results are within the relevant specification limits is transmitted as "Acceptance" and opened to the use of the Production through the system. If the results of the analysis are outside the limit values, the raw material statement is transmitted as "Rejection". In this case, this raw material is automatically blocked through the system and closed to use. The relevant production operating officer states the final decision on SAP-QM based on the process and raw material status. In case of accepting the raw material, stating the reason and makes the decision as "Accept even though it is wrong" to remove the block. In case of" rejection " decision, notification is sent to the relevant unit and necessary actions are initiated. While the parameters in the specification are related to whether the raw material can be used technically in production, some parameters (coating area in paints etc.) are of commercial importance, not technical. It is stated in the specifications that laboratory results outside the limits of this parameter will be considered as "Conditional Acceptance". Since the use of a raw material within the scope of conditional acceptance will cause an increase in the production costs of the company, this amount of increase is calculated according to the difference in the parameters specified in the specification and compensated from the supplier. Due to the continuity of production, samples of raw materials that are required to be consumed are taken without waiting for the completion of the analysis. However, even if the use decision is rejected, it will not be put into blocked stock. Raw materials in this case (coal, lime, etc.) are considered optional.

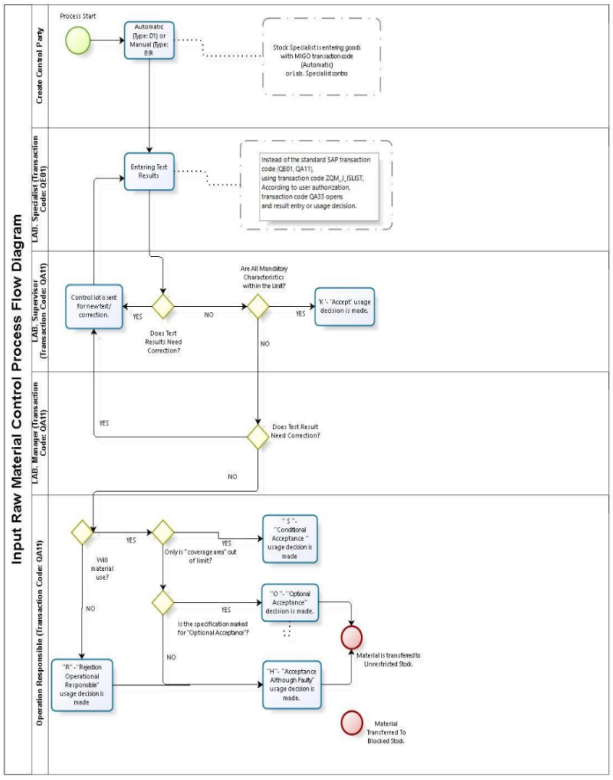

Figure 1: *QM Module System Flow Diagram*

2.2. Process / Routine Analysis

The internal control processes are subject to regular follow-up in a healthy way which this analysis of work to be done/can be made reliable and easy, since the repetition of the analysis and ensure the feasibility of all steps to be reportable on the basis of the predetermined unit is a frequency analysis list structure is based on the integration SAP system [6].

The customizing of the process/routine Analyses to the SAP system begins with the creation of material cards by assigning them to the material type specially opened for each type of analysis. The control plan for these materials is created and recorded to the system which analyses will be performed with these control plans. Based on the periods in the analysis frequency list, registration of the sample samples taken to the system is entered into the system by the analyst. After starting the analysis of the sample in the laboratory, the results of the analysis are entered into the system by the controllers.

After the result entries are completed, the system automatically sends the results of the analysis to the related people by mail. If there is at least one out of limit value in the analysis results, the control decision is indicated as "Not Appropriate" in the mail content and the out of limit value/values are highlighted in red. If all values are within the limit, the control decision is indicated in the mail as "Appropriate".

The person who created the sample record, the controller, the sample results etc. information can be reported with the development report made in SAP system. The authorized person can receive these reports Daily, monthly, in/out of the limit, in the form of graphics, as well as entering search parameters in excel at any time.

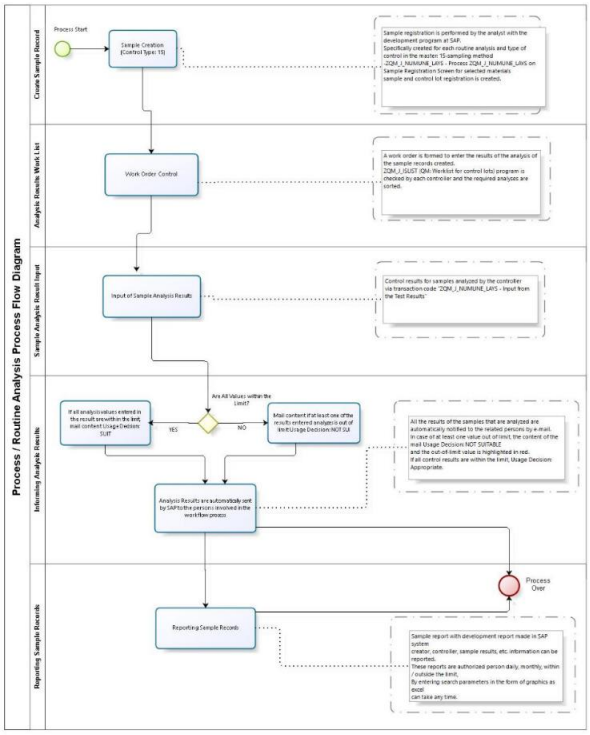

Figure 2: *Process/Routine Analysis Flow Diagram*

2.3. Non-Routine Analysis (Internal/External Customer)

Non-routine analysis is evaluated in two areas: internal customer analysis and external customer analysis. In both areas, improvements and additional programs made in SAP are used, completely different from the QM module standard.

Analysis requests from the process for analyses not defined in the Analysis Frequency List as internal customers; all analysis requests from third parties are defined as external clients.

All non-routine analysis (internal-external customer) requests are received by e-mail and sample records are created in SAP. "Rejection" or "Acceptance" decision is made by examining the feasibility of the analysis requests for the sample record. The analysis request for which the "Rejection" decision is made is forwarded to the requester via SAP via e-mail. The decision to accept the analysis request is notified to the relevant

laboratory personnel by e-mail as a work order. In this statement, if the required analysis parameters are to be performed according to which standard, the results are entered into SAP by the controller. The Laboratory Supervisor can accept or reject the result by examining the result statement from SAP. Rejected analysis results are processed according to the reason of rejection specified in SAP (Repeat Analysis, Incorrect Result Input, etc.). When the result is accepted, the results of the desired analysis are automatically sent to the requester via e-mail in excel format.

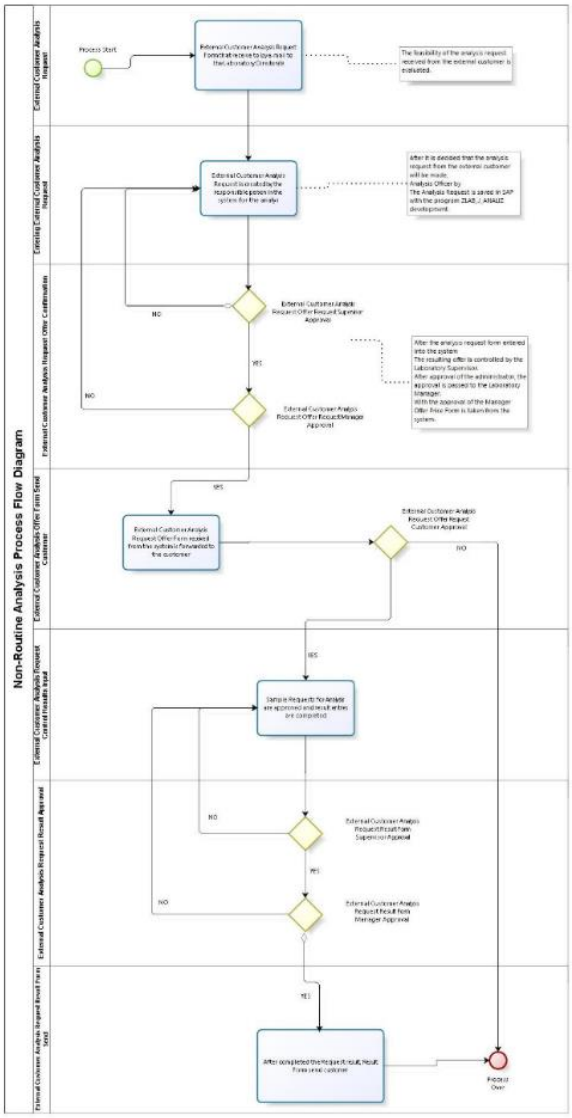

Figure 3: *Non-Routine Analysis System Flow Diagram*

3. Conclusion

These methods based on information technology directly affect product quality in iron and steel companies. Fast delivery of data with this system is important for product quality. The system enables all business processes to be carried out on a single system, preventing human factor errors and keeping data safe and processable in iron and steel companies using SAP. The advantages of the study are that the tests carried out with a specific business plan can be analyzed independently of the batch number and the information is complete at each stage. The disadvantages are the lack of cost calculation of the tests and no prioritization is made for the analyses.

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