What can be learned from a Knowledge-intensive System?

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Abstract

The paper aims at describing what can be learned from a Knowledge-intensive System (KIS) by a manager of an Indonesian SME Garment Manufacturer (ISGM). For this purpose, we use the system LIA (Leading to Information Access). LIA is a system that (1) handles financial related transactions, (2) processes them according to Indonesian accounting standard procedures, and (3) gives the interpretation of the process results to the financial analysis. By learning from the interpretation of the company's historical data, an owner's understanding of critical financial factors in garment industry may increase and let the company flourish.

Keywords: Knowledge-intensive System, Financial Analysis, Learning Process, Indonesia SME Garment Manufacturers, Business Administration

1. Introduction

The current instability of the world economy is also felt in Indonesia. Therefore, the Indonesian SME Garment Manufacturers (ISGMs) should maximize the use of all resources (cf. Rowley, 1999, 2009). The resources can be divided into four categories, namely (1) land or natural resources, (2) labour, (3) capital, and (4) enterprise (see Parry & Kemp, 2009). Some researchers prefer to group labour and enterprise together and refer to them as human resources.

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Obviously, most of the ISGMs have weak points. They can be summarized by four categories, namely (1) a lack of capital, (2) a lack of skills, (3) problems in productivity and business development, and (4) a lack of communication and knowledge sharing among managers (Indarti, 2006; Cheng, Lu, & Sheu, 2009; Soetrisno, 2009).

To obtain more capital from external parties such as banks, the ISGMs have to prove that they have a good business prospect and strong and solid capabilities to sustain. To achieve this condition, the ISMGs should focus on how to increase the capabilities of their human resources. The use of knowledge regarding the 'best practice' in the garment business will support the manager's effort to exploit the physical resources efficiently.

Nowadays, many owners are looking for an appropriate successor, or a successor who is able to deal with financial knowledge from a Knowledge-intensive System (KIS). So, the solution to enhance knowledge sharing for the ISGM is driven by the ISGM owners' preference. However, the owner's reasoning frequently is as follows: "when dealing with a financial issue, for me, it is more acceptable to be supported by an intelligent software program than to have a newcomer as the manager" (Gunawan, Wahdan, van den Herik, & Athuri, 2011).

Using LIA properly, the ISGM managers are supported by trustful information on their company's condition when they have to make any decision. In their interaction with LIA, the managers may obtain a professional guidance in such a way that it looks like the advice comes from a human financial expert.

The problem statement (PS) reads as follows: to what extent will LIA support a manager in learning how to be able to survive in the garment industry? The paper describes the feedback of business managers on the results of LIA that has been feed by the historical data from their company.

2. Related Research

Various artificial intelligence techniques have been developed to mimic the way of human thinking and how they make decisions. Each of the techniques has its own advantages and drawbacks.

When a decision support system (DSS) has to deal with really complex issues, the time needed to design and to implement such a DSS is long. Currently, researchers investigate to what extent a DSS can be combined with a KIS. Empirical studies identify improvements in the decision processes when a KISis used (cf. Antony & Santhanam, 2007).

A KIS is primarily developed to help users in their decision-making activities. But as an unintentional consequence, the KIS may stimulate the users to learn more about a problem (Antony & Santhanam, 2007).

KIS has been applied to abundant decision problems in many domains, such as (the example span a decade) for supporting investments decisions (Poh, 2000), for performance measurement (Ammar, Duncombe, Jump, & Wright, 2004; Khan & Wibisono, 2008; Wang, Huang, & Lai, 2008), for formulating budget planning (which is called Knowledge-based Intelligent Decision Support System: KIDSS sys-

tem) (Wen, Wang, & Wang, 2005), for supporting business system in small financial institutes(Chung & Pak, 2006), and others use.

When people develop a KIS, it commonly involves three activities, namely designing the knowledge engine, building the program, and implementing the program in a company. In the first activity, there are five stages in the KIS development, namely (1) knowledge acquisition, (2) knowledge analysis and representation, (3) knowledge validation, (4) inference design, and (5) explanation and justification.

Depending on the complexity of the issue, the interpretation of a result as arrived at by the KIS is not always easy and can lead to different conclusions. To overcome the occurrence of different conclusions, researchers developed various methods such as (1) model-driven, (2) data-mining, (3) case-based reasoning (CBR), and (4) fuzzy methods.

3. Research Methodology

For constructing LIA, our research methodology consists of three stages, viz. literature review, fieldwork (surveys and case studies), and analysis of the results. Literature review is a basic ingredient of this research. It is performed from five different angles. The topics are (1) ISGM, (2) AIS, (3) KIS, (4) financial accounting, (5) and management accounting.

For the fieldwork, we combine three methods from the five methods described by Wagner et al. (2002). The three methods are (1) unstructured interviewing techniques, (2) structured interviewing techniques, and (3) protocol analysis. The acquired knowledge was validated by letting the experienced-financial experts review the result of the knowledge acquisition process. Identification of the problem categorization will be performed by means of (1) interview with experienced financial experts, (2) identified financial events, and (3) financial and accounting methods from the literature review. Then, a protocol analysis will be executed to uncover the processes of problem solving by experienced financial experts when evaluating a company's performance. Next, problem behavior graphs (PBG) will be used to figure out the financial experts' solving strategy (Shiue et al., 2008).

Thirty-one garment managers (or owners) from different companies were interviewed in our sample. The goal was (1) to obtain their knowledge in managing the ISGMs and (2) to obtain information on financial statements. As most of them were interested to use the software for free later on (which was promised), they were willing to spend their time.

In order to obtain the knowledge of financial experts regarding the financial issue in the ISGM, we constructed a new case study, derived from the input given by five ISGMs. The five companies were willing to participate even to a larger extent by providing their restricted financial data for our analysis, in anonymous form. The remaining twenty-six ISGMs did not want to participate in providing their financial data because of tax issues.

Owing to the limited number of ISGM owners who were willing to provide their financial statements, we attempted to obtain the general ISGM's financial conditions

by using the archival research conducted annually by the BPS-Statistics Indonesia. From the 23,430 manufacturers (on average from 2001 till 2008), which participate(d) in the annual manufacturing survey, a sample of 2,504 garment manufacturers (on average) is used for the purpose of our study. Using the data from this survey, we compose some financial ratios and use them as the industry average (as a source of comparison between the companies with the industry).

Using the financial data in the new case study, in-depth interviews were conducted to obtain knowledge from the financial experts. Twenty-five financial experts participated in our survey.

In the knowledge acquisition stage, we gather related knowledge and categorize it in a knowledge base. More precisely, it is a process of transferring knowledge extracted from domain experts into the representation that computers can process. The sources of the knowledge can be range from literature (such as textbooks, journal articles, technical reports) to human experts.

We use the acquired knowledge acquisition to build an appropriate model. The results from the knowledge acquisition are converted into an intermediate representation. The intermediate representation will structure the coded representations of the knowledge so as to store it in a knowledge base. Then, the knowledge from the KIS is verified against the experts or the knowledge sources.

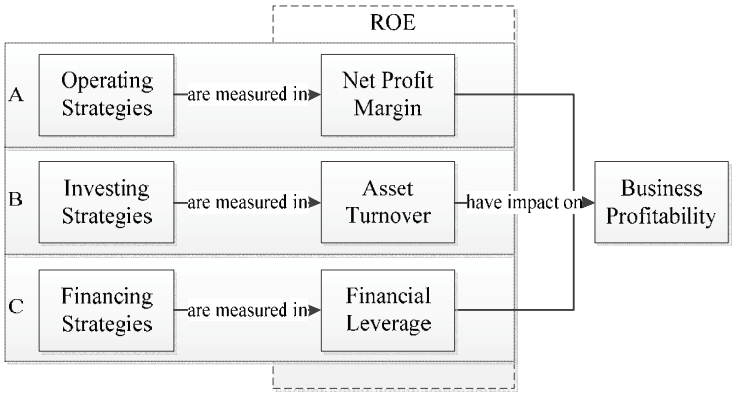
Below we discuss the four methods that are used in LIA. First, LIA uses a model-driven system. It analyses the issue at stake with the help of a model and the corresponding intrinsic relations. The experts' way of thinking in solving a problem is recorded in these built-in relations.

Second, the data mining method is used in LIA. Unique patterns are to be found in the historical data. By learning trends and patterns that are available in the historical data, a company's performance can be identified. Then, we may obtain an in-depth insight into what happened in the past.

The source of the information is an Accounting Information System (AIS). The AIS records the daily transactions based on the accounting procedures. Until now, the data stored in the AIS was transformed into useful information for a manager when deciding a business decision. The AIS should be the primary system for a KIS in providing the relevant information needed to perform the daily management activities. The AIS is a system that (1) collects, (2) records, (3) stores, and (4) processes financially-related data to produce information for decision makers (Romney & Steinbart, 2006).

Third, CBR aims at solving new problems based on solutions of similar problems in the past. Efforts in identifying the significant problems and in investigating the root of the problems are crucial when supporting the manager on how to handle the problems in the future. Without the knowledge of the garment experts, the KIS will need more time in identifying the root of the problem. For instance, there is a common case in ISGMs of customers returning their products bought. So, ISGMs suffer great loss because of inappropriate customers.

Fourth, fuzzy rules are used for reasoning with a fuzzy concept, such as high debt and high risk. It is quite difficult to determine what the level of high is. When a current ratio shows 3.0 as a result, the figure means that the company has an adequate



Source: Libby et al. (2009).

Figure 1. The impact of strategies on profitability

liquidity position. However, the figure 3.0 can also be interpreted as a bad signal when it is combined with the results from other financial ratios.

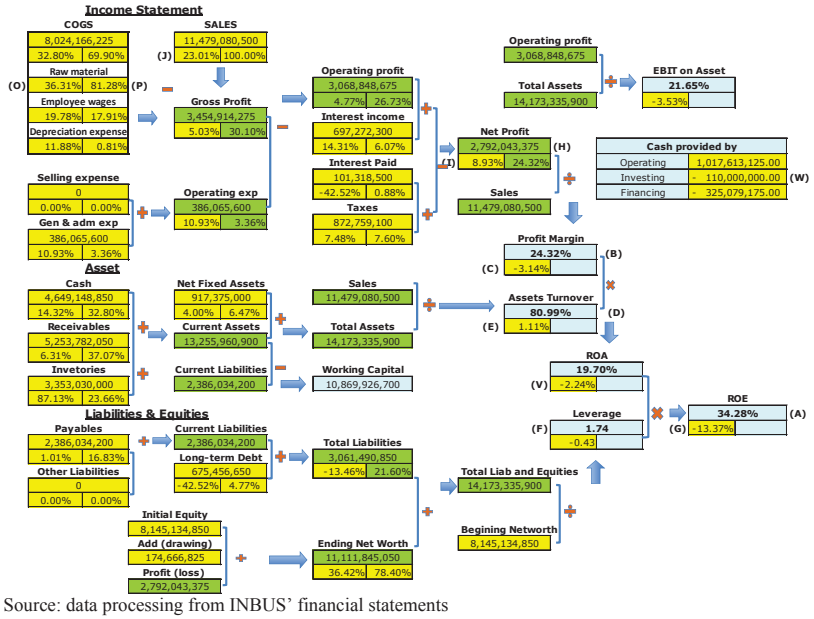
4. Financial calculations and their interpretation

The first phase of analysis process in LIA adopted the DuPont model (Gunawan, Wahdan, van den Herik, Athuri, & Tan Lian Soei, 2011). The DuPont model provides an overview on the business' operating, investing, and financing strategies that affect the profitability of a business (Libby, Libby, & Short, 2009). The DuPont model enables the manager to evaluate ROE by three factors: (1) net profit margin, (2) asset turnover, and (3) financial leverage (see Figure 1). Libby et al. (2009) describe that these three factors are profit drivers of a business. These three factors describe the three ways that management can improve ROE.

For a better understanding, we provide an example of the result of LIA in Figure 2. Figure 2 is a general outcome from LIA on financial statement analysis of INBUS in 2007. Figure 2 illustrates the outputs on financial calculations resulted by LIA. LIA also provides interpretation in words for the numbers on the financial statements. The interpretation is depending on combination on various financial methods. By following the multi stage interpretation from the LIA, the manager will be able to understand the sequence in analysing financial statements and the meaning of the numbers resulted from financial calculations. Some logic used in LIA are described below.

In 2007, INBUS was able to provide Return on Equity (ROE) 34.28% (see (A) in Figure 2). To explain why INBUS can achieve this 34.28%, a financial analysis based on the DuPont model is used. Using the DuPont model, the manager may gain a better appreciation of the interrelationship between the income statement and balance sheet statement, without becoming overloaded by details (Milbourn & Haight, 2005).

From Figure 2, the managers may conclude that the success from operating strategies was 24.32% (see (B) in Figure 2). It was about 3.14% less than in the



Source: data processing from INBUS' financial statements

Figure 2. The DuPont Analysis for INBUS on 2007

previous year (see (C) in Figure 2). The success from the investing strategies is 80.99% (see (D) in Figure 2), and this number is greater about 1.11% from previous year (see (E) in Figure 2). The financial strategy has the greatest impact for the ROE (see (F) in Figure 2).

For INBUS, the ROE shows that the firm in 2007 was earning a profit of about 34.28 cents per IDR of the owner's investment (see (A) in Figure 2). INBUS was generally considered to have a good profitability, in particular when the manager compared the 34.28% with the interest offered by banks. The ROE percentage reached more than two times of the interest offered by banks. When the managers analysed from the timeline perspective, the ROE in 2006 was higher 13.37% from the ROE in 2007 (see (G) in Figure 2). But in 2008, INBUS succeeded to increase the ROE to 24.87% from the ROE in 2007.

LIA also provides analysis based on comparison of a value with another value from the same account in previous year (for figuring a trend) or on comparison of a value of an account to a value from the overall accounts. This comparison resulted percentage of the accounts. With the percentage, the managers will be more aware about how significant changes may have an impact to the company. For instance, the net profit of INBUS in 2007 was IDR 2,792,043,375 (see (H) in Figure 2). When the managers observe this number, the number will contribute to nothing. However, when the managers observe that the net profit in 2007 was increase 8.93% from the net profit in 2006 (see (I) in Figure 2), the managers may say the business sounds good.

When the managers compare the increase of 8.93% on net profit with that the increase of 23.01% sales in 2007 (see (J) in Figure 2), they may surprise for this huge difference. The managers cannot conclude straightforwardly that the company failed in its production efficiency.

LIA shows that the composition of net profit to sales was 24.32% (see (B) in Figure 2 or (K) in Table 1). When the managers compared the composition of net profit to sales in 2006, they found 27.47% (see (L) in Table 1). The significant change is in the cost of goods sold (COGS) - from 64.75% in 2006 (see (M) in Table 1) to 69.90% in 2007 (see (N) in Table 1).

Table 1. The example of the common-size income statement (based on sales).

	2005	2006	2007	2008
Revenue	100.00%	100.00%	100.00%	100.00%
Total Revenue	100.00%	100.00%	100.00%	100.00%
Cost of Good Sold	49.27%	**(M)** 64.75%	**(N)** 69.90%	45.24%
Gross Profit	50.73%	35.25%	30.10%	54.76%
Operating expenses	0.00%	0.00%	0.00%	0.00%
Marketing expense	0.00%	0.00%	0.00%	0.00%
Selling expense	0.00%	0.00%	0.00%	0.00%
Utility expense	2.55%	3.08%	2.77%	1.77%
Salary expense	0.75%	0.51%	0.47%	0.39%
Insurance expense	0.00%	0.00%	0.00%	0.00%
Maintenance expense	0.03%	0.02%	0.01%	0.01%
Rent expense	0.00%	0.00%	0.00%	0.00%
Other operation expense	0.06%	0.01%	0.02%	0.06%
Property depreciation expense	0.17%	0.11%	0.09%	0.07%
Total operating expenses	3.56%	3.73%	3.36%	2.30%
Interest income	4.25%	6.54%	6.07%	6.60%
Interest expense	2.86%	1.89%	0.88%	0.53%
Tax expense	13.00%	8.70%	7.60%	15.46%
Net Profit	35.56%	**(L)** 27.47%	**(K)** 24.32%	43.06%

Source: data processing from INBUS' financial statement

LIA guides the manager to observe the comparison over several years. Using the percentage figure in COGS (see (O) in Figure 2), the managers may have a question about why the raw material expenditure increased 36.31% in 2007 (from 2006)? Another question was is it acceptable to have 81.28% composition of raw material to COGS (see (P) in Figure 2)? The managers can observe the result of financial ratios and in some extent to compare their firm's performances with the industry average. For instance, the gross profit margin of INBUS is lower one times than the industry average (see (Q) in Table 2; variance is the difference between gross profit margin of INBUS with the industry average from 2,504 garment manufacturers participated in annual manufacturing survey by BPS).

With this analytical approach, the managers will be able to obtain better insight into the company. When the managers communicate with LIA, they think that the interaction is similar with the financial experts.Considering financial issue is a sensitive and restricted issue for the ISGM, the role of KIS is more acceptable than the role of

the real financial experts. Moreover, with their effort to minimize cost, most of the ISGM managers are not willing to hire a professional financial expert.

Table 2. The example of profitability ratios.

Gross Profit Margin	0.51	0.35	0.30	0.55
Monthly Growth/Decline		-0.15	-0.05	0.25
Variance	**(Q)**		-1.00	-0.95
Operating Profit Margin	0.47	0.32	0.27	0.52
Monthly Growth/Decline		-0.16	-0.05	0.26
Cash Flow Margin		0.28	0.09	0.39
Monthly Growth/Decline			-0.20	0.30
Net Profit Margin	0.36	0.27	0.24	0.43
Monthly Growth/Decline		-0.08	-0.03	0.19
Return on Investment (Assets	0.23	0.22	0.20	0.28
Monthly Growth/Decline		-0.01	-0.02	0.08
Return on Equity		0.48	0.34	0.59
Monthly Growth/Decline			-0.13	0.25
Financial Leverage Multiplier		2.17	1.74	2.11
Monthly Growth/Decline			-0.43	0.37

Source: data processing from SJ's financial statement

5. Four contributions of LIA to INBUS

Dealing with numerous employees and various production processes, the INBUS managers have to be supported with up-to-date and reliable information.To accomplish their monitoring task, the managers use production indicators and financial indicators. We call these production indicators Key Performance Indicators (KPIs). Most KPIs are used to monitor and to evaluate the internal process of the company(Gunawan, Wahdan, van den Herik, & Kornarius, 2011). The financial indicators are used to monitor and to evaluate the company's financial conditions, in particular when dealing with external parties such as banks, suppliers, and customers.

Based on both types of indicators (KPIs and financial indicators), the managers may make adequate decisions. A challenging problem arises when the managers do not have any support from either a person or a system for their monitoring, evaluating, and decision making activities.To give a comprehensive understanding about the complicated challenges faced by the ISGMs, we describe our findings on INBUS. INBUS is an ISGM that operates in West Java, Indonesia.

To increase its profit margin, INBUS managers agree to focus on controlling most of the significant indicators related to six entities, namely (1) suppliers, (2) cutting employees, (3) production employees, (4) partners, (5) customers, and (6) the management. To support this idea, the managers recorded all financial-related transaction in an excel file.

Recently, the management stumbled into two kinds of problems. The first problem arises when the data in the excel sheet are too huge. The managers need more time to compose useful information, such as KPIs, from the huge amount of data. Sometimes, the managers forgot to include some data in their calculation. The second problem happens when the company has to deal with banks for obtaining more funding. The records in the company did not follow adequate accounting procedures. After the managers obtained support to make the records following accounting procedures, they confused on the real meaning of those numbers. Therefore, they only focused on the value of profit and the cash flow of the company.

At that point of time, we proposed LIA. After a long discussion about the features of LIA, the manager agreed that there are four contributions or benefits in using LIA. The first contribution is that LIA provides an easy way for the INBUS to record its financial transactions, according to the SAK-ETAP implementation. The person who enters the data into the KIS will only faces five modules,namely: (1) module for selling the garment products, (2) module for purchasing inventories, (3) module for purchasing fixed assets, (4) module for general issues, and (5) module for production processes.LIA will categorize automatically the data recorded from each of the module to specific accounts, according to the SAK-ETAP procedure. Thus, the employee who records the transactions does not need to have high accounting capabilities. LIA is able to provide the company's financial statements.

The second contribution is that LIA can provide information of the sixteen KPIs automatically. Using LIA, there is no need for the managers to calculate the data such as previously they has done with Excel. Table 3pinpoint the use of a KPI resulting from LIA. This KPI shows up-to-date information regarding the standardized use of the fabric per group product. This KPI is crucial when the managers want to evaluate the performance of employees in the cutting department. For instance, for each kg 'combat' fabric material, the sewing employees have to be able to produce at least six pieces clothes of children polo shirt.

Table 3. The example of the average use of fabric per group product.

Group product	Kinds of fabric	
	Combat	Lacoste
Children polo shirt		
a. Clothes	6 pieces per kg	5.5 pieces per kg
b. Ripe	148 pieces per kg	148 pieces per kg
Adult polo shirt		
a. Clothes	3 pieces per kg	3 pieces per kg
b. Ripe	120 pieces per kg	120 pieces per kg

Source: data processing from historical data of SJ.

Using this KPI, INBUS managers can monitor the performances of the employees in sewing department. Aware of a tight control from the managers, the sewing employee will try to work at their best. When the employee failed to catch the standard, LIA will show it as an outlier. LIA will give an early warning to the managers. With this feature, the managers will be easier to communicate with the employees to investigate the reason of the event. If the event is because of the ineffectiveness of the employees and it happens repeatedly, LIA will recommend the changes in the employees' final wages. This bad performance will have a direct impact to the final wages.

LIA shows the standard value stated by the managers and the average from the production processes. With this feature, the managers can evaluate the need to change the standard value. The managers also can order LIA to not use data from specific outlier production processes in calculation the average.

In summary, LIA supports the managers as if it is a professional garment manager who monitors closely the production processes. The problems in productivity and business development may still occur but the managers will be able to minimize this risk by being aware of it soon. The managers can directly coordinate and communicate this issue with the supervisors to prevent the same situation in the future.

The third contribution is that LIA is able to provide numerous financial calculations and the interpretation for the result of those calculations. The knowledge extracted from KIS makes the interaction with LIA is similar with the interaction with a financial expert. LIA is able to provide financial expert's opinion regarding the possibility cause of the changes on the financial numbers. In analysing the financial performance, LIA use the DuPont model in the first stage. For a non-financial expert, the interpretation of the results of the DuPont model is not as easy as the calculation of the data in the model. It becomes a complicated challenge for INBUS managers. The interpretation of the results may vary since the changing and the composition of each factor can lead the analyst to a different conclusion. We singled out this contribution for an extensive overview in a separate section (see section 4).

The fourth contribution is that by using LIA regularly, the managers will be able to learn on how to analyse his business. The logic of thinking of financial experts stored in the KIS will be transferred to the manager. For example, when the managers compared Return on Assets (ROA - a measure of management efficiency) year to year, they found that the productivity was decreasing 2.24% from 2006 to 2007 (see (V) in Figure 2). However, the managers could not interpret that the management was not efficient from 2006 to 2007. Even the decreasing in ROA shows that a business has gone worse, the managers should check other financial indicators. LIA provides some possible reasons why the decreasing number happened. One of the possible reasons is an additional in asset during the period. LIA pinpoints that there was a huge amount of outflow for investment in 2007 (IDR 110 million; see (W) in Figure 2). Based on cash flow analysis, LIA provides evidence that the increasing was caused by an addition of a gross fixed assets. INBUS bought a new thread machine to support its existing three thread machines.

6. Conclusions

Most of the ISGMs have four weak points, namely (1) a lack of capital, (2) a lack of skills, (3) problems in productivity and business development, and (4) a lack of communication and knowledge sharing among managers. To overcome the last three weaknesses, we propose the use of KIS. KIS is one of the artificial intelligence products that it is able to deal with experts' knowledge in a specific field.

LIA provides sixteen KPIs which are used for giving an in-depth insight into the activities of the company (see Gunawan, Wahdan, van den Herik, & Kornarius, 2011). Using the financial data from the AIS, a standard value for each KPI can be formed. This standard value will be used when the manager wants to set a performance standard that must be achieved by the employees. Using the knowledge stored in the KIS, a manager will be able to obtain the insight about the ISGM's previous performance. This knowledge can be used for supporting the manager in monitoring the business weekly. Learning from the KIS, the manager also will be make adequate strategy to maintain productivity and quality level, and to control the production cost.

LIA will not only support the manager in managing internal issues of the ISGM but also in dealing with external financial parties such as banks. LIA helps the manager in recording the daily financial transactions according to Indonesian accounting standards (SAK-ETAP). LIA converts those accounting data into valuable financial information. The knowledge stored in the KIS will support the manager to identify the possible cause of the changes in the financial statements. The KIS provides interpretation for the result of each financial statements analysis. Based on continuous use of LIA, the manager will be able to learn how professional financial experts analyse and evaluate the financial performance of the ISGMs.

To be precise, LIA contributes to four benefits for INBUS, namely (1) the use of LIA eliminates the need of having an employee who has high competency in accounting, (2) the managers will be alerted when the production differs significantly from the standard value,so, the managers can directly coordinate and communicate this issue with the supervisors to prevent the same situation in the future, (3) LIA helps the managers to compute and to provide possible interpretation for the numbers resulting from financial statements analysis, and (4) the managers will learn how to manage the business by using the knowledge of the company and the knowledge on how to use the financial statements analysis.

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