Towards the Smart Industry for the Sustainability through Open Innovation based on ITSM (Information Technology Service Management)

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***Abstract*—The Indonesian coffee industry has become a trend that has a strategic role and potential for the livelihoods of the business people in it, as well as Indonesia's economic growth. One of the trends that stole attention is the concept of smart industry, the concept of a digital-based industry that is highly relevant to technological developments in this era. When companies want to implement a smart industry, companies need a strategy to implement IT (Information Technology) so that the investment spent is right to build the company's targets. This study aims to design a systematic IS/IT strategy to realize the concept of smart industries that are effective. The analysis and design method used is the Ward & Peppard framework which consists of two phases, namely the input and output phases. The input phase consists of internal business analysis, external business, IT internal and external. The output stage includes the design of IT management strategies, business information systems and IT strategies. The results of this study are in the form of a portfolio of IT designs at the Margamulya Coffee Producers Cooperative consisting of business strategy designs and IT management.**

***Keywords*—Smart industry; Ward and Peppard; IS/IT strategy**

I. INTRODUCTION

Industry 4.0 requires many companies to use these technologies to move to a digitally connected industrial environment, providing regulatory and legal flexibility for additional ubiquitous, cloud-based production. It is management and can provide hands-on training and innovative education [1]. After a successful implementation, some potential benefits can be recognized, but the resulting effects are not always obvious. In addition, the impact of making changes to the current production environment, and therefore the risks, is difficult to predict. If you know the consequences of your changes, you can always look forward to them in multiple steps and can easily modernize and change your manufacturing company [2]. Coffee is the third largest contributor to foreign exchange for plantations for Indonesia with a total plantation area of 1,227,787 ha. The level of coffee production in Indonesia reached 11,491,000 tons in the period 2016-2017 while occupying the position of the 4th largest coffee producer and exporter in the world. Based on company status, the Indonesian coffee industry is divided into three categories, namely smallholders, government, and private.

Smallholders are plantations owned by households and are not a legal business entity. In general smallholder farmers form a legal community called the Cooperative. Meanwhile, with a land area of 96.19%, smallholder farmers are the largest contributor of all types of coffee producers, both private and government. With this strategic role and potential, Indonesian coffee smallholders are expected to continue to grow amid global competition. However, Indonesian coffee smallholders have complex problems, namely low-quality control, inadequate infrastructure, climate change, socio-economic conditions and technological limitations. In the end, these problems have caused various losses in the Indonesian coffee industry such as vulnerability to price fluctuations, crop failure and low productivity. The benefits of smart industry for organizations is that product development can be faster, save resources, improve productivity, increase the need for skilled labour, increase investment, make optimal decision making, engineering. Business processes become dynamic, and can give birth to new business models and new ways to create added value. However, in Indonesia, technological issues are included as one of the main problems that hinder the development of the industrial sector, especially in the type of Small Medium Enterprises (SMEs).

The method used to design information system in the KPKM is the Ward & Peppard framework. The strengths of Ward & Peppard's framework are, in the business analysis phase that can design business strategies before entering the IT strategy design phase, the classification between the definitions of IS and IT is structured to facilitate the strategy to be understood, the existence of external analysis that can take into account factors outside the company that affects the company's business processes, and the steps taken do not have to be sequential so that they can prioritize which steps are most likely to be done. This framework is divided into 2 stages, namely the input and output stages. The input phase includes analysis of internal business, external business, IT internal and external. At the output stage consists of designing business strategies, IS, IT and IT management that will produce a portfolio of what Information Systems will be needed to support the company's business processes. The output produced in this study is in the form of a portfolio of strategy designs. It is hoped that this strategy can help coffee cooperatives in realizing the application of smart industries to increase the competitive advantage and productivity of cooperatives and can be a solution to smallholder problems in general and specifically on the object of study.

II. Literature Review

A. Digital Transformation

A coffee shop lifestyle as a trend in modern society can be a good business opportunity as competition intensifies among entrepreneurs. The growth of coffee shop consumers is accompanied by the growth of entrepreneurs, who are now very popular with the youth. The most important thing about having a coffee shop is promoting on social media. Using filters on social media or application in the phone is a very valuable way for someone or a product to convey expectations to consumers [3]. One such potential tool for coffee farmers is to foster a strong awareness of profitability across their geographic regions given the importance of scenario planning in the coffee production cycle. Understanding the spatial characteristics of profitable producers can provide better decision-making insights into production and management decisions in the coffee industry, even across the globe [4]. This digital transformation has become one of the pillars of industrial strategy that has completely changed the job patterns of the majority of industrial applications, and companies need their employees to understand and use the new developed business models. Therefore, interests of this transformation are characterized by mastering the process of digitization of operations, redefining of business lines, good data analysis, and rapid integration within the organization [5], which collaboration and data sharing become the key consideration.

The adoption of smart industry concepts, including operating procedures, technologies and systems, is dependent on human factors. Training, professional function, well-being, human performance, and physical and mental health are factors that influence the decisions and behaviors of one or more productive organizations. Human workers want to enter the market, stay in the market, building their careers, earned fair wages, stability, intellectual growth, learning, and / or professional achievement. On the other hand, companies generally want the best possible human performance to improve productivity [6]. The limitations and requirements placed on the devices and systems used depend heavily on the application chosen and the layers considered [7]. In addition, ensuring adequate production of coffee plantations requires government support for additional investments in construction that have a negative impact on the ecosystem [8]. Despite the apparent efforts of the scientific community to articulate the vision of strategic alignment of IT and business, IT and business are inevitably dynamic so that organizations can be applied to the real world. Contributions to this topic grow very rapidly, but the relationship between assumptions and conclusions is inconsistent and inconsistent. The main reason is that the proposed model is highly conceptual and detached from the actual reality of the organization [9], [10].

B. Profit Optimization

The main goal of the transition to the smart industry is to enable organizations to monitor machines and equipment directly in real time by implementing smart operations using machines that can analyze their data and predict when maintenance will take place. It also improves supply chain management through product tracking, logistics tracking, inventory management, and scanning real factory process cases to clear processes in use and verify compliance with designed business processes [5]. Interestingly, at certain countries, the number of profit was earned from coffee industry has the power in economic to strengthen the national currency through hexport import trading [11]. Of course, critical factors can be linked to the support from government regulation related to the tariff barriers [12]. Therefore, ultimate developments, especially post-harvest processing, can add value to coffee products, open up business and employment opportunities, and can lead to a wider multiplier effect [13].

In the coffee industry, some by-products are produced during the production and consumption of coffee, which makes them an important waste from an environmental point of view, preventing the worst in the future, and detrimental to long-term operations [14]. One way to increase quality awareness is to emphasize brand personality. When communicated properly, there are personal characteristics that are preserved to create value for potential customers in increasing the quality of the brand itself [15]. The upgrade process with appropriate technology allows company to better respond to competitors in the globalized market through high added value activities, achieving a better positioning process in the international market and help promote it. It may have a positive impact on the sector or industry by improving value chain practices to improve performance, increase return on investment, and ultimately improve profits [16].

C. Innovation Ecosystem

Rapidly changing topics are underway for a future where less has and more is shared. Home appliances are connected via the Internet of Things (IoT), and homes are powered by renewable energy. New entrepreneurs take inspiration from the success of the founder's last wave, in which several web services are available to facilitate entrepreneurship and improve access to capital. Industry 4.0 is an industry approach that addresses all aspects of the industrial operating model, including culture, management responsibility, and interaction with regulators that require companies to consider new models in the ecosystem [17]. Most industries began with some kind of invention, such as telephones, light bulbs, radios, and television. Credits for the invention are awarded to the inventor, while credits for establishing the industry are awarded to entrepreneurs who establish new companies. There is the required question on the exact definition on what happens before industry, and not just how it emerged or who the perpetrator is involved but when they participate and how they participate [18]. In the technology-intensive industries, the teamwork process is often complicated by dispersed interests among industry participants. Such competition can hinder teamwork, as industry participants fail to advance their own interests and the interests of the industry as a whole to gain legitimacy.

Like the history of the Industrial Revolution, innovation also has evolved in several stages. In the beginning, it can be defined as a closed or regulatory binding innovation, in which the most of new ideas are the result of the organization's in-house research and development to develop its own core competencies such as Bell Labs and NASA. The second stage is collaborative innovation in which the organization collaborates with outside sources or partners for value chain

innovations such as Apple, Dell, Zara, and Boeing. Therefore, the third stage is open innovation, as organizations search for new sources of innovation internally and externally. This is very similar to the crowdsourcing innovation that the most famous ones are NineSigma, InnoCentive, and YourEncore. Then, the trend is shifting to Innovation 4.0 or co-innovation where the organizations develop an innovation ecosystem to evaluate and approximate the ideas generated through all useful sources, including in-house research and development, collaboration, open sourcing and co-creation with clients and partners to create an implementation plan [19].

The future of the ecosystem should be seen as a new paradigm as a set of cutting-edge technologies that support effective and accurate engineering decisions in real time by introducing various ICT technologies and integrating existing technologies [20]. The innovation ecosystem concept put more emphasis on value creation and collaboration where the companies co-evolve capabilitie around a new engagement method or mechanism to support new product, satisfy customer need and incorporate to the advancement process competitively [21]; the question of who belongs in an ecosystem and who does not cause the natural and natural problems of the ecosystem structure. The diversity in the types of participants, their roles, and their interconnectedness means that issues are not distributed evenly among the participants. The interconnectedness of ecosystem participants also raises the issue of how ecosystems are coordinated and managed. In many cases, there are central companies that coordinate services for the system. These firms may control the technology or brand architecture that drives the value of the ecosystem, and coordination may depend on the management of the architecture in regards to organizing access to specific common platforms. Indeed, a large subset of the literature proposes platforms as tuning artifacts used by pivotal firms, services, tools, and technologies that other members of the ecosystem can use to enhance their unique performance characteristics [22].

III. Methodology

The smart future should help innovate and develop smart solutions to complex problems and ensure a human environment with dynamic change. This is due to natural phenomenon, the deliberate design of human ingenuity, or the cooperation of individuals and can be classified as incremental (exploitative), radical (exploratory), ambidextrous (responsive) and disruptive (destructive) [19]. In this case, Ward & Peppard framework was adopted. By using the business and IS/IT environment analysis as an input, the output of this framework consists of business/IS strategy, IS/IT strategy, and IT strategy. There are several analyses used to generate business/IS strategy, the step by step shown in the following Fig. 1, Business Environment Analysis, which started from business environment analysis on both internal and external side.

This business environment analysis aims to assess the strength-weakness factors from the internal environment and the opportunities-threat factors from the external environment. These strength and weakness factors are internal factors that are generated from the business processes that occur within Margamulya coffee producer called KPKM. While the opportunity and threat factors are external factors that explain things that can affect the business processes within the organization, both direct and indirect.

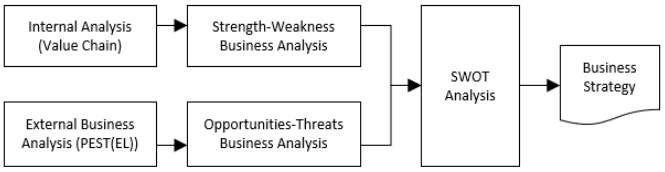

Fig. 1. Business Environment Analysis.

The next step is to align the business strategy generated from previous analysis into IS/IT strategy needed by KPKM. Critical Success Factor Analysis (CSF) used to map the main factors considered in achieving the organization's vision and mission. Based on the results of CSF, an information system (IS) to be developed was formed, which indirectly support the KPKM business strategy. Those information systems are mapped using McFarlan quadrant.

The last step in Ward & Peppard framework is generate the IT strategy and infrastructure to support the IS strategy. IT requirements are carried out by mapping IS/IT strategic principles with IS requirements.

IV. Result and Analysis

A. Internal Analysis

In the formulation of the IS strategy at KPKM, the first step taken is a business analysis from both internal and external sides. Analysis of the business environment aims to see and assess the strength - weakness factors of the internal environment and the opportunities - threat factors of the external environment. These strengths and weaknesses are internal factors that are compiled from the business process that occurs so that the advantages and disadvantages of KPKM are obtained. On the business process, the opportunity and threat factors are external factors that explain things that can affect the running of an organization's business processes, both direct and indirect. Many manufacturers are already leveraging smart plant components in areas such as advanced planning and scheduling with real-time production and inventory data, or augmented reality for maintenance. But a true smart factory is a more inclusive effort, going beyond the manufacturing floor to impact businesses and the wider ecosystem. Smart factories are essential to a wider digital supply network and have multiple aspects that manufacturers can leverage to better adapt to changing markets. On the one hand, industrial policy is designed to encourage exporters by offering special treatment to preferential sectors, such as tax exempt periods, large investors' access to land, and special credit terms [23].

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adapt to changing markets. Based on activity internal to the analysis value chain, subsequently carried out the analysis by doing the identification of the factor of strength and weakness of the activities of internal compiled from the business to get things that become advantages and weaknesses of KPKM in the business, which is based on SWOT analysis in Table I, Internal Analysis.

TABLE I. INTERNAL ANALYSIS

S /W	Internal Condition Indicator	Internal Activities
Strength	Has a unique coffee taste characteristic	Cultivation
	A good brand image with the various champions that have been achieved	Marketing and cultivation
	reliable, has various certificates both national and international	Audit
	Has relationships with various business sectors	*Public Relations*
Weakness	Low accountability	Production, Finance and secretary
	A less transparent financial system	Finance
	Low Documentation	Finance and marketing
	The capital system still depends on the bank	Finance

B. Root Cause Analysis

Root Cause analysis is used to identify the root of the problem which becomes weakness KPKM with the results of this analysis will be processed into input as can be seen in Table II, Root Cause Analysis, that later on use as the requirements needed to produce reference solutions. Most organizations cannot focus on just one type of innovation, exploitative or exploratory. Many organizations have specific core competencies that are built over time, which can continually improve these capabilities to increase your productivity to generate additional financial benefits. However, in a volatile and rapidly changing market environment, we cannot focus on improving our existing core competencies. Therefore, exploratory innovation is essential. An important strategic issue for enterprises is to balance exploitative and exploratory innovations, making use of their existing core competencies, while striving to develop new competitive advantages through exploratory innovations. When workplace problems occur, the immediate symptoms are hard to overcome. In other words, the root cause has not been addressed and needs to be fixed multiple times. Organizations that can strike the right balance between the two types of innovation can not only alleviate the tension between two major pathways to innovation, but they can also pursue the synergies between their strengths. In this way, an eye-catching innovation is a rapidly changing market setting where organizational strategies are global, technological advances, dynamic changes, global urbanization trends, and environmental sustainability initiatives to create competitive advantage [19]. To commercialize new technologies, licensing is often used to existing companies rather than by step-by-step, which is the traditional method of technology transfer.

TABLE II. ROOT CAUSE ANALYSIS

Problem (*Effect*)	**Cause (*Cause*)**
Low Accountability	There is no recording process
Financial System Lack of Transparency	Financial accountability systems are less informative
Low Documentation	Document storage is still paper based
	Document storage is not organized and centralized.
The financial system is not yet independent	The financial capacity of cooperative members is inadequate

C. Requirement Analysis

Requirement analysis is the process of determining user expectations for an application that has been created or modified. In short, it includes every task that is performed to identify the needs of different stakeholders within the organization environment, at certain extent may relate to the culture. Therefore, it means analyzing, documenting, validating and managing software or system requirements that are high-quality documented, workable, measurable, testable and traceable requirements that help identify business opportunities and systems. It is defined to facilitate design. An entrepreneurial process can take place in any enterprise or organization and hence even the government can host such a process. The government's role in entrepreneurship is particularly wide-ranging, given that the decisions and policies adopted can contribute directly to the development of entrepreneurial activity in the sector by both private and public companies [23]. The coffee industry is attracting attention as a product that a large proportion of consumers around the world buy frequently daily at social events, as well as the interest of non-governmental, governmental, multilateral and development professionals with early adoption of certain standard in developing the strategy. Therefore, it is not surprising that coffee remains at the forefront of sustainability initiatives going beyond other agro-industries in response to the growing interest in sustainability [24].

Typically, IT management stakeholders use the integration of enterprise applications strategically from the top down rather than technically from the bottom up. Initially, through the systematic integration of BPM technology, knowledge management technology and social software, supporting the value-added processes of modern enterprises would be an entirely new IT quality. In a good organization, all value-added processes, whether formal or tightly organized and informal, and social processes are subject to management and IT support [26], [27]. The Table III, Requirement Analysis shows the requirement analysis by aligning internal activity and objective of the organization based on internal activity identified in the organization.

D. External Analysis

External analysis means investigating the company's industry environment, including factors such as competitive structure, competitiveness, dynamics, and history. At the macro level, external analysis includes macroeconomic analysis, global, political, social, demographic and technical analysis. The primary purpose of external analyzes is to identify opportunities and threats in an industry or any sector that drives

profitability, growth and volatility. Firms make decisions on sustainability issues based on available information and management is responsible for considering the best information. In the case of sustainability, decision makers often face complex and ambiguous scenarios, and as a result, they do not make fundamental changes to enhance the company's sustainability. It is also true that companies are becoming more interested in developing environmentally friendly and healthy products, so they should prioritize profits in decision-making and not use them as an excuse to not take any action [24]. It is possible to increase profits while protecting the environment by reducing waste or emissions, in which most occasion, societies still ask more due to the expectation of the industry to take active role in the issues of environmental and ecological.

To complete and support the external analysis, companies need to conduct a survey of the political, economic, social and technical situation of the industry, which is also known as PEST analysis as can be seen in Table IV, PESTEL Analysis. In politics, the analysis on issues such as international trade barriers and changes in the regulatory environment consists of several issues in the economy, such as interest rates, exchange rates and inflation. On the other hand, social demography raises the issue of changing populations and age groups, while technical issues represent scientific progress, research and development investments, and emerging technologies. The main purpose of PEST analysis is to use business plans to test major external shifts in the industry, and strategies must be updated to align with common industry trends. In fact, this data helps organizations get to know their customers better, and suggests increasing sales, especially in the form of differentiating marketing strategies and creating targeted marketing. Companies can also change their supply chain and adapt to obtain more accurate data from their partners [28].

TABLE III. REQUIREMENT ANALYSIS

Internal Activity	***Objective***	***Requirements***
Production, Secretary & Finance	Increase accountability	There is periodic reporting of information from each division to the central management
		The existence of a clear and efficient format and recording procedure.
Secretary & Finance	Increase the role of information documentation	The documentation process is digitized
		All cross-sectional documents are integrated and can be managed centrally.
		Cooperative documents can be stored safely and can be accessed easily by those who need them
Finance	Increase Financial Transparency	The existence of regular reporting in a shorter period of time (per week to per month)
		Financial statement information consists of a complete and accountable collection of data elements
	Has an independent financial system	There is access or media that makes it easy for each member to find out the results of cooperative financial reports
		Increase the income and welfare of members

TABLE IV. PESTEL ANALAYSIS

PEST (EL)	**External Environment**	**Impact on Organization**
Political	The West Java Provincial Government is specifically paying attention to the coffee industry with the campaign "World Quality Java Preanger, Towards the World Market"	**O-1** Create opportunities to massively market products and receive assistance in various forms (subsidized tools, seeds and training)
	Jokowi, as the president, will issue a policy on forest land use under a 30-year contract	**O-2** Cooperatives will find it easier to collaborate with borrowers and sponsors.
Economy	Trends in world coffee consumption and foreign currency fluctuations greatly affect the selling price of coffee	**O-3** The selling price of Gunung Tilu coffee can be high
		T- 1 The selling price of Gunung Tilu coffee could be lower
	Vulnerability of IJON practice	**T- 2** Causes farmers to sell coffee at a lower price and not distribute it to the cooperative
Social	The number of coffee industry players in the Bandung Regency environment in particular.	**O-4** Must have relations among themselves because of the need for imports which must have a certain quota
		O-5 In terms of marketing, in general, between them can complement each other's customer demands.
		T- 3 When the demand for Preanger (West Java) is low, a similar coffee industry can become a competitor
	participation of the international community through certification	**O-6** Can guarantee the welfare of farmers
Technology	The role of ICT in the industrial world has developed rapidly, therefore adequate infrastructure is needed by cooperatives	**O-7** Can provide competitive advantage, efficiency and various other advantages if implemented properly
		T- 4 If it cannot adapt to developmental conditions, it will be difficult for the competitiveness of KPKM to increase. In the end, it was difficult for KPKM to advance to the level of an independent exporter.
Environment	Unpredictable climate change	**T- 5** The emergence of various diseases in plants, aham appears and has the potential for crop failure
Regulation	The Indonesian government regulates the operation of cooperatives Law 25 of 1992 where the Law requires cooperatives to regulate several principles, capital, business processes and organizational structures that must exist in cooperatives	**O-8** Facilitates cooperatives in shaping their organizational principles and forms.
	Law 19 of 2013 regulates agricultural cooperatives in importing, extension services, and land empowerment	**O-9** Make it easy for cooperatives to import and minimize the potential for fraud by competitors

After defining the strengths, weaknesses, opportunities and threats of the organization, a business strategy is mapped based on a matrix of strengths-opportunities (SO), weaknesses-opportunities (WO), weaknesses-threats (WT) and weaknesses-opportunities (WO) as shown in the following Table V, SWOT analysis.

Based on the SWOT analysis, a business strategy is generated as shown in Table VI, Mapping Business Analysis. Then the new business strategy is then being compared with the old business strategy as depicted in Table VII, Comparison Analysis.

TABLE V. SWOT ANALYSIS

	Strength (4 factors)	**Weakness (4 factors)**
Opportunities (8 factors)	Strengthen the role of *branding* and marketing functions. [1]	Following international coffee certification. [2] Technology optimization to improve internal / external transparency, customer service quality and data utilization. [3]
Threats (6 factors)	Carry out research and development efforts [4] Collaborate with organizations that specialize in agriculture and / or meteorology [5]	Implementing an integrated SI, especially in the production, membership (HR), finance and reporting business processes [6] Improvement of education methods and capital systems [7]

TABLE VI. MAPPING BUSINESS ANALYSIS

Internal Business	**External Business**	**Business strategy**
S-1 Has a unique coffee flavour characteristic	**O-1** Opportunities are created to market massively products and receive assistance in various forms (subsidized tools, seeds and training)	Strengthen the role of *branding* and marketing functions
W-5 The capital system still depends on the bank	**O-5** International Community Can guarantee the welfare of farmers	Following international coffee certification
W-1 Low accountability W-2 A less transparent financial system	**O-6** Can provide competitive advantage, efficiency and various other advantages if implemented properly	Technology optimization to improve internal / external transparency , customer service quality and data utilization
S-1 Has a unique coffee flavour characteristic	**T-2** The selling price of Gunung Tilu coffee could be lower	Conduct research and development efforts
S-4 Has collaborated with various business sectors	**T-6** Bad weather causes crop disease and crop failure	Cooperate with organizations that specialize in agriculture and / or meteorology
W-1 Low accountability **W-2** A less transparent financial system	**T-5** If it cannot adapt to developmental conditions, it will be difficult for the competitiveness of KPKM to increase	Implementing an integrated SI, especially in the production, membership (HR), finance and reporting business processes
W-5 The capital system still depends on the bank	**T-3** Causes farmers to sell coffee at a lower price and not distribute it to the cooperative	Improving education methods and capital systems

E. IT Business Alignment Strategy

The points to be considered in the preservation of the coffee industry relate to the role of the natural environment and characteristics of the ecosystem, the existing traditional agricultural knowledge and local farming practices, and the socio-economic conditions of the agricultural community [25]. Consider the development of same concept of smart but different field, the input-output development model, which considers a diverse set of smart city domains, characterizes the externalities of resources, productivity, applications, and establishment processes. “Resources” relates to human resources, knowledge, creativity, ICT infrastructure, and financial assets. Productivity is categorized as "dynamic productivity" and "management and leadership capacity" that adds value to resources and turns them into intended outputs. “Applications” are related to outputs, and “externalities” are management and regulation, technology, governance, policy contexts, people, economic infrastructure, and environmental conditions [29], [30]. Undoubtedly, there is also widespread criticism of the concept of intelligence in relation to an important and important issue that is the fairness of one of the beneficiaries of the smart industry strategy and do local citizens benefit from their investments more than economic and political actors [31].

Increased social distancing affects the number of interactions, the potential for knowledge and creativity sharing, and trust in society. Digital or technological disparities are specific issues that some smart action can address by providing all citizens with access to technology or specific knowledge. While the technology itself opens the gaps, it is taken for granted that smart concepts have a promise to bring them to an end. This has to be anticipated and planned for both cases as there has to be a balance between efficiency and equity that is of course required the support from the government such as the regulatory and tax incentive [32], [33]. In aligning the cooperative business strategy into the KPKM strategy where the information on the analysis process is needed to identify the needs that are in line with the business strategy, which in this case using the Critical Success Factor (CSF) analysis which is used to map the main factors that concern the organization in achieving the organization's vision and mission. Based on the results of observations and interviews, a CSF was obtained for each of the KPKM Business Plans as in Table VIII, Business Plan below. Further based on CSF, the information system is mapped using McFarlan quadrant which divided into four (4) types namely Strategic (St), High Potential (HP), Key Operational (KO), and Support (Sup). The result of mapping analysis can be seen in Table IX, Mapping Using McFarlan Quadrant.

TABLE VII. COMPARISON ANALYSIS

No.	Old Business Strategy	New Business Strategies
1	Improve member welfare	Improve member welfare
2	Expanding the types of products / services	Expanding the types of products / services
3	Build credibility of cooperatives to stakeholders who have the potential to prosper farmers.	Build credibility of cooperatives to stakeholders who have the potential to prosper farmers.
4	-	Increase member loyalty and trust
5	-	Improve product quality
6	-	Maintain the continuity of the organization
7	-	Improve service quality
8	-	Increase market segmentation and penetration
9	-	Developing an independent capital system

TABLE VIII. BUSINESS PLAN

Strategic theme	Strategy Explanation	CSF	Information Needs	SI Strategies and SI Needs
Increased member income	Maximizing the income of each member	Good knowledge and skill	• Knowledge level of member • Member profile • Member needs • Types of training and development	Create a system that can measure and provide information related to member performance and training information. - IS (Information System) training and member profiles integrated into HRIS. - Features measuring the level of knowledge of members integrated in HRIS.
Build company credibility towards stakeholders who have the potential to prosper farmers.	Increase trust in consumers, potential consumers as well as partners and prospective partners	Participation in national and international certifications	• Level of certification readiness • Audit report	• Creating a special system related to certification including the specifications for the audit report and documentation requirements. • Creating a reporting system for each part of the cooperative that is centralized to the core board. • Determine the format and recording procedure. - Create an IS Audit
Increase member loyalty and trust	Accountability and transparency of assets.	There is informative data on assets and finance	• Subsidies and external assistance • Cooperative finance • Asset and borrowing records	• Realizing the financial reporting mechanism consisting of complete and accountable data elements. • Make it easy for members to access and find out the results of financial reports. • Become a media for routine cooperative financial reporting. - IS Finance • Create IS that can record and notify members regarding old and new assets - IS Asset Management system
Expanding the types of products / services	Have product / service innovations in accordance with market needs	Marketing effectiveness The quality of the type of product / service	• Criteria for segmenting prospective customers • Position of organization among competitors • Detailed product / service innovation research	Making IS that can help make organizational decisions in terms of marketing and product / service development. - Customer Relationship Management - IS Marketing - Business Intellegent
Improve product quality	Have good product development and production management	• Can consistently maintain product quality • Possess innovative and efficient cultivation and processing techniques	• Product specifications • Type of product processing • Recommendations for cultivation and / or processing innovations	• Build IS that can record and analyze the production process, and can provide suggestions related to improving the quality of cultivation and production. - IS Cultivation and Production
Organizational sustainability	Guarantee the regeneration of cooperative	• Have authentic documentation both on the	• Annual Meeting result • Company Profile • Documents of each section	• Creating a reporting system for each part of the cooperative that is centralized to the core board.

	management	management and function side of each division of the cooperative. • Cooperatives are able to compete with competitors	of the cooperative	• Determine the format and recording procedure. • Making IS that can digitize the cooperative strategy record (Annual Meeting) and the work of each section. • Keep cooperative documents safely and easily accessible to those who need them . • Making cross-sectional documents can be integrated at the same time can be managed centrally. - Archive feature in IS Asset Management - Profile feature on cooperative websites
Improve service quality	Improve the quality of service to customers and potential customers	Have services and provide information that can be accessed at any time by customers or prospective customers and can accommodate suggestions or criticism	• Information on services and product variants • Cooperative location and contact information • Payment information	Create various e-banking or fintech features and handle purchasing services - Multi paymnet purchuse system - Feature services are contained in the Website
Has an independent capital system	Transfer of capital originating from the bank to members and sponsors	Each member is able to contribute a large amount of capital	• Member profile • Member financial level	Provide information on the financial capacity and condition of members (health, children's education, etc.) - Financial data of members in HRIS

TABLE IX. MAPPING USING MCFARLAN QUADRANT

Information Systems (IS)	**Function**	**Type**	**Explanation**
Human Resource IS	A system for monitoring the welfare conditions and performance of cooperative members	Sup	This system is only used to support the performance of KPKM members
IS Audit	A system for conducting audits and measuring certification readiness.	St	This system can increase the trust of stakeholders who have and will collaborate with KPKM.
IS Finance	A system for calculating, recording and managing cooperative finances in detail, accurately and transparently	Sup	This system supports the performance of the KPKM in terms of financial management
Asset Management	A system that records and manages asset data. Starting from procurement, repair to borrowing assets.	Sup	This system supports the performance of the KPKM in terms of asset management
Customer Relation Management	A system that analyzes and predicts customer behavior as a decision support tool 3	St	This system is used to support the performance of the KPKM in identifying customer needs
IS *Marketing*	A system that manages all product marketing activities carried out by the marketing department from measuring the performance of the marketing team, achieving sales targets to designing marketing strategies.	HP	With this system, it is hoped that KPKM can improve the performance of marketing activities
BI	System To provide information on policy indicators quickly and accurately to cooperative administrators in setting policies.	St	If this system does not exist, the cooperative management will not have accurate information
IS Cultivation & Production	A system that helps monitor, manage and make decisions regarding cultivation and production activities	KO	This system helps and provides accurate data about the efficiency, effectiveness and development of cultivation and production processes.
Official Website	Help market cooperative products and services, display cooperative profile information, and become a medium for customer service.	HP	With this system, KPKM can facilitate promotional activities and services to customers
Multi paymnet purchuse system	Providing an electronic transaction system through various types of payment methods that make it easier for customers to make transactions. The methods referred to are ATM, *Internet banking*, *Mobile Banking*, and *E Money*	KO	The absence of this system will make it difficult for KPKM transactions with customers who are familiar with using online-based payments

Information:

*) Types of Information Systems are classified based on the McFarlan quadrant which is divided into 4 types: *Strategic* (St), *High Potential* (HP), *Key Operational* (KO), and *Support* (Sup).

From the results of the identification of the information system using the CSF method, the results of the needs for the JPIC information system were obtained. The requirements for the JPIC information system can be mapped into the SI strategy portfolio using the McFarlan matrix. Starting with the situation in which all production activities are traditional, industrial cavitation can be considered as a situation in which companies in one country switch to more modern technology and the industrial sector in another country cannot participate in this movement. But in some industries, there are huge multitudes: access to cloud technology, predictive analytics, and IaaS services for both virtual data centers and storage systems, and the use of Monitoring Surveillance and Data Acquisition (SCADA) [34], [35], [36]. KPKM does not yet

have an existing technology-based information system, so the GAP between the existing IS & IT portfolio and the targeting business process is entirely new with the matrix for the SI-KPKM strategy can be seen in Table X, Matrix Strategy. The service operation manages the services the company is currently using, focuses on service management practices.

TABLE X. MATRIX STRATEGY

Strategic	**High Potential**
-IS Audit -CRM -BI	- *Official Website* -IS *Marketing*
Support	**Key Operational**
-*Human Resource* (HRIS) -IS *Asset Management* -IS *Finance*	-IS Cultivation and Production - *Multi payment purchase system*

One of the most important technologies is blockchain technology. In theory this is a clever industry concept that can provide many features such as replacing slow manual steps with fast automation, tracing the origin and characteristics of goods, including raw materials, semi-finished products and finished products. Information that includes passengers, timely payments, insurance and customs payments, and information to regulators about cargo and passengers includes participants such as exporters, importers, and carriers [37]. There are other technologies that are important components of a smart industry, which is the Internet of Things (IoT) provides convenience for continuous spatial analysis over a relatively large coverage area by optimizing between remote sensing and GIS to develop an ecosystem for digital innovation [38]. The growth of new digital industrial technology, also known as Industry Revolution 4.0, is an innovation that allows data to be aggregated and analyzed between machines, with faster and more efficient operations of high-quality products at a lower cost [39]. Other technologies, such as autonomous robotics, cloud computing and augmented reality, can also be seen as supporting the smart industry. Unfortunately, there are certain deficiencies related to the presence of a deteriorated educational system with low training of engineers where a lot of technology transfer but a low absorption capacity due to the small investment of local companies in research and development together with weak infrastructure to support smart industry concept with significance delay and no emphasis on the development of electronic product and weak articulation [40]. To understand the IS strategy in Table X, Matrix Strategy, we describe the application architecture layers consisting of the front office, middle office, and back office as shown in the Fig. 2, Layers of Propose KPKM Application Architecture.

Once the IS strategy has been defined, the IT and infrastructure are generated to support the information system. IT requirements are generated by mapping IS/IT strategic principles and IS requirements. The IT strategy can be seen in Table XI, IT Strategy.

Innovation is a tool to promote the sustainable development of education and attract the attention of teachers, educators and researchers around the world. The introduction of new concepts and technologies into the curriculum and the removal of old concepts and techniques is sometimes referred to as curriculum innovation [41]. The increasing social role of the coexistence of robots, humans, and technology is a precursor to unknown and possibly fundamental changes, but there is no single human perspective to this change [42]. Shifting product development to concurrent engineering mode requires industrial engineers to be actively involved from the initial concept design stage. Therefore, it increases product safety and participation in environmental issues, affecting individual workplaces and society as a whole. Code of Ethics is discussed in [43], [44]. Interestingly, the leading position of such new technological systems that support smart concepts is believed to be of great benefit to the economic catch-up and long-term competitiveness of developing countries [45].

F. Smart Industry based on Innovation Ecosystem

In terms of innovation, the position and support for employing research and development in the private sector has the strongest impact on patents for all sources of knowledge. In short, the quality of research in the university is very important to contribute to the smart industry [46]. Innovative companies are not isolated, self-sufficient entities, but are very environmentally friendly. This inclusion can have a significant impact on the innovation process, and it is not too far to assume that not all types of environments are equally suitable for a particular type of R&D activity [47]. The production elasticity of spending on R&D can be interpreted as an indicator of the productivity of inputs in the innovation process, and hence the efficiency of the innovation system in a given region. In particular, good availability of inputs for this kind of process, extensive division of innovative work, and superb knowledge among local stakeholders, either in the public research institute or in the private sector brings the flexibility to be relatively high if the site is spread out within company [48]. However, the smallholder coffee sector continues to suffer from a lack of efficient and effective support services such as publishing, credit and input supply. In particular, there is no for-profit company engaged in the growth and dissemination of improved coffee beans [49].

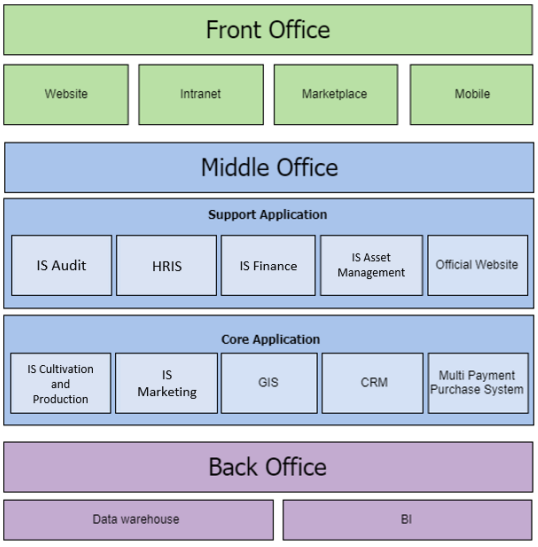

Fig. 2. Layers of Propose KPKM Application Architecture.

TABLE XI. IT STRATEGY

IS/IT strategy based on Int & Ext analysis	Information System (IS)	Information Technology (IT)	Information
The development of IS / IT integration is in line with the business strategy	IS Marketing and Strategy Archive system Multi paymnet purchuse system; BI; CRM	Web Server (APACHE); Database Server (MySQL); Platform (PHP); Multipayment Purchase System; BI; CRM	CRM software is recommended to use a third party, namely "FarmLogics". On the other hand, the ATM, Mobile Banking, E-Wallet applications will be connected via the server.
Appropriate IT security infrastructure (not under / over protective)		Unified Threat Management (UTM); Intrusion Detection System (IDS)	UTM and IDS are needed to deter and detect attacks from external parties
IS / IT development in managing and utilizing data	IS Finance; IS Asset Management	DSS; Intranet; Web Server (APACHE); Database Server (MySQL)	The DSS application on IS Finance will be integrated with SI Cultivation and Production to conclude a series of decisions. On the other hand, IS Asset Management will actively record internal borrowing transactions.
Development of a data exchange system with the government and certificate providers	IS Audit and Certification	Web Server (APACHE); Database Server (MySQL); Intranet	Data and information exchange system with internal and external auditors.
The development of IS / IT supports the level of production and quality of plantation products	IS Cultivation and Production	GIS; Web Server (APACHE); Database Server (MySQL); Android SDK (Java); Intranet	IS Production involves many technologies where GIS will generate geographic plantation information, while SDK will generate technical information (such as seed moisture, moisture content, etc.)
Increasing the number and competence of human resources who are experts in the IS / IT field	HRIS	Android SDK (Java); Web Server (APACHE); Database Server (MySQL); Intranet	HRIS uses an integrated and centralized application and website platform on the web server.
Adjustment of infrastructure capacity (network , server , storage) that supports integrated IS / IT		LAN network between offices, cafes and warehouses; Core Switch	LAN networks are needed for the acceleration and security of the internal information exchange process.

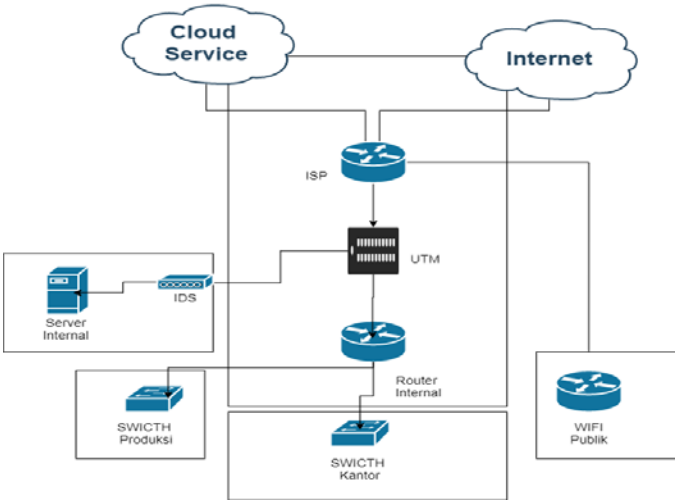

Fig. 3. New Network Topology.

To better understand the proposed infrastructure topology can be seen in Fig. 3, New Network Topology.

Due to the factors and their influence on the adoption of improved coffee production technology, access to credit, availability of non-farm income, level of education, availability of manpower and access to extension services, it is assumed that it has become evident to have a major influence on the adoption of scale. , The gender and age of farmers do not have a significant influence on adoption, suggesting that the improved coffee technology is primarily size, gender and age neutral. On the other hand, the decision to adopt agricultural technology for coffee households depends on their economic situation, farm characteristics, and institutional effectiveness [50]. On the other hand, other descriptive results show that there is a significant difference between employers and non-employees in terms of number of livestock ownership, spades or shovels belongings and model farming. This indicates that the ownership number is a typical farmer in which adult education and the possession of pruning shears have been found to have a positive effect on the adoption of coffee technology. On the other hand, family marriage and radio ownership negatively affected coffee technology adoption. Educating farmers through formal or informal programs, increasing production skills to strengthen and increase the number of exemplary farmers, providing pruning shears and improving the livestock sector focused are good policy recommendations where the presence has been disclosed [51]. On the other hand, the results of the multivariate model showed that the adoption was positively associated with improved recruitment of corn strains and the abandoned cows, which will enhance the adoption of other agricultural technologies. The land area, television, and radio ownership also have positively and significantly influenced the adoption of the improved coffee varieties while the distance to all-weather roads has a negative in decreasing the adoption of coffee varieties due to the remoteness of farmers from roads in all weather conditions. The size of the land and the education of the household heads also have a positive and significant impact on the adoption of improved varieties of maize but the distance between TLU and city area has a big negative effect [52].

TABLE XII. IS/IT MANAGEMENT STRATEGY

No.	IS / IT Management	Classification	Description
1	Making good IS / IT governance based on *best practices*	Regulation and governance	Design and use IS / IT governance that refers to *best practices* in the JPIC environment
2	Procurement and improvement of HR competencies in the IS / IT domain	HR	Recruit human resources in accordance with the needs of the cooperative as well as conduct training and briefings.
3	Addition of IS / IT division	Organizational Structure	Creating a special section that handles Cooperative IS / IT issues

Aside from infrastructure topology, following in Table XII is the proposed IS/IT Management Strategy for KPKM.

Specialty coffee is standardized throughout the coffee processing cycle, from selecting the criteria for growing coffee to brewing coffee for customers, with an emphasis on fruity, floral and citrus flavors. The coffee is rated higher organoleptic, which in fact that the coffee grounds must be able to pass the side or elementary grading and cupping tests [53]. The economic value of the coffee beans depends on the quality of the flavor, but the quality and quality of cupping for the three types of coffee varies greatly depending on the type and amount of compounds present in the esteemed beans [54]. Unfortunately, in many cases, all used warehouses can be classified as substandard, a condition that accelerates quality deterioration due to moisture loss, coffee weight loss and compensation between management and store managers [55]. After all, coffee has been cultivated, processed, roasted and brewed for many years, and coffee beans make up about 50% of coffee cherries, and it produces a large amount of by-products. In fact, coffee is the second largest commodity after oil and the second most popular beverage after water, and most coffee product manufacturers face high prices for imported raw materials and energy, which is a major factor [56]. Production processes such as extraction and drying are both energy intensity and environmental issues from many studies that have been identified to improve the quality of the flavor and other attribute within the coffee [57], [58].

In order to find out how significant the contribution of the proposed IS/IT strategy in optimization of the smart industry concept, measurements are conducted using the smart industry readiness index. The following Table XIII is the result of smart industry measurement.

TABLE XIII. SMART INDUSTRY MEASUREMENT

Dimension	Index						Information	
	0	**1**	**2**	**3**	**4**	**5**	**Existing**	**Targeting**
Vertical Integration							Undefined	Intelligent
Horizontal Integration							Undefined	Intelligent
Integrated Product Lifecycle							Undefined	Intelligent
Shop Floor Automation							Basic	Basic
Enterprise Automation							None	Flexible
Facility Automation							None	Basic
Shop Floor Connectivity							None	Interoperable and Secure
Enterprise Connectivity							None	Interoperable and Secure
Facility Connectivity							None	Interoperable and Secure
Shop Floor Intelligence							None	Computerized
Enterprise Intelligence							Computerized	Predictive
Facility Intelligence							None	Computerized
Workforce Learning & Development							Structured	Structured
Leadership Competency							Structured	Structured
Inter- and Intra-Company Collaboration							Structured	Structured
Strategy & Governance							Structured	Structured

Information:
*) As Is Index
To Be Index

V. CONCLUSION

In short, smart industry refers to a more responsive organization or company that allows all components in the supply chain to be shared in the form of an innovation ecosystem and uses smart technology to work with a variety of partners. The alignment IT and business strategy can guarantees the most effective transparency and collaboration, which is expected to eliminate the complexity of the existing problems with the development. Organizations manage relationships with different stakeholders, balance the three aspects of social, economic and environmental sustainability, to support green initiatives and plan using information and communications technology. It needs to link the systems and coordinate smart industry integration. It governs with a focus on the needs of customer-driven enterprises, especially using information and communication technology to make decisions, involve multiple stakeholders, and use collaborative methods with internal control and external cooperation.

Further research can describe more specific on the business strategy side. As for IS/IT strategy, further research can provide additional parameters such as financial by adding a Break Event Point to the technology investment list, in order to measure the readiness of cooperative organizations in implementing smart industry.

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