

# Development of Artificial Intelligence (AI) to Improve Agriculture, Business, and Education in Indonesia by UMG IdeaLab

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## Abstract

Artificial Intelligence (AI) has now achieved the ability to undertake a wide variety of tasks, ranging from general to specific tasks, including playing games, verifying mathematical algorithm, composing poetry, driving in heavy traffic, and even identifying symptoms of illness. UMG IdeaLab, that was established in 2018 in Jakarta, Indonesia, is a tech start-up incubator that has been seeking collaboration with many working sectors, including agriculture, business, and technology. More specifically, UMG IdeaLab has been supporting the advancement of e-commerce, agricultural company solution, AI robotics, AI education solution, speech recognition engine, and autonomous drone. Its mission is to develop Indonesia through technological solutions. To date, UMG IdeaLab has 8 AI companies from 33 affiliated companies that are considered innovative and provide solutions for Indonesia. The affiliation company such as PT. MSMB that provide the software and application for helping farmers to improve their agricultural productivity. This paper aims to provide a proposal for the development of AI in the business sector, particularly e-commerce in Indonesia.

### Keywords:

Artificial Intelligent, Business solution, UMG IdeaLab, Agricultural Application, Multi Finance Company.

## 1. Introduction

Artificial Intelligence (AI) has prominent roles in today's world, it helps with the widespread deployment of practical speech identification, device translation, autonomous machine, and household robotics. It is a great deal of empirical progress, specifically in the enhancement of probabilistic learning, machine learning, internet appliance, and computer vision. The advancement of AI has even been portrayed in popular culture, such as in Steven Spielberg's film titled *A.I. Artificial Intelligence* showcases how a robotic boy is capable of expressing emotions and feelings of love to his

adoptive human parents. At the same time, scientists who study intelligent machines also foresee a future filled with independent, thinking robots, and computer companions. Thus far, AI has covered a wide variety of tasks, ranging from general (learning and perception) to specific tasks, such as playing games, verifying mathematical algorithm, composing poetry, driving a vehicle on a busy road, and identifying symptoms of illness.

AI development is also necessary in improving agriculture—an important sector in Indonesia. Indonesian agriculture output has been stagnant and its rates keep on declining due to shortages of labor, chemical farming that damages land structure, animal attacks, and the harrowing state of the farmers’ economic welfare. UMG IdeaLab offers some solution for Indonesian agriculture problems by utilizing AI technology.

UMG IdeaLab, that was established in 2018 in Jakarta, Indonesia, is a tech start-up incubator that has been seeking collaboration with many working sectors, including agriculture, business, and technology. More specifically, UMG IdeaLab has been supporting the advancement of e-commerce, agricultural company solution, AI robotics, AI education solution, speech recognition engine, and autonomous drone. Its mission is to develop Indonesia through technological solutions. The purpose of this paper is to provide a proposal for the development of AI in the business and e-commerce in Indonesia.

## 2. Literature Review

Artificial Intelligence (AI) is the study of the computation that make it possible for machines to perceive, reason, and act. Based on the definition, artificial intelligence is detached from the field of psychology as it emphasizes more on computation, it also differs from most of computer science because of the emphasis on perception, reasoning and action. When it comes to goals, artificial intelligence can be considered as part of engineering and part science (Russel, 2016).

The learning agent in AI is capable of obtaining precepts from its surrounding and performing actions. Every learning agent provides goals that maps the percept sequences to actions and finds many ways to represent these actions, such as reactive agents, real-time planners, and decision-theoretic systems. In this case, learning refers to the way in which the machine is capable of adapting and adjusting itself to new environment beyond the knowledge given by its designer (Barr & Feigenbaum, 2014).

AI is one of the newest fields in science and engineering. A rationalist approach involves a combination of mathematics and engineering, such as in the Turing Test approach (acting humanly), the cognitive modeling approach (thinking humanly), the “laws of thought” approach (thinking rationally), the rational agent approach (acting rationally) as shown in figure 1 (Russel, 2016).

<p><b>Thinking Humanly</b>                      “The exciting new effort to make computers think . . . <i>machines with minds</i>, in the full and literal sense.” (Haugeland, 1985)                      “[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . .” (Bellman, 1978)</p>	<p><b>Thinking Rationally</b>                      “The study of mental faculties through the use of computational models.” (Chamiak and McDermott, 1985)                      “The study of the computations that make it possible to perceive, reason, and act.” (Winston, 1992)</p>
<p><b>Acting Humanly</b>                      “The art of creating machines that perform functions that require intelligence when performed by people.” (Kurzweil, 1990)                      “The study of how to make computers do things at which, at the moment, people are better.” (Rich and Knight, 1991)</p>	<p><b>Acting Rationally</b>                      “Computational Intelligence is the study of the design of intelligent agents.” (Poole <i>et al.</i>, 1998)                      “AI . . . is concerned with intelligent behavior in artifacts.” (Nilsson, 1998)</p>

Figure 1. Some definitions of artificial intelligence organized into four categories (Russel, 2016)

### 2.1. Expert Systems

Early AI researchers understand that the human brain works like a computer. It receives data and information then translates it into symbols. Next, the brain changes it back to a discoverable thought. The earliest invention of AI,

although very rigid, was actually a crucial achievement. The software is known as an expert system applied for business use. The expert system is an AI software that emulates the science and decision-making process of a person with proficiency in a specific area. The expert system contains two segments—a knowledge base and an inference engine (Russel, 2016). It is capable of calculating options or pointing to alternatives to help people make the best decision.

## **2.2 Artificial Neural Network (ANN)**

Different from traditional AI expert systems which are specialized and inflexible, ANN program are trainable and more adaptable. They can process a huge range of data and information. They can also learn from their mistakes. This type of AI is best for analyzing and recognizing patterns. Some police departments use an ANN search engine called Coplink to search multiple case files from different locations and criminal database to find patterns to seemingly unrelated crimes. Coplink has successfully helped in catching the two snipers in the Washington, D.C., area in 2002. The flow of artificial Neural Network System is shown in figure 2 (Thomas, 2005).

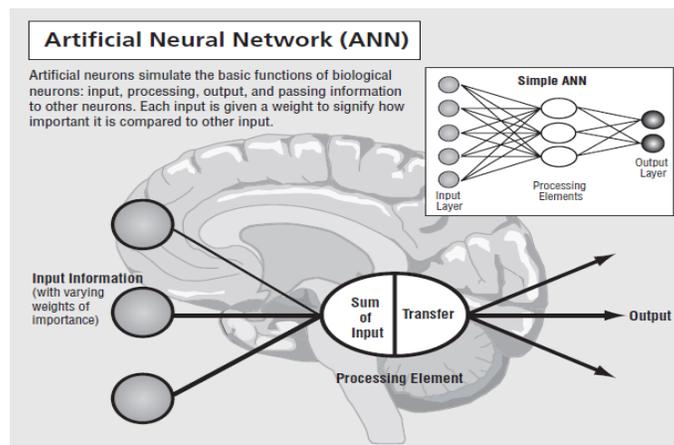


Figure 2. Artificial Neural Network System

## **2.3. Logic and Fuzzy Logic**

Fuzzy logic system works best with flexible rules. It can process applicable rules and generates continuous, fuzzy output. The weather forecast, for example, employs fuzzy logic. The fuzzy logic system can identify when the air temperature is being partly hot instead of simply hot or cold. It can also indicate temperature in the form of a percentage. Fuzzy logic programs are used to monitor the temperature of the water inside washing machines, to control car engines, elevators, and video cameras, and to recognize the subtle differences in written and spoken languages (Thomas, 2005).

## **2.4. Alien Intelligence**

AI is faster and has a larger capacity for storage and memory than any human. A human neuron fires in one-thousandth of a second, but a computer transistor can fire in less than one-billionth of a second. Such a computer can process vast amounts of data that would bury a human processor and can quickly find patterns invisible to the human eye. The logical processes that some systems go through are so complex that even the best programmers cannot understand them. These computers, in a sense, speak a language that is understood only by another computer. More sophisticated games use AI software to analyze their human player's gaming style. These programs actually learn to refine the game characters' social interactions so they can adapt to the human player's behavior (Thomas, 2005).

## **2.5. E-Commerce**

Nowadays, a person does not have to get into a car to go shopping because sophisticated AI applications and the Internet make it possible to do so. As online purchasing gets more popular, companies compete to find ways to maintain the growth of e-commerce and maximize their own market share and profits. One way is with an AI program called a collaborating filter that enables companies to analyze their customers' buying patterns. Instead of employing humans to help consumers, many businesses are now relying on automated help desks that use artificial intelligence

system called case-based reasoning that works to match up the customer's problem to similar problems stored in its memory. It can also apply the solution that works best in the past to the current problem (Thomas, 2005).

## **2.6. AI in Business**

Artificial Neural Network (ANN) expert system is used not only to make money but also to save money. The artificial neural networks compare existing patterns to previous situations and eventually "learn" what works and what does not as the program digests a lot more data. They can also seek out connections between data that a human programmer may not have thought of. Information on credit card applicant's buying habits, income, number of children, and residence are fed into the system. The system can also identify the type of customers who have committed credit card fraud. Over time, as patterns change, the ANN expert system adapts and follows the new patterns that emerge to highlight those customers who are a good credit risk and those who are not. AI can also maximize the benefits of gold trading and gold price prediction that is needed for traders. These days people can invest on gold digitally, and there is where AI can play such an important role to influence the price of gold and find prediction for its prices in the future (Priyadil, Santony, and Na'am, 2019).

## **2.7. Digital in Medical World**

Expert systems are also used in the medical field to help doctors diagnose patients. A diagnostic expert system called MYCIN can help diagnose certain blood infections. Researchers had tested the accuracy of MYCIN by comparing its diagnosis with five prestigious staff members of the Stanford School of Medicine. The doctors were given ten written medical histories and asked to diagnose the patients and give their recommendations. The researchers found that the MYCIN expert system performed significantly better than the human panel. Special machines that have been dubbed robot scientists can formulate hypotheses, design experiments, and interpret the results as well as human scientists can. Another AI medical machine can even scan biopsy slides which is normally can only be observed using a microscope.

## **2.8 AI, Robotics and Industries**

Robots are hydraulically powered and programmed to move in repeated patterns with high precision. Automobile manufacturers soon replaced assembly line workers with Unimate, the first industrial robot, which could perform the most exhausting and physically demanding tasks. In order for industrial robot computers to have precise mechanical movement, mathematical and geometric calculation must be hardwired into it (Thomas, 2005).

Today, robotic arms are used in almost every type of industry. They are especially useful in places where humans are prone to injure themselves or damage the products. Smaller robotic arms, for example, are useful in the sterile environment of a silicon chip factory, a line of work where human workers mostly struggle because they need to wear head-to-toe coveralls so that they will not contaminate the product with dandruff, flaking skin cells, or dirt. Industrial robotic arms are also commonly utilized to work with toxic material where humans cannot deal with without risking their safety, such as in a nuclear reactor (Thomas, 2005).

## **2.9 AI in Education**

Accessibility of the internet and smartphones for children in Indonesia opens up the opportunity to use mobile games as an educational tool, especially in math and science—some of the subjects that many elementary students are struggling with. Learning, from constructivism point of view, can be understood as achieving understanding through active discovery (Mayes 2007). Constructivism learning theory perceives students as self-regulated learners, who are motivated by learning itself, not only by grade or other's approval. The Learner-Centered Psychological Principles describes learner as those who are actively seeking knowledge by (1) reinterpreting information and experience for himself or herself, (2) being self-motivated by the quest for knowledge, (3) working with others to socially construct meaning, and (4) being aware of his or her own learning strategies and capable of applying them to new problems or circumstances (Slavin, 2003). Therefore, mobile games will be a strategic approach that is much needed to encourage students' intrinsic motivation to learn.

## **3. Solution**

The growth of startups in some cities of Indonesia will open opportunities to further improvement for the Indonesia's digital economy. This condition is in line with the Government's vision to place Indonesia as the center of digital economy in Southeast Asia in 2020 (Ministry of Communication and Information of Indonesian Republic, 2015). In

the field of agriculture UMG IdeaLab offers an integrated and smart logic solution starts from planting, informing seed availability, providing information about labor, production, and quality control by utilizing AI technology.

UMG IdeaLab has supported 33 affiliated companies that are considered innovative and provide solutions for Indonesia. UMG IdeaLab's efforts to focus on Indonesian startups were shown seriously by providing funding to startups, such as PT. MSMB (agricultural AI solution), Widya Wicara, Widya Robotic (AI Robotic), Frogs (Autonomous Drone), Artificial Intelligence Center Indonesia (AICI – AI education in university), Bahasakita (Speech Engine in Bahasa Indonesia), Botika (Chatbot AI), Skiloka (for AI Training and Workshop).

PT. Mitra Sejahtera Membangun Bangsa (MSMB), UMG IdeaLab's affiliated company, created integrated software and application to enable farmers to sell their product to the customers, increase farming productivity, and provide all farming data information. MSMB won in many start-up competitions in Indonesia and worldwide, including being the finalist of Intellectual Property Innovation and Entrepreneur Competition Global (IPIEC Global) in Shanghai, China. PT Mitra Sejahtera Pembangunan Bangsa (MSMB) which was established on February 15, 2018 has a vision to be a technology pioneer in agriculture, animal husbandry, fish farming and farmers education of technology in Indonesia. MSMB is one of the startups chosen by the Asian Development Bank (ADB) and Bappenas as partners in implementing the Leveraging ICT for Irrigated Agricultural Extension program in some cities, such as Pasaman at West Sumatra and Sukabumi at West Java in Indonesia.

In agricultural AI solution, the data from the RiTx Water Discharge Sensor is processed to determine the right water treatment and planting system that is in accordance with the amount of water available in real time. Water Debit Sensor can detect, measure, and record water levels and water currents and send data to a server to make the information accessible through mobile application in real time. This RiTx Soil and Weather Sensor can inform the accurate soil conditions and current weather forecasts for the next eight days. This tool can detect the temperature, soil moisture, pH (acidity) of the soil, EC (electrical conductivity) of the soil, relative humidity, air temperature, wind speed and direction, and even rainfall to determine the appropriate treatment of the land. Sensors can also accurately record data about the condition of agricultural weather (agro-climate) and agricultural land (soil). Therefore, by making this information available on mobile application, farmers will be able to tend the needs of its plantation and anticipate situations for successful harvests.

RiTx Drone Surveillance from Frog Company is also making it easy for plantation mapping, agriculture, and mining. You can map land fertility and crop conditions, crop density on the land, irrigation paths and landslide potential, as well as agricultural potential. RiTx Drone has the ability to determine whether the land is suitable for rice, oil palm or corn fields. It is equipped with RGB and NIR cameras that can produce 2D and 3D maps as well as soil and plant fertility maps. With RiTx Drone Sprayer, fertilizers and pesticides can be spread on an area of 1 ha in just 15 minutes, which is more effective and efficient compared to manually doing it with hands. The drone can carry as much as 20L fertilizer, and it can cover 1 ha in 10 minutes. The spraying effectiveness is at 70 percent, and thus, it can reduce the cost of spraying services up to 30 percent.

#### **4. Conclusion**

The development of artificial intelligence (AI) has been helping humans doing many jobs more efficiently. The fact that AI applications can be used to optimize farming, manufacturing, medical care, household work, and education indicate its significant role in our today's society. The UMG IdeaLab has been supporting the enhancement of AI in order to solve humans' problems in many sectors, including business and agriculture. The affiliated company, such as PT. MSMB, for instance, is capable of providing the software and applications to help the farmers increase their agricultural productivity. UMG IdeaLab also has Crowde application, a peer-to-peer lending platform, which enables people to invest in local farmers. The startup companies funded and supported by UMG IdeaLab has won many awards, both nationally and internationally. In the future, UMG IdeaLab aims to help university students to learn more about artificial intelligence, such as robotic, startup business, and applications.

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## **Biographies**

**Harry Kasuma (Kiwi) Aliwarga** is a chief executive officer and co-owner of UMG Myanmar, one of the country's leading business conglomerates. Born in Jakarta, Indonesia, Mr. Aliwarga graduated from the Institute of Technology of Indonesia (ITI) in 1992 with a degree in industrial engineering and later received a master's degree in civil engineering at the Asia Institute of Technology in Thailand. Kiwi Aliwarga began his professional career in the business development division at Astra International, one of Indonesia's largest trading companies, where he worked from 1992 to 1995. He went on to become business development manager at United Tractors-Indonesia (UT) before founding UMG Myanmar in 1998 with his partner MarLar Win. Mr. Aliwarga has set the ambitious goal of making UMG a billion-dollar company by 2020, by relying on three essential pillars: people, leadership, and the relentless pursuit of excellence.

**Lina Gozali** is a lecturer of Industrial Engineering Department at Universitas Tarumangara since 2006 and be a freelance lecturer at Universitas Trisakti since 1995. She got Bachelor degree at Trisakti University, Jakarta - Indonesia, then she graduated Master Degree at STIE IBII, Jakarta – Indonesia, and graduated her Ph.D at Universiti Teknologi Malaysia, Kuala Lumpur – Malaysia in year 2018. Her apprentice college experience was in paper at Kertas Bekasi Teguh, shoe at PT Jaya Harapan Barutama, automotive chain drive industry at Federal Superior Chain Manufacturing. She teaches Production System and Supply Chain Management Subjects and her Ph.D research about Indonesian Business Incubator. She actively writing for almost 40 publications since 2008 in Industrial Engineering research sector such as: Production Scheduling, Plant Lay Out, Maintenance, Line Balancing, Supply Chain Management, Production Planning and Inventory Control. She had been worked at PT. Astra Otoparts Tbk as International Business Development Department for 4 years, Citibank, N.A as customer service for 1 year, PT. Pandrol as assistant marketing manager for 1 year. PT. Texmaco as merchandiser for 3 years.

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