COMPANY RESEARCH AND ANALYSIS REPORT

Kudan

4425

TSE Mothers

24-Jul.-2019

FISCO Ltd. Analyst
Kimiteru Miyata

FISCO

FISCO Ltd.
http://www.fisco.co.jp

Index

Overview

A deep tech development firm with a bright mid-to-long term future

Kudan (4425) is a company whose business model involves carrying out research and development in the field of artificial perception (AP) and providing IP licenses for the use of its software to its clientele. AP, which can be thought of as providing machines with "eyes," is a key part of what is known as deep tech, functioning as the foundation for a broad range of industries, and will in the future be an essential element of all machinery featuring such devices as cameras or 3-D sensors. As the only company in the world to have developed commercial-quality algorithms in the field of AP technology, Kudan is recognized as the industry leader by advanced technology businesses across the globe. With Kudan's technology being adopted by such corporations as Synopsys, a world leader in semiconductor IP, and Thales, a major global player in the aeronautics, military and defense industries, expectations for future growth over the mid-to-long term are extremely high. Organizationally, also, Kudan features a unique corporate structure. While research and development is carried out in the UK, the company is managed from Japan, with a global business structure allowing the development of new markets not only in Japan and the UK, but in China and the United States as well. Furthermore, as Kudan is focused entirely on algorithm development, it makes it possible to maintain a small but elite staff, thereby restricting any need for organizational or investment expansion in line with future growth.

Kudan has independently developed one of the core technologies of AP known as SLAM (Simultaneous Localization and Mapping) to a commercial level at which it can handle a wide range of practical industrial uses, and provides to its customers licenses for the use of its IP known as KudanSLAM. KudanSLAM draws data from cameras and LiDAR systems to allow highly accurate spatial and positional perception, and it is very probable that this technology will be used in a wide range of future applications in next-generation products and solutions. Currently, through the use of its global corporate structure, Kudan is developing new markets through collaboration with leading companies throughout the world. With dramatic growth anticipated in markets where its technology can be practically applied, including autonomous driving systems, digital mapping, robotics, IoT, AR (augmented reality) and VR (virtual reality), the company continues to demonstrate dramatic growth. At the present time, no other company has the ability to provide AP technology at a commercial level, meaning that Kudan has a virtual monopoly on the industry.

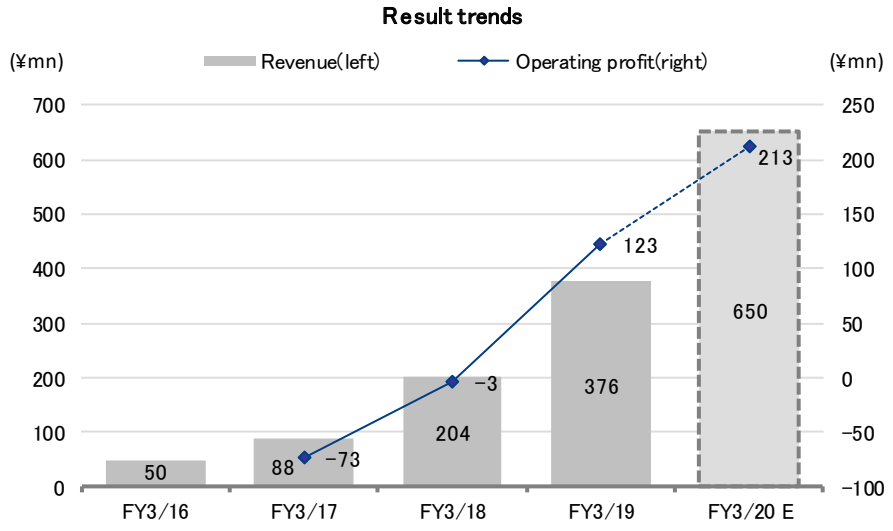
For the fiscal year ending March 2019, Kudan demonstrated a significant increase in both revenue and profit, with sales of JPY 376 million (an 83.8 percent increase over the previous year) and an operating profit of JPY 123 million (compared to a loss of JPY 3 million the previous year). An increase in the number of companies to whom KudanSLAM licenses were sold, as well as an increase in license value and the signing of contracts with major clients as a result of the consistent achievement of developmental milestones in the refinement of the technology are believed to have contributed to these positive results. For the fiscal year ending March 2020, Kudan is projecting significant further growth, with sales of JPY 650 million (a 72.8 percent increase over the previous year) and an operating profit of JPY 213 million (up 73.8 percent from the previous year) forecast. With positive market indicators in the fields of autonomous driving and robotics, an increased profit is anticipated through sales of KudanSLAM IP licenses and further developmental milestone achievements. Strengthening of business development and M&A are also being considered, but as only costs and no profits have been forecast for these areas, Kudan's performance projections for the coming years are seen as quite conservative.

Overview

Kudan's AP business can be expected to continue to be profitable due to the factors of increased demand as a result of the continued expansion of the markets for autonomous driving, digital mapping, robotics, IoT, AR and VR, increased licensing income through the progressive achievement of developmental milestones, and an increase in royalty income through the adoption of Kudan's technology in the products of user companies. In addition to this, a wide range of other possibilities can be imagined, including the integration of Kudan's AP technology with AI and IoT, and the establishment of Kudan as a developmental hub in the field of deep tech, all of which paints a bright and expansive future for the company. For this reason, the key issues facing the company today are the strengthening of an efficient technical and business development paradigm that matches the small yet elite organizational structure of the firm, and the development of a comprehensive internal management system as a listed company. As a result, it is possible that the company may incur some temporary increases in expenditure, but the fact that the company has successfully established such a minimalist corporate structure means that over the mid-to-long term, any cost increases as a proportion of license sales should be able to be kept to a minimum. Naturally, risks associated with the potential loss of technological superiority and the potential for future substitution of its technology, commonly experienced by enterprises with strong initial growth, must be taken into consideration. It must be said, however, that Kudan is a company with a very bright future, for whom any such concerns are outweighed by the projected mid-to-long term growth of AP technology as a key element of future deep tech.

Key Points

- R&D company developing AP technology which forms a key element of the deep tech supporting a wide range of industries
- Established a virtual monopoly on the market by developing the only commercially viable AP technology
- Demand growing rapidly in fields where the technology can be applied, such as autonomous driving and IoT, meaning mid-to-long term growth is anticipated



Note: FY3/16 is non-consolidated. No operating profit shown.
Source: Created by Fisco based on Kudan's summary of accounts

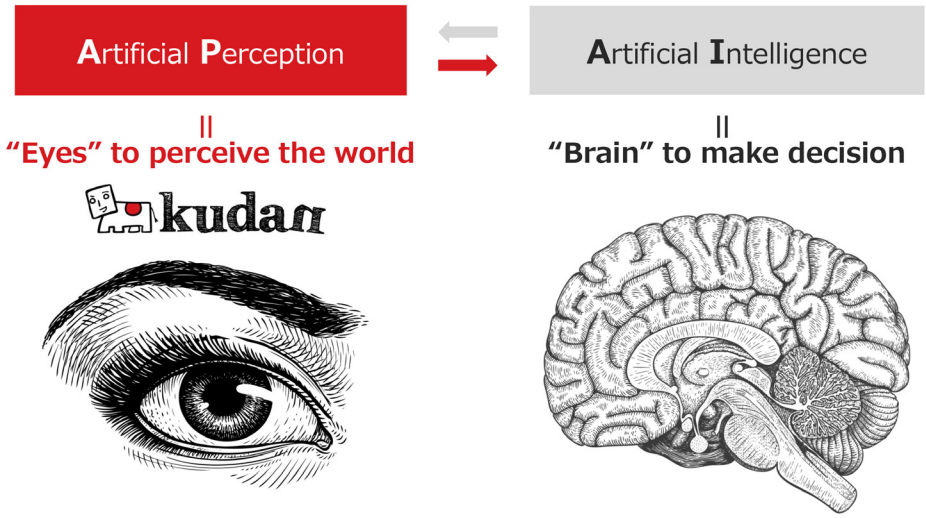
Company Overview

A company conducting R&D in the field of AP technology, allowing machines to develop autonomy

1. Company Overview

With a stated vision of providing "eyes to all machines," Kudan carries out research and development in the field of AP (artificial perception), a technology furnishing machines with the equivalent of human eyes, and conducts its business through the sales of IP licenses and related services. Developments in AI (artificial intelligence), the "brains" of machines, have been notable in recent years, but it is only when AI is paired with AP technology which allows machines to perceive their own spatial or locational positioning that they may be able to break free from human control and evolve into fully operational autonomous machines. AP is considered an example of deep tech due to the fact that it is a fundamental technology underpinning innumerable applications in a wide range of industries. What is truly groundbreaking about Kudan's technology even within the field of AP, though, is that it has taken technology which was hitherto restricted to the area of academic research, and developed it to a commercial level in which it functions successfully in a range of practical environments. It is for this reason that Kudan's technology has drawn interest from advanced technology firms around the globe, with more and more corporations using the KudanSLAM AP IP licenses developed by Kudan. In just five years since its inception, Kudan has developed to the point where it is anticipated to undergo significant future growth in the mid-to-long term.

AP technology as providing machines with eyes



Source: Documents detailing the company's future growth potential

Listed on the stock market just four years after launch

2. History

President and CEO Tomohiro Ohno established Kudan Limited (currently a subsidiary of Kudan Inc.) in the United Kingdom in January 2011, and began research and development on the company's own version of SLAM, a tool at the foundation of AP technology. Kudan Inc. was established in Japan in November 2014 as an operational base to develop a Japanese market for the company and to strengthen its managerial structure. Since then, the company has continued to expand dramatically through the research and development of AP technology including KudanSLAM, through forging partnerships with other companies, and finally through its listing on the Mothers section of the Tokyo Stock Exchange.

History

Date	History
January 2011	Kudan Limited (currently a subsidiary of Kudan Inc.) established in the UK
November 2014	Kudan Inc. established with its headquarters in Chiyoda-ku, Tokyo
January 2015	Kudan Limited made into a wholly-owned subsidiary of Kudan Inc.
June 2015	Company headquarters transferred to Shinjuku, Tokyo
July 2015	AR engine "Kudan AR SDK" released
October 2016	Business partnership agreement signed with Hakuhodo Inc.
December 2016	Evaluation demo version of "KudanSLAM" software developed
August 2017	Visual SLAM library "KudanSLAM Alfa" released
June 2018	Capital alliance signed with Kokusai Kogyo Co., Ltd., Zenrin-Datacom Co., Ltd and Xacti Corporation
March 2018	Visual SLAM library "KudanSLAM Carnelian" released
August 2018	RGB-D SLAM library "KudanSLAM Galena" released
December 2018	Visual-LiDAR-SLAM development partner program initiated, combining Visual SLAM with LiDAR
December 2018	Listed on the Mothers section of the Tokyo Stock Exchange
January 2019	Milestone achieved for ultra-precise large-scale map production
February 2019	Super high-speed SP-SLAM service for digital signal processors begun

*"KudanSLAM Carnelian" is an advanced version improving the basic functionality of "KudanSLAM Alfa" and implementing loop closure, a method of optimizing map data by recognizing sensor trajectory loops. "KudanSLAM Galena" is an advanced version improving upon the accuracy of "KudanSLAM Carnelian" through the use of 3-D sensor data as well as camera image data as input.
Source: Created by Fisco based on securities registration documentation

A global corporation based in Japan and the UK and run by a small group of elite professionals

3. Organizational Overview (Locations and Human Resources)

Kudan's technological research and development division is in the UK with its managerial division in Japan, while it has in place a global structure which can develop business and provide technology to tech firms throughout the world without any geographical restrictions. In addition to the fact that it has optimized its structure to feature hubs in Japan and the UK, perfectly placed to access the major marketplaces for advanced technology in Europe and the US and in East Asia, the use of the services provided by the company are not affected by language or geography, allowing for efficient access to the global market. Furthermore, as Kudan's business is entirely focused on algorithm development and provision, both its technical research and development division and its business development division can be handled by small yet elite teams, minimizing the need for organizational or investment expansion in response to growth. As its employees hail from a wide variety of national backgrounds, it can also be said to have achieved significant diversity in that regard. In all of these ways, Kudan has a quite unique organizational make-up.

Business Overview

License sales of KudanSLAM, a software allowing the implementation of AP core technology

1. Business Details

Kudan's core business is the sale of IP licenses for its KudanSLAM software, which is designed to incorporate the key AP technologies SLAM*1, ALAM*2, VIO*3, SfM*4 and other algorithms*5 into the hardware of the clients to whom it is provided. Up until the fiscal year ending March 2018, Kudan sold licenses for the precursor of KudanSLAM, an AR engine called Kudan AR SDK, to clients such as mobile application development companies, but has since switched its focus entirely to KudanSLAM, with the objective of evolving deep tech and expanding into non-AR areas. As a result of this transition, Kudan's customer base has also evolved in recent years. Where its major clientele consisted primarily of social VR developers such as MindMaze and social app and game developers such as enish (TYO: 3667) in the fiscal year ending March 2017, by the following fiscal year its client base included the unicorn startup Magic Leap, developer of mixed reality wearable computer systems, and the LINE Plus subsidiary of LINE (TYO: 3938). By the second quarter of the fiscal year ending March 2019 its major clients had changed once again, this time to include the OEM Xacti, developer of camera and image processing engines, geospatial data technology company Kokusai Kogyo, under the umbrella of the Japan Asia Group (TYO: 3751), and Nikon (TYO: 7731), the internationally-renowned manufacturer of single-lens reflex cameras. From the fact that its major customers have undergone a change away from mobile app developers in this manner, it can be appreciated that Kudan is attempting to engage the industry at a deeper and broader level, and expand applications for its software beyond AR alone. Furthermore, while details will provided later, it should also be noted at this point that in addition to the fact that Kudan remains one of the few AP technology providers even when seen on a global scale, the technological superiority of its KudanSLAM software has already seen it achieve widespread recognition from the world's leading advanced technology firms, the majority of which are familiar with Kudan's products, leading to a rapid increase in the adoption of Kudan SLAM as an elemental technology in their new ventures.

*1 SLAM: An acronym standing for "simultaneous localization and mapping," this term refers to technologies in which a computer system constructs a 3-D map of a real-world environment while simultaneously tracking its own position within it. Visual SLAM is used to refer to a system using camera imagery as input data for map construction and positional tracking, while RGB-D SLAM uses both camera imagery and 3-D sensor data for the same purpose.

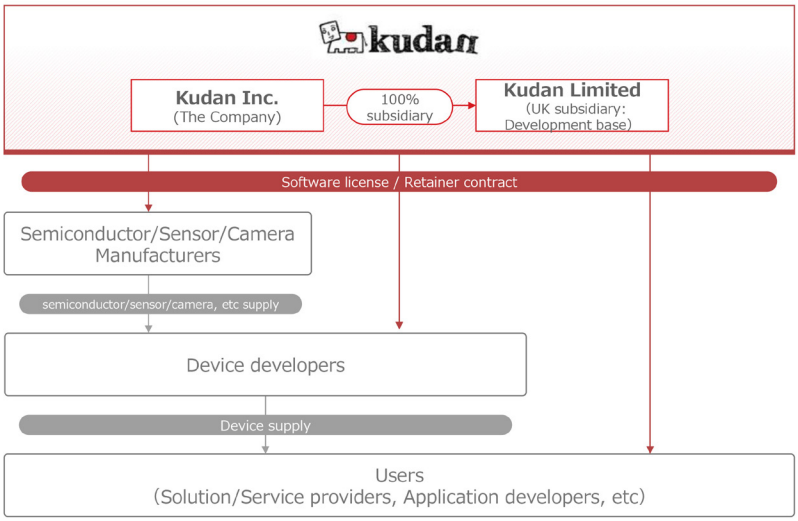
*2 ALAM: An acronym standing for "asynchronous localization and mapping," this term refers to technologies in which a computer system constructs a 3-D map of a real-world environment and tracks its own position within it at different times.

*3 VIO: An acronym standing for "visual inertial odometry," this term refers to technology using camera imagery to estimate position and orientation.

*4 SfM: An acronym standing for "structure from motion," this term refers to a technique for estimating 3-D structures from 2-D camera imagery and motion.

*5 Algorithm: A calculable mathematical model devised for the solving of a specific problem. In many cases, it is expressed in the form of a computer program.

Business organizational chart



Source: Securities registration documentation

AP as an essential core technology for any machine with a camera

2. What is AP?

AP technology provides machines with high-quality visual capability in the same way that the eye does for human beings. In concrete terms, it refers to a series of operations which take data acquired from cameras or 3-D sensors, process it mathematically via a computer program, output detailed, real-time data pertaining to the spatial elements (direction, distance, size, etc.) and motive elements (position, movement, etc.) of an object, and compare the data to other data in its memory (previously recorded sensory data). Kudan has developed its own AP technology based on a reconstruction of the previously existing fundamental technology for sensor data and imagery processing known as “computer vision.”

AP has proven itself to be an essential technology for the development of autonomous control for a wide range of machinery and robotics under their broadest definitions, including industrial robots, domestic robots, next-gen mobility (such as autonomous automobiles), and aerial devices (such as drones). It is also essential for the implementation of spatial perception in the AR (augmented reality) and VR (virtual reality) systems which will be used as next-gen computer user interfaces. Finally, it will also function as a core technology for such applications as next-gen digital mapping and dynamic mapping (a fluid mapping system in which real-world environments and conditions will be reflected instantaneously) to create big data, as well as digital twinning (the creation of a virtual space that functions as a “twin” of the real environment and is synchronized with it in real time). As can be seen, AP is a core technology which is absolutely essential for all machinery featuring cameras, and which is anticipated to be applied to a variety of fields as a tool for creating next-gen solutions to a diverse range of problems.

The establishment of robust quality that can withstand commercial use

3. Characteristics of Kudan's Technology

Kudan's competitive advantage in this field in which novel, complex technologies are being constantly produced derives from the fact that the AP technology it has developed features an extremely flexible technical design which allows it to be applied not only to current products but to adapt to the demands of future technologies as well. Its use is not restricted to certain technical fields or industries, but can be applied broadly across a wide range of applications. In addition to this flexibility and broad applicability, the basic performance indicators of Kudan's technology (accuracy, speed, robustness, versatility) far outstrip those of any analogous technology, making its use commercially viable in terms of application to actual products and solutions. All analogous technology to that produced by Kudan is either academic open source material, lacking in the versatility and performance levels necessary for commercial application, or developed for a very specific, narrow purpose on a given hardware platform, with an inability to be adapted for broader use. In this respect, Kudan has been able to strategically position itself to respond to the mid-to-long term needs of the expanding visual technology market. Due to this lack of competition in an emerging technological field, Kudan has achieved widespread recognition among advanced technology firms, with customers in some 40 countries already including many of the Forbes Global 2000 (the world's 2000 largest global corporations as published each year by Forbes magazine). Below are listed the major characteristics of Kudan's technology which have led to this dominance of its market.

(1) Unique algorithms

By comparison to the single open-source algorithms developed in academic circles, Kudan's technologies are broad ranging, and developed using a hybrid method with its own unique algorithms at their core but combining multiple algorithms which work in unison. It is for this reason that, when detecting a 3-D geometric structure, for example, both speed and accuracy can be combined by integrating a technique which allows for high-speed recognition with another technique prioritizing superior accuracy and stability. Further, in order to optimize recognition accuracy and processing speed when dealing with a 3-D structure (a 3-D characteristic point cloud), the concentration of point clouds for recognition can be freely and flexibly adjusted to match the environment and purpose of use. Kudan's software also contains a variety of other unique mathematical models to ensure its practicality, such as optimization calculations to sequentially improve accuracy of detected point clouds, and high-speed comparisons with previously saved data.

(2) Flexibility in arithmetic processing environments

Another vital element of the practical expansion of AP technology lies in its flexibility towards a variety of arithmetic processing platforms. In order to adapt to a varied range of arithmetic processing environments, Kudan's technology makes possible the optimization and acceleration of the algorithms' arithmetic processing of a range of processor textures (CPU, DSP, GPU, etc.). The technology can also be transferred to all the major operating systems (Linux, Windows, MacOS, iOS, Android, etc.). allowing it to function in a wide variety of system environments.

(3) Flexibility of sensor use

Kudan's technology is designed to function with a wide range of sensors and has a broad range of applications. Not only is it compatible with most cameras, it also exhibits flexibility with respect to number of cameras and lenses (single-lens, dual-lens and multi-lens cameras) and optical sensor data reading formats (sequential or simultaneous reading). Outside of cameras, also, the technology has the ability to combine data produced by a range of other 3-D sensors (LiDAR, ToF, etc.), internal sensors (IMU, mechanical odometry, etc.) and location sensors (GPS, Beacon, etc.) to adroitly make best use of the strengths that each type of sensor possesses.

(4) Flexibility in terms of use of partial functionality

While the high-level application of AP requires complex integration with other technologies, Kudan's technology allows for the extraction and use of individual modules, whose functionality can be flexibly combined with existing systems owned by individual customers. These modules can be freely combined at a number of different levels, allowing for them to be optimized at the semiconductor or application levels, for example.

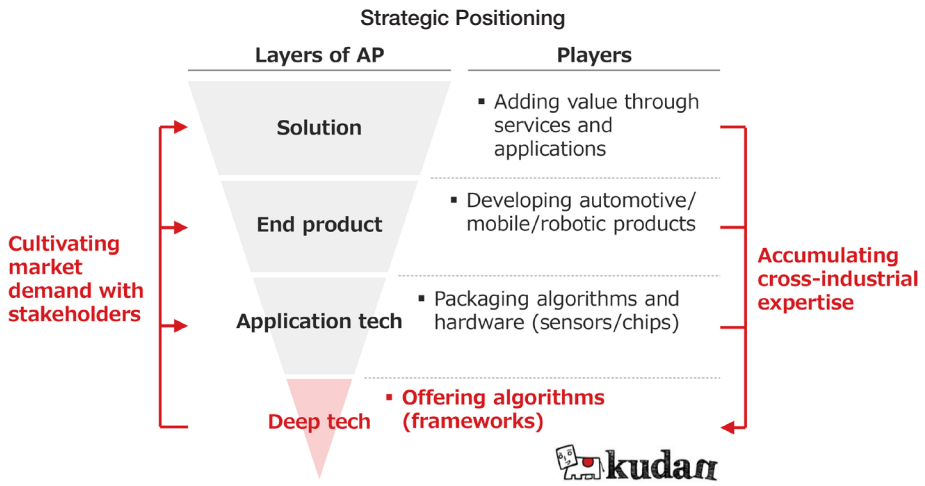
(5) Flexible, high-level performance

In addition to the fact that they allow for all processing to be carried out at high speeds, the uniquely developed algorithms used in Kudan's software allow for the simultaneous realization of high precision (whereby variance of outputted values from true values is kept to a minimum) and robustness (whereby functionality is maintained regardless of the environment or conditions in which it is used). They are also designed so that detailed individual functions, including detection accuracy, robustness, processing speed, data size and power usage, can be finely tuned in accordance with conditions of use and required specifications to optimize performance in a wide variety of applications.

A core technology underpinning a range of applications, products and solutions

4. Strategic Positioning

As has been demonstrated, Kudan's software functions as fundamental deep tech which can be flexibly applied to an extremely wide range of technology, products and solutions. While continuing to focus on the development of this fundamental deep tech infrastructure, Kudan is also cultivating markets for its products through collaborative ventures with major advanced technology firms at every layer of the industrial structure. At the same time, the company believes that a wider range of applications of its technology can be anticipated through the accumulation of broad, cross-genre technical knowledge pertaining to the entire industry. Furthermore, research and development is also being carried out in the fields of machine perception, deep perception and neural perception networks with an eye to the future combination of its AP technology with other core systems governing AI (artificial intelligence) or IoT (the internet of things). In this way, Kudan is strategically positioning itself as a key player within the deep tech field, making the foundations that support other technology more robust and solid, and allowing it to support a wider range of applications, products and solutions.



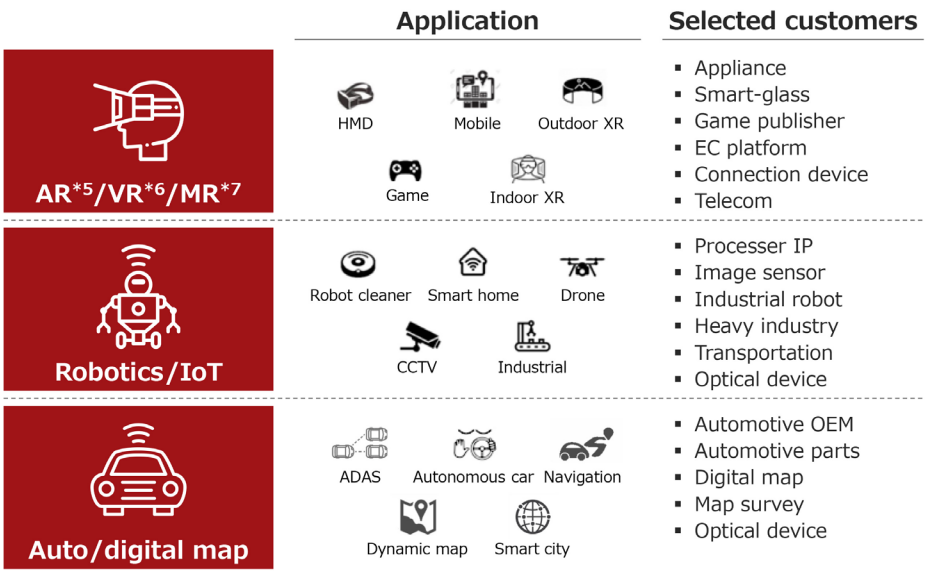
Source: Documents detailing the company's future growth potential

An initial focus on AR and robotics to cultivate a customer base

5. Current Status of Business Ventures and R&D

Kudan began its KudanSLAM service in the fiscal year ending March 2018. This served to develop its customer base in three major areas: AR and VR (virtual reality) applications, wherein clients included optical sensor manufacturers, MR (mixed reality) glasses manufacturers, telecommunications equipment manufacturers, electrical appliance manufacturers, e-commerce platforms and video game developers; the field of robotics and IoT, wherein clients included optical device manufacturers, heavy machinery and industrial robotics manufacturers, electric appliance manufacturers, transportation equipment manufacturers and signal processing IP companies; and automotive and map applications, wherein clients included automotive parts manufacturers, digital map companies and spatial information consulting firms. While it would have been possible to have courted a wider customer base at this point, the fact that Kudan restricted its activities to these areas turned out to be for the best, allowing it quickly establish a positive financial performance.

Client base expansion into varied markets and applications



Source: Documents detailing the company's future growth potential

Performance Trends

KudanSLAM software licensing fees as the company's primary revenue source

1. Historical Profitability and Profit Structure

Kudan's original revenue source was KudanSLAM's predecessor, Kudan AR SDK, an AR engine designed for mobile application development. From the fiscal year ending March 2018, KudanSLAM, an IP-licensed version of SLAM developed with the purpose of evolving its embeddability and expanding its application beyond the AR sphere, began to be provided to advanced technology firms across the globe. From the following year, almost all of the group's management resources were poured into R&D and business development for KudanSLAM and related projects. As a result, while reliance on certain clients did peak in the second quarter of the fiscal year ending March 2019, with Kudan's top five clients accounting for over 70 percent of revenue, the company was able to build strong relationships with clients at the cutting edge of a variety of fields, which served not only to help Kudan's engineers quickly acquire the knowledge they needed but also helped reduce the burden of individual customized support. The fact that the company made its first profit at this time makes it a key turning point in Kudan's history. The issue of over-reliance on certain clients, incidentally, is expected to be ameliorated with continued expansion of sales.

Kudan's revenue comes from the two types of license it offers for KudanSLAM: the development license, which clients use for the purposes of R&D, and the commercial license, which clients can use in products for sale on the market. Revenue begins to be generated after the signing of a licensing contract and the provision of the algorithms to the client. Payment methods vary from up-front payment at the time of acquisition to payments over specified time periods.

Kudan's technology development has already made a profit, based primarily on the 30 or so companies with whom it has development license contracts, while several companies have already begun the move to commercialize their products. Over the medium term, client numbers are expected to grow by 30 percent per annum, with around 30 percent of those clients opting to use the commercial license. In addition, the continual rise of development license prices in accordance with milestone achievement and a significant increase in royalty income derived from sales of products featuring the technology are also anticipated.

Significant profit increases through the achievement of development milestones

2. Performance Trends for the Fiscal Year Ending March 2019

Successful monetization of the company's products began in the fiscal year ending March 2019, when Kudan demonstrated a significant increase in both revenue and profit, with sales of JPY 376 million (an 83.8 percent increase over the previous year), an operating profit of JPY 123 million (compared to a loss of JPY 3 million the previous year), a pretax recurring profit of JPY 103 million (a 2300 percent increase over the previous year) and net income for the term attributable to parent company shareholders of JPY 103 million (a 2700 percent increase over the previous year). It was during this period that continued independent development of fundamental AP technology such as SLAM led to the achievement of research milestones, with Kudan's R&D able to become profitable via the sales of KudanSLAM to a wide range of advanced technology firms.

The major factor behind increased sales and gross profit margin has been an increase in the number of companies to which KudanSLAM licenses have been provided, including several major contracts. As revenue is in the form of licensing fees, gross profit percentage is high with only very minimal unit costs. Increased sales costs are due to labor and sundry costs as a result of business expansion and an increase in R&D expenditure due to a strengthening of R&D activity. In terms of non-operating revenue and expenses, factors include foreign exchange losses as a result of recent dramatic exchange rate fluctuations as well as stock issuance costs and flotation expenses related to the company's listing on the Mothers section of the Tokyo Stock Exchange.

Performance for the fiscal year ending March 2019

(Units: JPY 1 million; %)

	FY3/18			FY3/19		
	Result	Ratio to revenue	YoY	Result	Ratio to revenue	YoY
Revenue	204	100.0	131.2	376	100.0	83.8
Gross profit margin	195	95.3	185.5	354	94.2	81.6
Sales costs	198	96.8	39.6	231	61.5	16.7
Operating profit	-3	-1.5	-	123	32.7	-
Pretax recurring profit	4	2.0	-	103	27.5	24x
Net income attributable to parent company shareholders	3	1.8	-	103	27.4	28x

Source: Created by Fisco based on Kudan's summary of accounts

Relatively conservative projections despite some upfront costs

3. Performance Forecast for the Fiscal Year Ending March 2020

For the fiscal year ending March 2020, Kudan is projecting significant further growth, with sales of JPY 650 million (a 72.8 percent increase over the previous year), an operating profit of JPY 213 million (up 73.8 percent from the previous year), a pretax recurring profit of JPY 213 million and net income for the term attributable to parent company shareholders of JPY 213 million (both numbers over twice those of the previous year) forecast. With positive market indicators in the fields of autonomous driving and robotics, an increased profit is anticipated through sales of KudanSLAM IP licenses and further developmental milestone achievements. In addition to continued R&D and a strengthening of global sales activity, Kudan is also investigating the possibility of investment into other companies in its field and other related deep tech industries, with the aim of securing long-term continuous growth.

As was the case for the fiscal year ending March 2019, revenue and gross profit margin are expected to exhibit significant growth as a result of license fee increases derived from milestone achievement. At the same time, with worldwide demand for KudanSLAM high, the company has determined there is a need to strengthen its global business development structure through the hiring of additional staff, which has led to a slight decrease in the projected ratio of operating profit to net sales. However, as sales projections are based on the previous year and only the costs have been considered for business development areas without any projected effects, Kudan's performance projections for the coming years must be seen as quite conservative. In the field of M&A, also, while research of deep tech firms in Europe in particular is underway, the potential effects of any investments have naturally not been included in the estimates.

Performance Trends

Performance forecast for the fiscal year ending March 2020

(Units: JPY 1 million; %)

	FY3/19			FY3/20		
	Result	Ratio to revenue	YoY	Forecast	Ratio to revenue	YoY
Revenue	376	100.0	83.8	650	100.0	72.8
Operating profit	123	32.7	-	213	32.8	73.8
Pretax recurring profit	103	27.5	24x	213	32.8	106.6
Net income attributable to parent company shareholders	103	27.4	28x	213	32.8	106.8

Source: Created by Fisco based on Kudan's summary of accounts

Mid-to-Long Term Growth Potential

Bright and ambitious projections for the company's future

1. Possibilities for Kudan in the Field of AP Technology

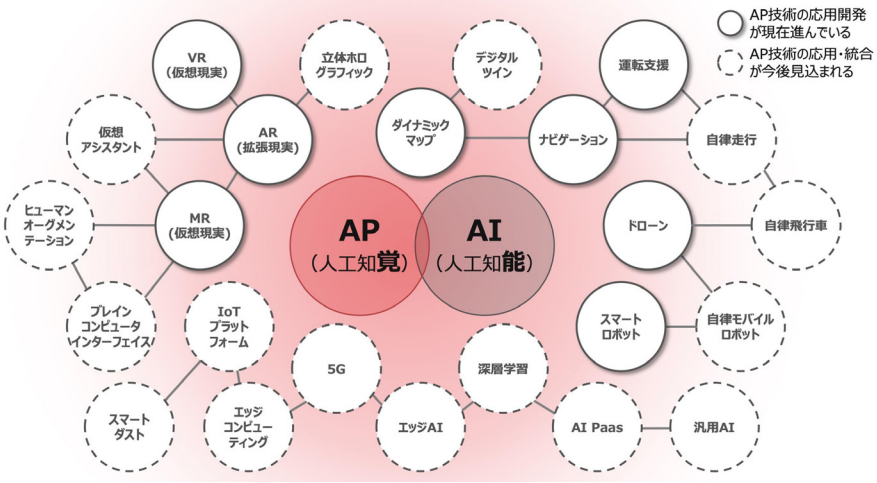
As Kudan has no competitors in the field of commercially viable AP technology, a wide range of possibilities suggest themselves for its future in the field: the evolution of the technology itself and its development into an integral part of deep tech, its integration with the neighboring fields of AI and IoT, and the establishment of a deep tech ecosystem with AP at its hub. For this reason, extremely bright and ambitious projections for Kudan's future can be made.

(1) Expansions of technical application

AP technology is already used in a wide variety of applications, from the most obvious uses in AR, VR and MR to other fields such as driving support and navigation, dynamic mapping, drones and smart robots. Kudan's customer base, already growing at a rate of 30 percent per annum, is expected, therefore, to continue to expand in the future. Looking ahead, even more advanced applications of the technology or integration with other technologies can be anticipated in the fields of autonomous driving and autonomous mobile robots, IoT platforms and human augmentation (the integration of human beings with AI or other technology). It is also seen as a potential difference-maker in the extremely competitive fields of semiconductor technology, AI and IoT. In this respect, in addition to the numerous applications for which it has already been developed, AP can be expected to expand Kudan's customer base to hundreds more companies and be used in a variety of products developed by global advanced technology firms in conjunction with a wide range of other cutting-edge technologies.

Mid-to-Long Term Growth Potential

Expansion of technical applications



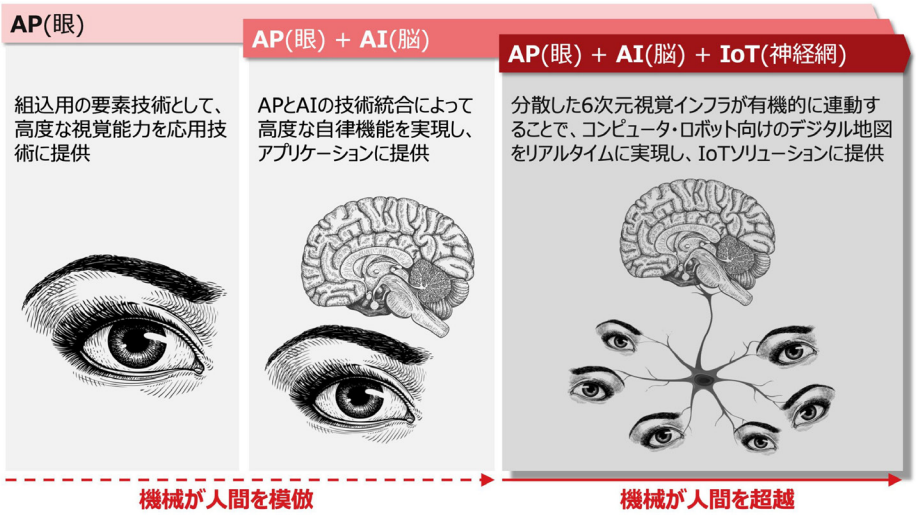
Source: Documents detailing the company's future growth potential

(2) Technical road map and the monetization of milestone achievements

Kudan's AP technology appears to combine well with the neighboring fields of AI and IoT. The company already has in place plans for technological integration between its AP technology and AI and IoT, with the intent of gradually expanding its applications. By using sensors to detect its surroundings and comparing the results with a library of data, AP has the ability to function as the eyes of a machine and, as an integrated element of that machine, provide it with high-level visual capability. Technology that further integrates the eye (AP) with the brain (AI) of an application or product can provide it with an advanced level of autonomous functionality by recognizing its visual stimuli and learning from them. Still, while it is possible to consider that this technology may be able to bestow a sense of "identity" upon a machine, at this level it is not possible for that machine to exceed the capacity of the human mind. However, when the eye (AP), the brain (AI) and the nervous system (IoT) function in an integrated manner, it may become possible for machines to make decisions based on their stimuli and to act on those decisions, ultimately sharing knowledge with other AP + AI systems and even having opinions of their own, allowing the potential creation of independent characters which may be considered very similar to a sense of "self," or "personality." Furthermore, unlike the human nervous system, the IoT has the ability to connect instantaneously with all other AP + AI systems the world over, an ability which will finally give machines (computers and robots) an advantage over mankind. By providing uniquely advanced AP technology, Kudan can be considered to be at the forefront of the untold possibilities that an integration of AP, AI and IoT technology may hold.

Mid-to-Long Term Growth Potential

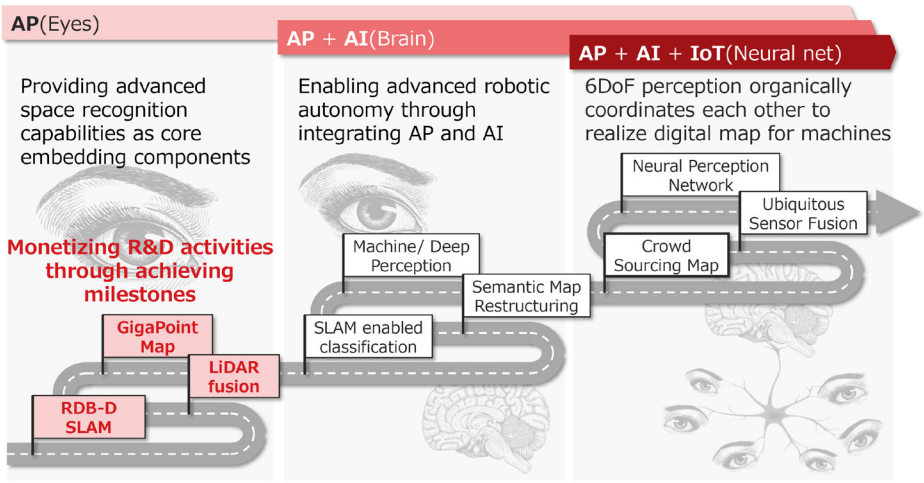
Technological road map



Source: Documents detailing the company's future growth potential

In the midst of this major technological evolution, Kudan has continued to steadily achieve its developmental milestones and gradually monetize its technical R&D. In terms of its AP technology R&D, Kudan has already made groundbreaking achievements such as in LiDAR fusion in December 2018, whereby it raised to practically functional levels the integration of Visual SLAM with LiDAR, making possible its implementation in the fields of autonomous driving and 3D mapping. In January 2019, a milestone was achieved by completing the development of its own SLAM Map (3D point cloud) technology which made possible the creation of a Giga Point Map featuring over one billion separate points. This technology has applications beyond just autonomous driving, and is also believed to be of significant value in such spheres as smart cities and digital twins. The use of technology developed in the fields of AP + AI or AP + AI + IoT in real-world applications is anticipated to result in the accumulation of new milestones to be achieved on into the future.

Monetization of milestones

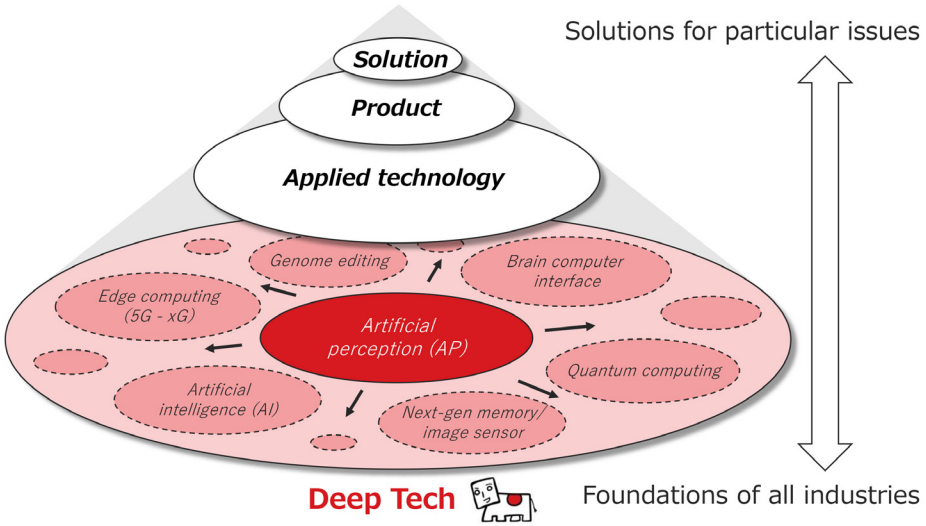


Source: Financial results summary documentation

(3) Investment programs

Widening its sphere of application from other technologies to products and on further to future technological solutions, Kudan's AP software is rapidly turning into a key elemental technology used in an extremely broad range of different fields. At the same time, it possesses tremendous possibilities as an example of future deep tech, potentially forming the foundation of entire industries such as quantum computing and next-generation memory and image sensors. The first step in this process is to examine the possibility of integrating the technology with other neighboring deep tech fields to create such amalgams as AP + AI and AP + AI + IoT. Kudan is already looking to expand into new parallel applications of this kind, and is also considering M&A possibilities with other deep tech firms. If such moves could place AP technology at the hub of new branches of deep tech, then this would put it in a still better position to provide a solid foundation for an even wider range of applied technologies.

Investment program

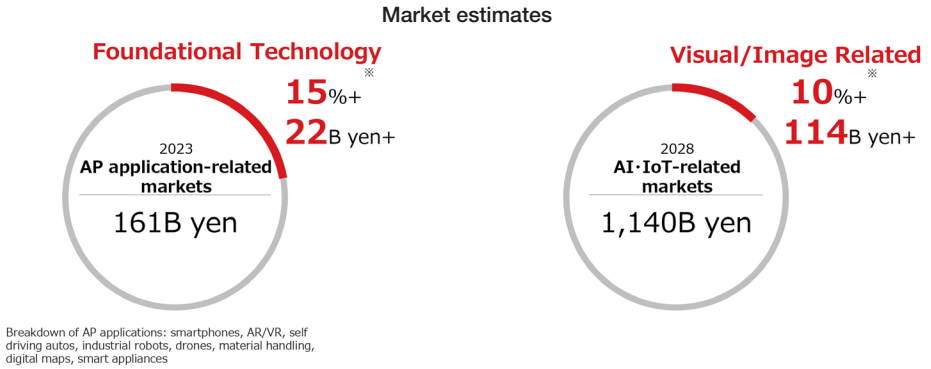


Source: Financial results summary documentation

(4) Market expansion projections

As has been shown, AP has applications in a wide range of fields supporting many other technologies, including future tech which has yet to be fully developed. Providing that application of AP technology continues as expected, the market for related applications is projected to reach some JPY 161 trillion by the year 2023. Kudan estimates that around 15 percent of this will be its target market. In addition, the AI and IoT markets, with which technical integration is already underway, are projected to be worth JPY 1,140 trillion by 2028, with Kudan estimating that ten percent of this market will be reachable by its products. No matter how one sees it, the market is enormous, and just as it has already done in the fields of telecommunications, semiconductors and aeronautical engineering, Kudan is perfectly poised to contribute with its deep tech to provide the foundations supporting future industry and society.

Mid-to-Long Term Growth Potential



Source: Documents detailing the company's future growth potential

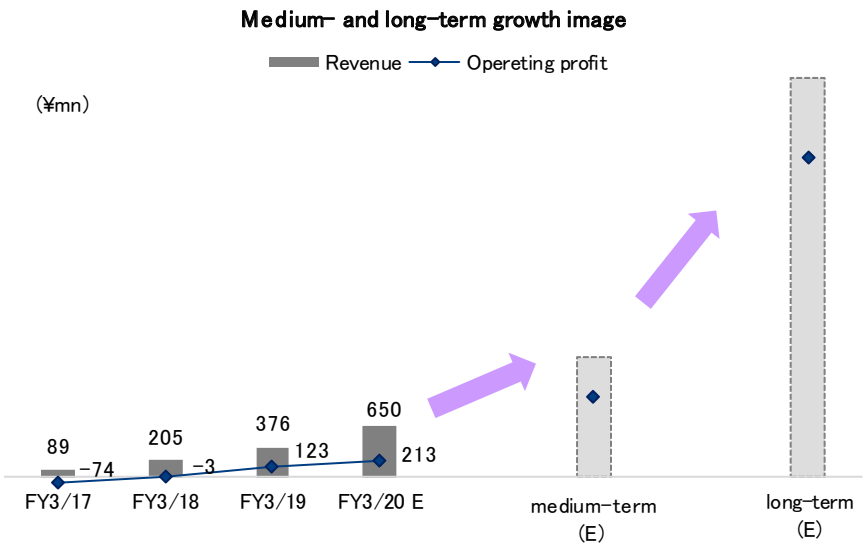
2. Management Philosophy and Mid-to-Long Term Development Plans

As a company of engineers making a living from R&D in the field of AP and from providing the results of its research to advanced technology firms, Kudan's goal is to produce technical innovation through its continued efforts in its research sphere. For this reason, the company has promoted as its philosophy "To stand alone, and dare to create what is new and different." This means that it is not afraid of doing what other companies do not, and is prepared to reject the prevailing wisdom of what is thought to be right. In terms of both R&D and business development, Kudan has striven to be a unique presence in the marketplace that cannot be compared to any other company, and to use that philosophy as a driving force in the development of its business and its research and to expand shareholder profits. In this respect, as the AP developed by Kudan is a unique technology giving the company a strong competitive advantage in the market (essentially a commercial monopoly) which functions as both an elemental technology for many industries and companies and as deep tech underpinning industry and society as a whole, it stands as the very embodiment of the company's management philosophy.

In order for Kudan to realize its objectives of expanding the application of its AP technology through integration from AP alone to AP + AI and on to AP + AI + IoT, then to position AP as a deep tech hub supporting the future of industries such as quantum computing and next-generation memory and image sensors, a continuation of the development of its software and core technology will be absolutely essential. To that end, what is needed is the strengthening of the technical development structure of the company by securing and training staff with exceptional aptitude and an ability to apply their knowledge outside their own specialist field. In addition to this, having announced that the company will be officially establishing its own audit and supervisory committee from the fiscal year ending March 2020, Kudan will also be carrying out a strengthening of its internal management systems with respect to corporate governance and regulatory compliance. While the securing of human resources and the establishment of additional structures will cost money, Kudan has the advantage of being run by a very small number of highly-skilled professionals, and as a firm focusing on technological research it has no intention of becoming a bloated megacorporation. For this reason, despite the fact that license fee sales, with their 100 percent profit ratio, are gathering pace, it is not anticipated that costs (in the form of sales expenses) will increase to any significant extent.

Mid-to-Long Term Growth Potential

While Kudan conducts its business with the unique characteristics and strengths that have been demonstrated, it does still have to contend with certain risks. In addition to standard business risks such as those related to exchange rates, Kudan must also be aware of the medium-term risks, however small, associated with an early growth enterprise of its type: those associated with the potential loss of technological superiority and the potential for future substitution of its technology, as well as those deriving from the technology, products or solutions to which their technology is applied falling behind in their respective fields. For these reasons, constant diligence is required to monitor any changes in client numbers or revenue patterns. Another risk is over-reliance on specific individuals. Kudan is well aware, in particular, that founder and CEO Tomohiro Ohno, whose decision-making plays a key role for the company, and CTO John Williams, who performs a vital function as leader of all research and development, are essentially irreplaceable. It is for this exact reason that one major issue facing the company now is the establishment of a corporate structure which does not rely excessively on these two individuals. Despite these risks, however, the mid-to-long term growth projected for Kudan as a result of its AP technology and the business opportunities it affords make it a company with an extremely bright future.



Source: Created by Fisco based on Kudan's summary of accounts

Policy for Shareholder Dividends

In terms of profit distribution, Kudan's fundamental policy is to regularly provide stable dividends to its shareholders, while retaining the funds necessary for future business expansion and reinforcement of its managerial structure. At this point in time, however, no dividends have yet been paid, and plans for future dividend payment amounts and timing remain undetermined. As policy, the distribution of surplus in the form of shareholder dividends will be examined on the basis of a comprehensive analysis of performance indicators, fiscal status and future business and investment plans, and any determination will be made with a consideration of maintaining balance with the necessity for internal retention.

Information Security

Through its business operations, Kudan is often made privy to its client companies' confidential information (including strategically sensitive information) and personal information. Information security protocols are in place to govern the handling of this information, and every effort is made to ensure appropriate measures are taken at all times.

FISCO

Disclaimer

FISCO Ltd. ("FISCO") offer stock price and index information for use under the approval of the Tokyo Stock Exchange, the Osaka Stock Exchange and Nikkei Inc.

This report is provided solely for the purpose of offering information, and is not a solicitation of investment nor any other act or action.

FISCO prepared and published this report based on information which it considered reliable; however, FISCO does not warrant the accuracy, completeness, fitness nor reliability of the contents of this report or the said information.

The issuers' securities, currencies, commodities, securities and other financial instruments mentioned in this report may increase or decrease in value or lose their value due to influence from corporate activities, economic policies, world affairs and other factors. This report does not make any promises regarding any future outcomes. If you use this report or any information mentioned herein, regardless of the purpose therefor, such use shall be made based on your judgment and responsibility, and FISCO shall not be liable for any damage incurred by you as a result of such use, irrespective of the reason.

This report has been prepared at the request of the company subject hereto based on the provision of information by such company through telephone interviews and the like. However, the hypotheses, conclusions and all other contents contained herein are based on analysis by FISCO. The contents of this report are as of the time of the preparation hereof, and are subject to change without notice. FISCO is not obligated to update this report.

FISCO and its affiliated companies, as well as the directors, officers and employees thereof, may currently or in the future trade or hold the financial instruments or the securities of issuers that are mentioned in this report.

Please use the information in this report upon accepting the above points.

■ For inquiry, please contact: ■
FISCO Ltd.
5-11-9 Minami Aoyama, Minato-ku, Tokyo, Japan 107-0062
Phone: 03-5774-2443 (Financial information Dept.)
Email: support@fisco.co.jp