Publicly available materials

Rev 1.0

White paper on SMKL (Smart Manufacturing Kaizen Level) using KPIs to “visualize” smart manufacturing in factories

～ Basics of vendor utilization Edition～

English version

2024/12/16

IAF (Industrial Automation Forum)

SMKL Project

SMKL White Paper Extension Working Group

Index

1. Preface

This white paper is the “Basics of Vendor*1 Utilization Edition” which follows the previously published “White Paper on SMKL (Smart Manufacturing KAIZEN Level) Factory Introduction Edition Using KPIs to Visualize Smart Manufacturing in Factories.” This white paper targets companies that sell and provide hardware/software products, services, solutions, consulting, etc. used in factories to users*2. We will also explain how to use the SMKL concept to respond to user intentions and contribute to sales activities.

In this white paper, we will show you how to use SMKL as a basic part, with the goal of being able to use it immediately after introduction for the purposes mentioned above. We plan to explain the application of SMKL to DX (Digital Transformation) in sales and marketing in the Application of Vendor Utilization Edition.

The intended users of this white paper are those who have read the factory introduction edition above in advance and understand the contents of SMKL.

※1 In this white paper, the term "vendor" refers to a business company that sells and provides products and services directly to buyers and users. Vendors do not necessarily develop or manufacture the products themselves. Here, products are not limited to tangible or intangible products.

※2 In this white paper, the term "user" refers to a buyer or user, but is also referred to as a "customer" or "client." In particular, this white paper refers to factories or people working in factories. A system integrator (SIer) is a user from the perspective of a facility or equipment vendor, but a vendor from the perspective of the system integrator's customers (users).

1.1 Background and issues

As mentioned in the “Factory Introduction Edition “, promotion of IoT (Internet of Things) and the SM (Smart Manufacturing) becomes the topic in industry, but they are poor in a still effective example, and even a user company is the situation with the hesitation in an investment judgment. On the other hand, the reality is that vendors are similarly unsure of what to recommend to customers in terms of sales strategy. Because neither the buyer nor the seller has any way of knowing the information the other party has, the situation described above occurs due to a lack of communication.

In the past, it was common practice for vendors to listen to users' intentions, understand their wishes, ideas, and targets, and then propose and receive orders for appropriate products, services, and solutions. Communication was established between the user and vendor sides.

However, in the current IoT/SM era, many users are faced with changes they have never experienced before and are unable to even envision what they should do. In addition, although vendors have knowledge about individual products and services, it is difficult to obtain information such as the status of user factories and the user's future vision. Because there are few vendors who can tell you the concept and overall structure of IoT/SM (call it SM in addition as follows), vendors are unable to provide appropriate user support. In other words, the current situation is that vendors are unable to provide appropriate information because user information is not available, and conversely, users are unable to make plans because vendors are unable to provide appropriate information or explanations.

This means that there is a so-called "barrier to information sharing" and it would be possible to resolve this if there was a tool to facilitate communication between the two parties. (Refer Figure1)

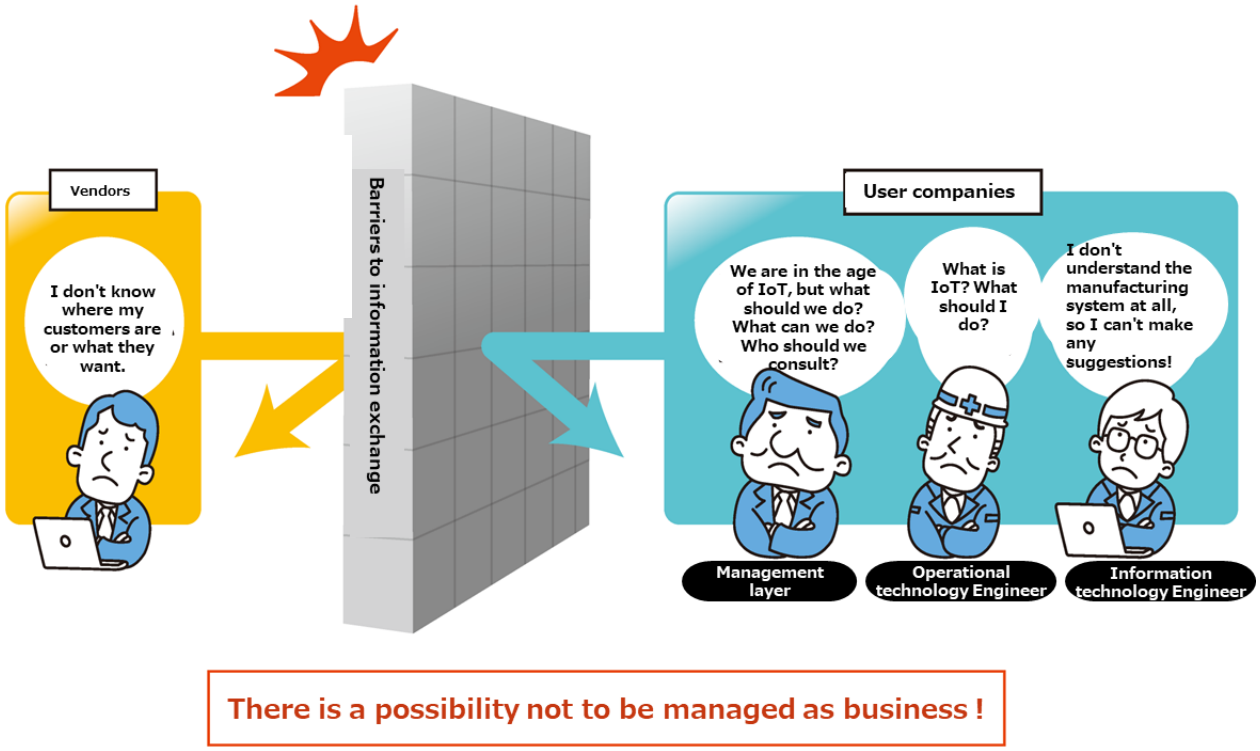

Figure 1. Barriers to information sharing between users and vendors in SM

Furthermore, there may be another issue. The challenge for vendors is that it is difficult for a single vendor alone to realize SM. SM uses a greater variety and amount of data from the factory floor than ever before. Therefore, it is generally necessary to collect, store, analyze, and process data using networks and communications, not only on-premises equipment but also cloud computing. Up until now, it was possible to satisfy users if they could provide equipment and equipment within a factory alone, but we will also propose ways to utilize user data using networks and communication methods and use computing technology to provide customer satisfaction. It is thought that there will be an increase in the number of situations in which the results sought by people are provided. In other words, there is a high possibility that vendors will be required to have not only OT (Operational Technology) to perform optimal control, but also ICT (Information and Communication Technology) to utilize information over the Internet. If you do not have all these in-house, communication between users and vendors will not be established as described above, so you will need to seek the cooperation of other companies (partner companies) to supplement this. To promote this so-called "fusion" of OT and ICT, a means of communication based on common indicators between multiple vendors (including partner companies) and users will be needed. (See Figures 2 and 3)

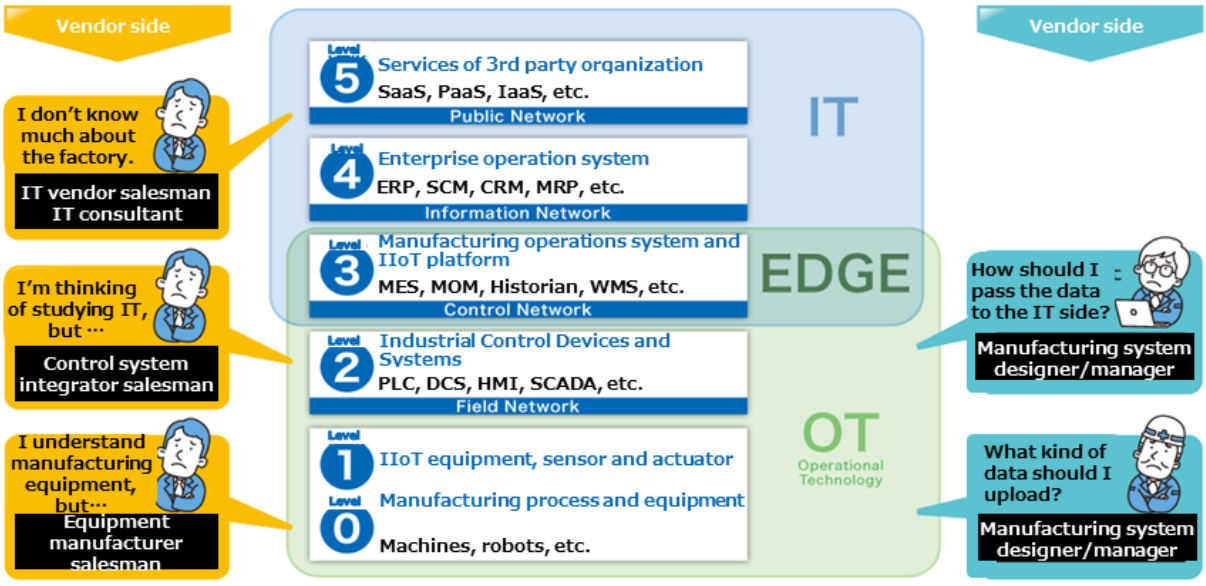

Figure 2. Manufacturing industry hierarchy and communication gap between vendors in the SM era.

Figure 2 is based on the production system hierarchy of ISA-95 (ISO/IEC62264), and the author added L5 and the network between the layers. The division between IT and OT on the right side of the figure does not indicate a clear division, but there is some overlap at L3, indicating that "Edge Computing" exists at the boundary between IT and OT.

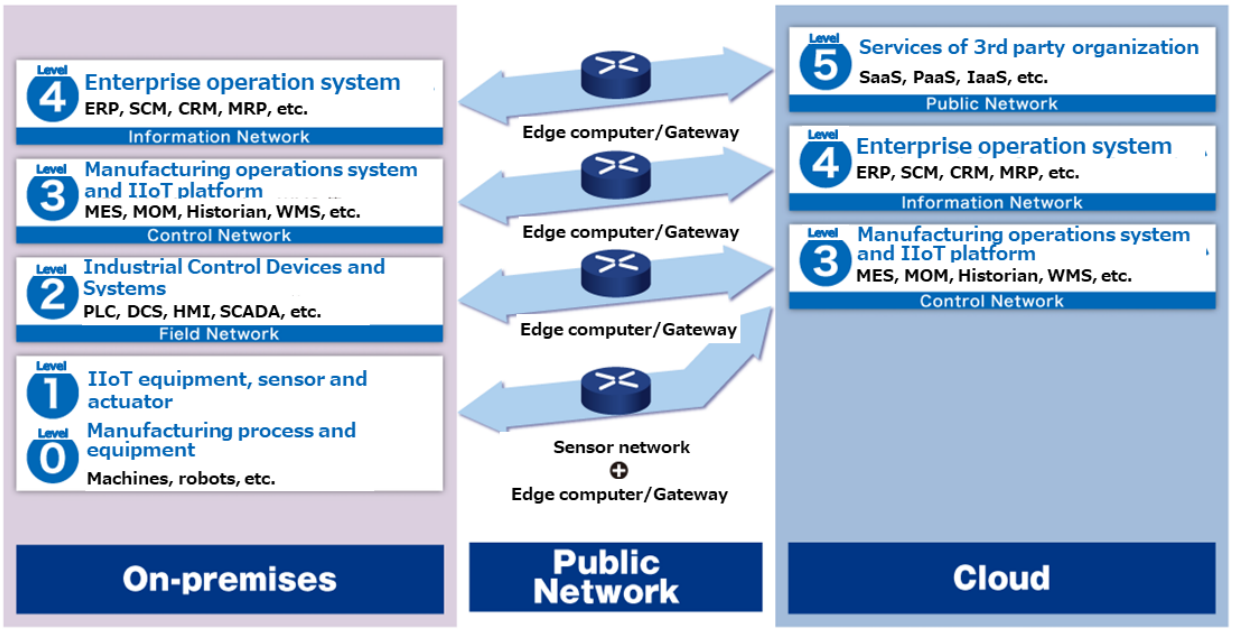

Figure 3. "Manufacturing industry hierarchy" when using cloud services

Figure 3 shows the hierarchy of a production system when using cloud services, and it does not consist only of on-premises (in-house equipment) as shown in Figure 2, but by connecting to the cloud via a network. This shows that the technology to do this will also spread to IT and CT (Communication Technology).

1.2 Proposals to solve the problem

In order to resolve the two issues mentioned in the previous section, it is important to understand the current situation at user factories and to stimulate communication between users and vendors. SMKL is an indicator developed not only to judge the level of SM progress, but also to solve the above-mentioned issues. Until now, there was no way to easily express the current state of SM in a user factory and how far SM should be progressed for which KPI to manage. SMKL has management targets on the horizontal axis and visualization

stages (representing SM maturity level) on the vertical axis, making it possible to express the “current situation” and “progress direction” clearly and easily. (See Figure 4)

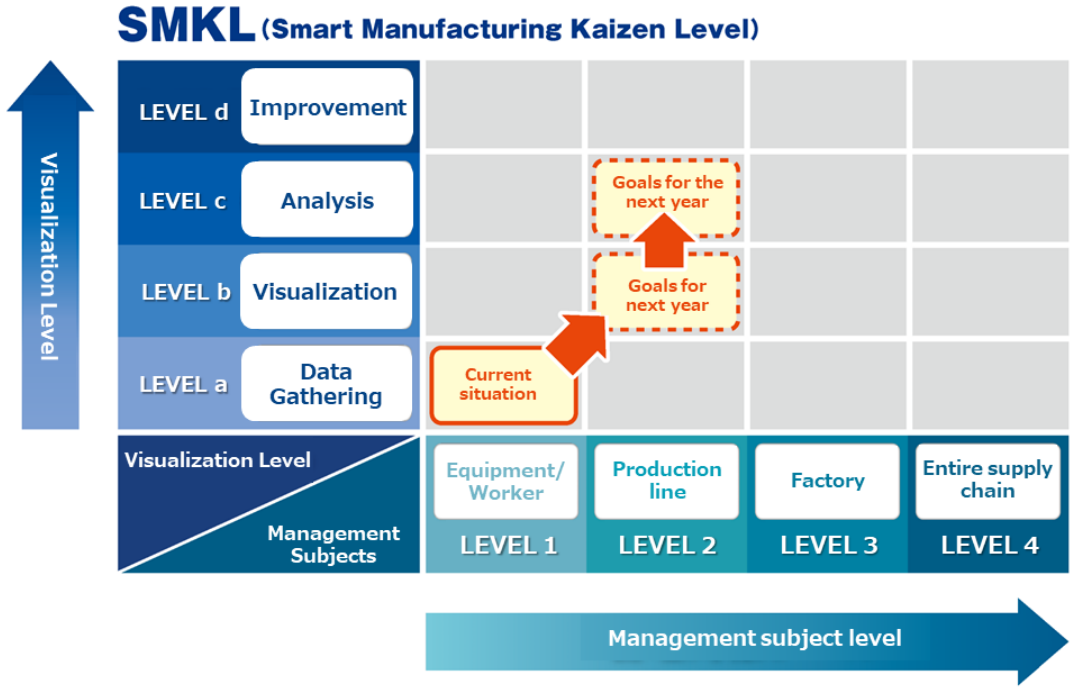

Figure 4. Examples of SMKL indicators and the “direction of SM”

In abstract terms, it can be said that in the SM era, communication is not going well even between users and vendors who have been doing business with each other for many years. What's more, business fields, transaction terms, technical terminology, etc. may be different from partner companies with which you have not done business before, making communication even more difficult. To solve this problem, SMKL is a concrete indicator with clear level divisions so that common understanding can be easily obtained even without specialized knowledge. Furthermore, SMKL uses a two-dimensional matrix representation that can be easily understood by anyone in any field.

In SMKL, as shown in Figure 4, the four stages on the vertical axis represent the maturity level of "visualization" and provide examples of what should be achieved at each stage. By learning this, you will be able to easily use SMKL in your daily sales and consulting activities.

On the other hand, SMKL's horizontal axis divides the management targets into "equipment/workers," "line," "factory," and "supply chain," so SMKL can be applied to many

factories and is easy for people in any field to manage. can be understood.

We will explain below that SMKL is a specification that can be used as a tool to solve problems for users and vendors in SM.

In the Factory Introduction Edition, we explained the relationship between users (factory personnel) and SMKL and showed how it can solve users' problems. I mentioned that smooth communication based on the same indicators within a company can increase the maturity of visualization in the SM era. However, there are some cases that cannot be resolved within the company alone. As mentioned earlier, in many cases, the cause is a lack of information, no means to obtain information, or no one who knows.

Also, as we have already explained, although vendors also have information that is useful to users, there are many issues in terms of what should be provided to which users. This white paper will clarify that "SMKL" is a means for these two parties to exchange information effectively and resolve mutual issues. This white paper will focus on solving problems on the vendor side, but it will be easy to understand that as a result, problems on the user side can also be solved.

As shown in Figure 5, the role of SMKL is specifically to provide SMKL values and associated information (indicated as |SMKL| in Figure 5) to vendors. This |SMKL| includes issues and information from the user side, which allows the vendor to visualize the user's values and intentions. Users' interest in SMKL leads to "customer attraction" and using the SMKL matrix becomes a clue for vendors' marketing activities. It is thought to be highly compatible with the "Data Driven" marketing and sales methods that have become mainstream in recent years.

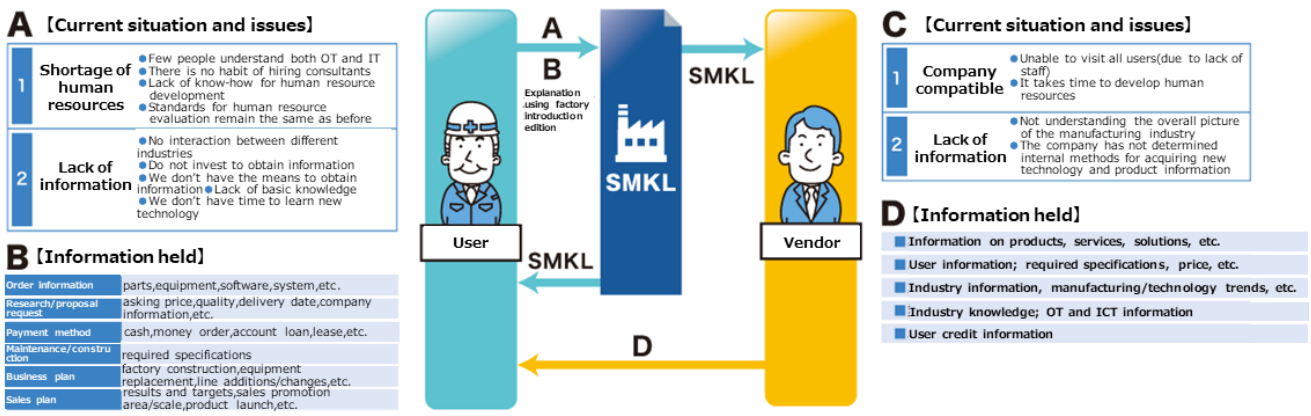

Figure 5. Solving problems for users and vendors using SMKL

Although this white paper is described as a vendor utilization edition, it consists of the following two parts. The usage of the two parts can be divided depending on the condition of the vendor.

(1) SMKL White Paper for Sales and Consulting - Basics of Vendor Utilization Edition- (this book)

We will provide and explain the basic methods so that you can introduce and quickly utilize SMKL. We also explain how to think about expanding SMKL's use cases.

(2) SMKL White Paper for Sales and Consulting ~Application of Vendor Utilization Edition~ (tentative name): (under consideration)

We provide a method to utilize SMKL for DX of vendor activities such as digital marketing.

2. SMKL overview

SMKL is a simple evaluation index that expresses a factory's SM in four stages of visualization and four scopes of management targets and allows you to judge to what stage a factory's SM has progressed.

2.1 Main features of SMKL

First, let's review the features of SMKL.

1）For factories promoting SM, SMKL is provided as a simple and easy-to-understand indicator of “for what purpose”, “where to target”, and “to what level”(visualization of data, improvements using AI, etc.) can SM be implemented.

2）SMKL allows you to "evaluate the direction of promoting SM in your factory" at the units of people, equipment, lines and processes, the entire factory, and the entire supply chain.

3）SMKL is useful for SM's continuous improvement activities (Kaizen) by allowing you to "understand the maturity level of visualization" such as collecting digitalized information at manufacturing sites, visualization, analysis, and improvement.

4）By using SMKL, it is possible to create a common understanding between management and equipment managers regarding "planned investment decisions for factory SM."

5）You can use SMKL to evaluate your current factory's IoT maturity level and use it as a tool to have easy-to-understand conversations with consultants and system integrators who propose SM about your future factory goals.

2.2 About SMKL installation environment

In an environment where SMKL is introduced, it is very important that the user has the intention to improve, and in that case SMKL becomes a very powerful tool to support improvement, but if there is no specific intention to improve. However, it can be a tool for determining the direction of improvement.

In the former case, SMKL is suitable for conversation tools to express the level of visualization and the direction of improvement between the management side that makes SM investment decisions and the person in charge of installing the equipment on site, consultants, system integrators, and equipment vendors.

On the other hand, in the latter case, you can emphasize the necessity of SM by showing users the trends of other companies. It can also be used for consulting work to make users aware of specific points for improvement.

In other words, since every factory has improvement items, SMKL is useful when approaching users in any environment.

3. Significance of using SMKL for sales and consultancy

The following are considered as the significance that sales and consultants use SMKL.

(1) It provides an opportunity to have a conversation with users about SM. By attaching the SMKL matrix to a proposal for users, it becomes eye-catching and can be introduced from the explanation of SMKL to the explanation of your own products. (See this white paper <Appendix A>)

(2) You can understand the management objects that users are interested in. (horizontal axis in Figure 4)

(3) You can understand the current visualization level of the user's factory equipment. (Vertical axis in Figure 4)

(4) You can understand the user's future direction of improvement, goals, and plans. (Top, right, diagonally upward right in Figure 4)

(5) You can suggest appropriate product, solution, service to a user based on (2) to

(6) Coordination between vendors can be achieved using common evaluation criteria with partner companies that provide each product, solution, and service.

(7) Products, solutions, and services that fall into each frame of the matrix in Figure 4 can be presented to users. (See this white paper <Appendix B>)

(8) Vendors can get a bird's-eye view of the products, solutions, and services they handle in-house and plan their product lineup. It can also be used by vendors as a clear resource for reconciling overlapping assortments within their companies.

(9) Vendors can create their own technology maps based on KPIs, such as Figure 6 "SMKL technology map (example)" in the factory introduction edition and show off their technology to users. Additionally, by mapping the products of partner companies in the blank frames, you can demonstrate to users that you can offer a wide range of services.

(10) By determining KPIs related to user issues and making a technology map from the KPI perspective, vendors can present the appropriate technology or product to that user.

(11) Vendors can check the management items that users are interested in. (Factory introduction edition <Appendix D> Utilization of "SMKL radar chart by management item")

(12) Based on (7) above, you can select KPIs related to management items that users are interested in. (Factory introduction edition <Appendix E> Utilization of "SMKL comprehensive management sheet")

(13) Based on the results of (2) to (8) above, vendors will create the investment plan together with the user or on behalf of the user using the "Smart Manufacturing Investment Plan" in the Factory Introduction Edition (Appendix C). By doing so, the vendor can understand the user's investment plans. It also allows vendors to be ahead of other companies in their initial sales activities (or order-winning activities).

(14) Vendors can shift from conventional field sales to inside sales. With the Corona era or the new normal era, opportunities to contact users are expected to decrease dramatically, but we will develop a web application (details will be explained in the Application of Vendor Utilization Edition) as a tool to smoothly make this transition. As a result, it can be used as a communication tool between users and vendors, between vendors, and for EC (Electric Commerce). This could be the first step in promoting DX for users and vendors.

4. Preparations for using SMKL

The first step in preparing for a vendor to use SMKL is to carefully read and understand the contents of the "Factory Introduction Edition". After that, if you carry out the following items as advance preparation, SMKL will have a more effective action on your business execution. Please note that item (3) below is required, but the others can be considered optional.

(1) Vendors copy "factory introduction" to print or a tablet or publish it in the company homepage and allow having you see it anytime in a user. Or it allows to be distribution or to deliver it by an email as electronic file directly with simple explanation of SMKL as a brochure in-house.

（2） Decide on your target users. Since users have various circumstances (business issues, level of visualization, etc.), we recommend that you initially select users who are highly interested in IT/DX conversion, while referring to Chapter 5 of this white paper.

（3） You prepare the diagrams and charts in the "Factory Introduction" that you deem necessary by printing them out, copying them onto a tablet, or posting them on your company's website. In particular, Figure 4 in this white paper (or Figure 1 in the factory introduction edition) should be ready to be presented to users.

（4） You map your own or partner company's products, solutions, and services that match your target users to the matrix in Figure 4. (Examples in <Appendix B>)

（5） You should give your users quick access to your mapped catalog of products and services.

（6） In order to record user approaches and trends and use them for sales, consulting activities, etc., you will be able to link them with marketing and sales application tools.

（7） You prepare questions to calculate the SMKL value, such as the "SMKL Promotion Level Diagnosis Check Sheet" (hereinafter referred to as the "SMKL Check Sheet") shown in Tables “a” and “b” shown on the following pages, and actually answer them to users. (The SMKL automatic diagnosis app sub-working is also considering this) After receiving the answers, you will calculate the SMKL value (we are also considering an application in the sub-working) and return it to the user. The answers to this check sheet become user information and are stored in the database for each user.

5. How to use SMKL that suits the user's actual situation

5.1 How to use SMKL that suits the user's actual situation

The "actual situation of users" here refers to (1) the degree of progress of digitalization and networking among users (hereinafter referred to as "achievement of digitalization"), and (2) the level of issues and business goals to be solved within user companies at the KPI level. (hereinafter referred to as "issue sharing"). Since the method of using SMKL differs depending on whether it is "completed" for these two items, I will explain them separately.

① (achievement of digitalization) mentioned above indicates whether the "visualization level" has reached "a" in the SMKL matrix. And if it has not reached it, it means that it is outside the scope of the SMKL matrix. In this case, users will not benefit from a detailed explanation of SMKL, so vendors will start by explaining the need for digitization and networking. If you have reached level "a", you have all the prerequisites to use SMKL.

In addition, ② (issue sharing) mentioned above indicates whether there is a common understanding of the issues within the user company, and if "yes", it is possible to decide on specific KPIs, and thereby the management target, which is the horizontal axis of the SMKL matrix. It is also possible to narrow down the information and specify the "visualization level". If not, vendors will calculate the SMKL evaluation value and provide an opportunity to consider what needs to be done about the current situation.

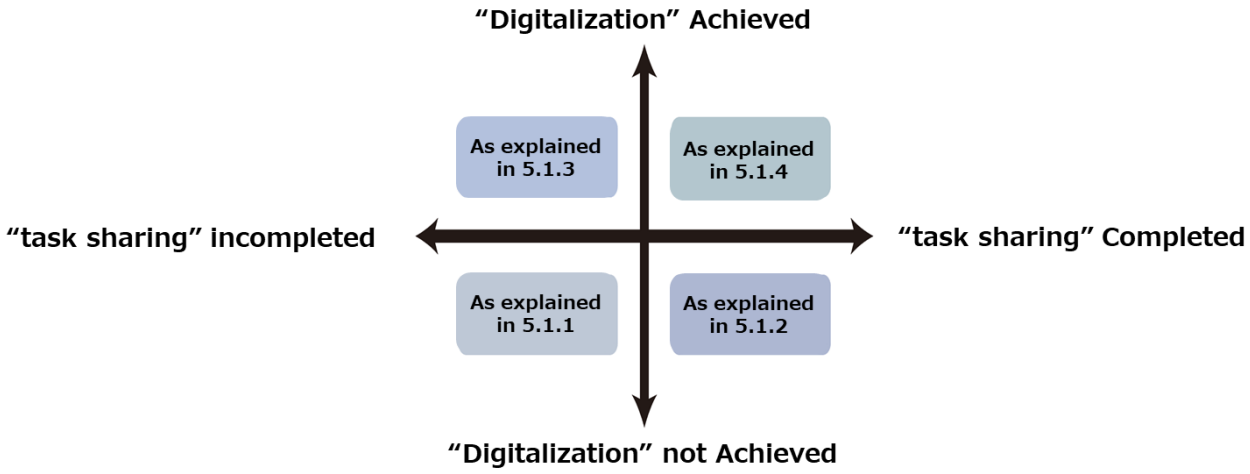

Figure 6. Explanation category of "SMKL usage method that suits the user's actual situation"

5.1.1 When digitalization is not achieved and issues are not shared

For users in this situation, vendors first carefully explain the changes in the social situation and the significance of improving it. In addition, vendors' first objective is to generate interest by sending SMKL pamphlets and other information via email (e-mail newsletter, etc.). After that, for example, using the SMKL check sheet, try to understand the current situation with the user and make them aware that their factory is outside the framework of the SMKL matrix. (See Figures 7 and 8)

The purpose of this stage is to become aware of the current situation of the user company and to make the user aware that something needs to be done.

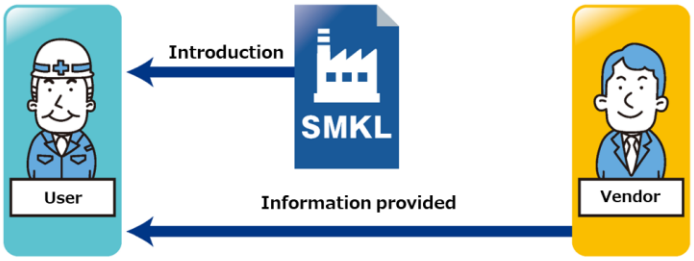

Figure 7. Vendor support for 5.1.1

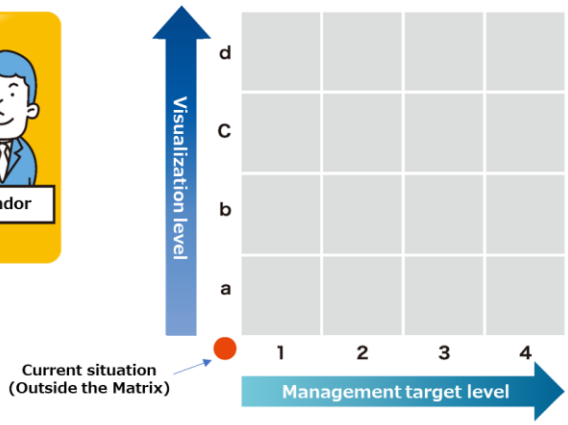

Figure 8. SMKL value for 5.1.1

5.1.2 When digitalization is not achieved but issues are shared

This is the most common pattern in traditional Japanese manufacturing.

Japan's manufacturing industry is accustomed to "improvement" activities daily, but data-based decision-making is not being done. Analog/offline is not bad, but it is said to be disadvantageous in terms of sharing data through visualization, eliminating individuality, efficiency, and rapid improvement.

In this situation, vendors need to fully explain to users the need for digitalization/networking (the benefits that can be achieved) and gain their understanding. Vendors then use SMKL to explain the need to take steps to achieve improvements. It is also a good idea to select KPIs and provide examples of specific improvement methods for the user's improvement items. To this end, vendors should map their products and solutions to the SMKL matrix. (See Figures 9 and 10)

For users in this situation, it is recommended to decide on "management items (KPIs)" for "visualization" as shown in (2) of Chapter 4 "How to evaluate the current value of SMKL" in the factory introduction edition. Vendors recommend that users plan full-scale SMKL operations using the method for evaluating SMKL as a reference. Users gather and organize members to consider management items and draw up detailed plans. Vendors need to support their users so that they can continue to evaluate SMKL. (Use the "SMKL Check Sheet")

After planning, you should push forward the plan by referring to the flow shown in Figure 3 of the factory introduction edition.

Here, the management item (KPI) does not mind either in KPI company's original in KPI defined in ISO22400 either.

This usage method is suitable for deciding the direction of an organization such as a company, factory, or production line, so it is mainly targeted at the management layer and the class of managers of user companies.

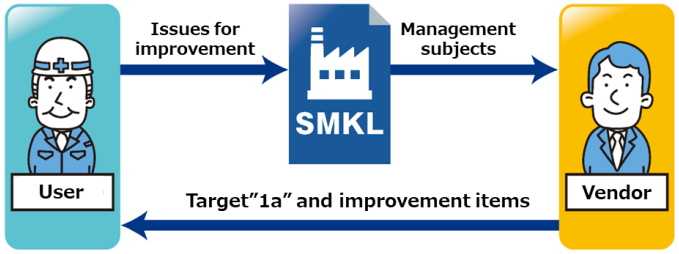

Figure 9. Vendor support for 5.1.2

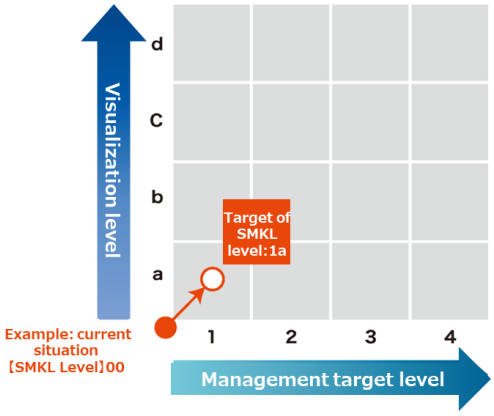

Figure10. SMKL value for 5.1.2

5.1.3 When achieving digitalization without sharing issues

Users are willing to improve, so they should readily accept SMKL.

For users in this situation, we recommend that vendors let users decide which management items to improve. At that time, users should decide “the management object” on specific equipment, product lines, and the entire factory as shown in Chapter 4 of the Factory Introduction

Edition "How to evaluate the current value of SMKL" (1), and then refer to the method to evaluate using SMKL. (See Figures 11 and 12)

The important point here is to have the user narrow down the management target to one specific piece of equipment or line. This is because it will be easier to see cost-effectiveness if you narrow down the targets of improvement as much as possible. Having them experience even small successes using SMKL increases the possibility that it will lead to continued improvement in the future.

This usage method is suitable for quickly understanding improvements in a limited range, so it is mainly targeted at user companies' design, maintenance, and materials staff.

Figure 11. Vendor support for 5.1.3

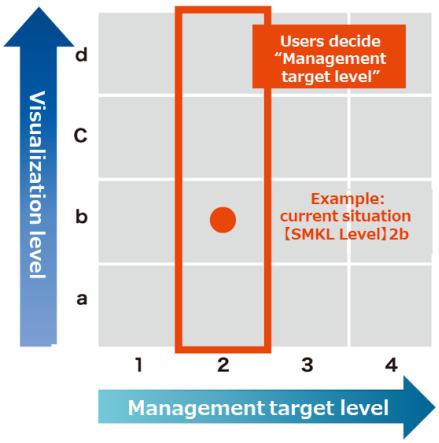

Figure 12. SMKL value for 5.1.3

5.1.4 When achieving either digitalization and sharing issues

It is assumed that users know in advance the information they want to manage or visualize.

For users in this situation, it is recommended to decide on "management items (KPI)" for "visualization" as shown in (2) of Chapter 4 "How to evaluate the current value of SMKL" in the factory introduction edition. We recommend that users plan full-scale SMKL operations by referring to the method for evaluating SMKL. The user gathers members who are familiar with management items and draws up a detailed plan. Vendors need to support their users so that they can continue to evaluate SMKL. (See Figures 13 and 14)

After planning, it is a good idea to proceed by referring to the flow shown in Figure 3 of the factory introduction edition.

Here, the management items (KPIs) can be KPIs defined by ISO22400 or your company's original KPIs.

This usage method is suitable for deciding the direction of an organization such as a company, factory, or production line, so it is mainly targeted at the management of user companies.

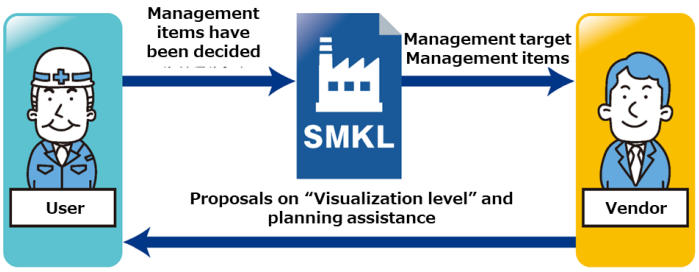

Figure 13. Vendor support for 5.1.4

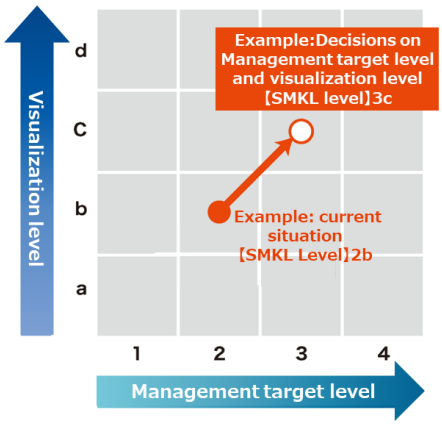

Figure 14. SMKL for 5.1.4

The above four methods of using SMKL that suit the actual circumstances of users are not independent of each other and progressing from 5.1.1 or 5.1.2 to 5.1.3 or 5.1.4 will improve the problem. is required. As a vendor, you want to jump straight to 5.1.4, but following the steps is important for building lasting relationships with your users.

Table 1 summarizes the contents of the above four cases.

Table 1. How to use SMKL according to the user's actual situation (summary)

	Digitalization not achieved	Achieving digitalization
Issues are not shared	5.1.1 ・Awareness activities ・Case studies of other companies ・Introduction of SMKL	5.1.3 ・SMKL overview explanation ・Narrow down management targets ・cf. Factory Introduction Chapter 4 (1)
Issues are shared	5.1.2 ・Explanation of the need for digital-ization/networking ・Present specific examples for real-izing improvements	5.1.4 ・Detailed explanation of SMKL ・Full-scale operation of SMKL ・cf. Factory Introduction Chapter 4 (2)

5.2 How to use SMKL according to user intentions

In chapter 5.1, we explained how to use SMKL from the actual situation (current situation) of user companies, but it is also assumed that SMKL will be used based on the user's intention (orientation). For example, when users start considering SM, they don't know their company's situation and what to do, so they follow the method in 5.1, and once they have implemented it, users' intention. It is inevitable that the user's intentions will come out.

In such cases, there are two possible ways to use SMKL:

5.2.1 Users decide which direction they want to go in based on the current SMKL evaluation value, and vendors provide information on products, services, solutions, etc. necessary to achieve that goal.

For example, if the company's factory is currently at level 2b as shown in Figure 15a, the user will decide whether to expand the scope of management, increase the level of visualization, or do both at the same time. Users use SMKL to obtain information on products, services, and solutions necessary to achieve their goals. To this end, vendors prepare information such as products that can be provided at each level. (See this white paper <Appendix B>)

A specific example is shown in Figure 15b. In a certain factory, if the production performance of the production line is currently being visualized using "ANDON" (equivalent to SMKL value 2b), then the user wants to raise the "visualization level" to "c". If you are planning to do so, the vendor will suggest the introduction of BI tools. To do this, vendors must prepare information on analytical software such as BI tools in advance. Similarly, if the user wishes to expand the scope of management to "3", the vendor will suggest implementing SCADA etc. to aggregate information from all lines. Having a means to collect not only product information such as SCADA but also data from all lines will increase the possibility that proposal activities will proceed smoothly.

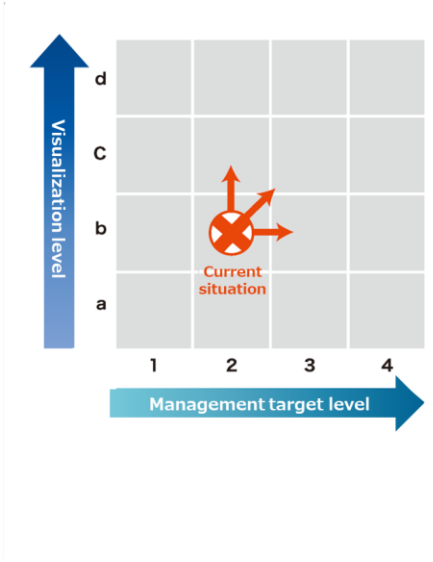

Figure 15a. When determining direction

Figure 15b. Specific example of Figure 15a

5.2.2 Decide on visualization management items (or KPIs), limit related management targets, and evaluate the visualization level using SMKL

Based on the user's business strategy, business goals, or issues, we decide on the "management items" to focus on and their "visualization" level, and then determine which management targets are related from those management items (KPIs). If 3c is the SMKL value as shown in Figure 16, the vendor will introduce the products, services, solutions, etc. necessary to achieve it, as in 5.2.1.

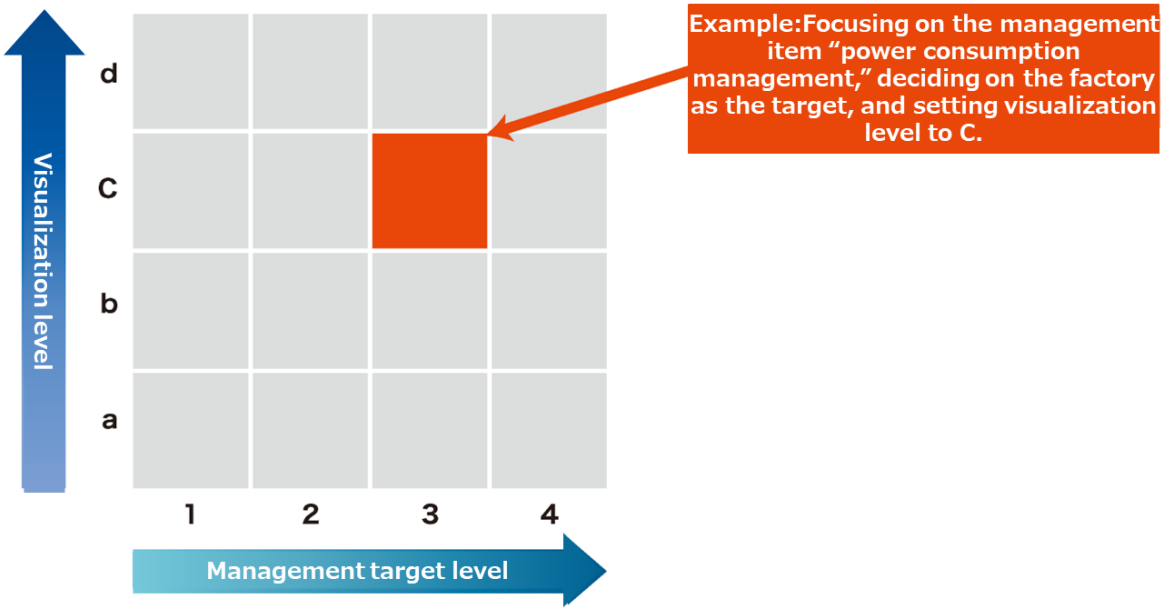

Figure 16. When determining the visualization level based on management items

6. Utilizing SMKL in sales and marketing activities

6.1 How to use SMKL in data-driven sales and marketing

SMKL is not just a tool to visualize the maturity level (progress) of SM. It's a tool that helps users become aware of their company's current situation, plan, execute, and continue. Therefore, it can be used in various user situations.

SMKL can also be a useful tool for vendors as it provides appropriate information and advice tailored to the user's circumstances.

In the SM era, sales and marketing activities are dominated by a method called "data-driven" marketing or "digital marketing," which encourages "decision-making" based on digital data.

Data-driven marketing is not a method that emerged in conjunction with the SM era, but the need for it has increased due to recent changes in social conditions and industry trends (the so-called VUCA era*3). In these times, vendors need to be flexible and agile in responding to changes in users, so they are required to obtain data from time to time and aim for goals (contracts, orders).

*3 VUCA: An acronym for Volatility, Uncertainty, Complexity, and Ambiguity, and refers to a situation in society where it is difficult to predict the future.

Users themselves should not only make improvements using the conventional PDCA cycle, but also make quick decisions using methods such as the OODA loop*4 in situations that cannot be planned for (unpredictable situations such as the coronavirus pandemic). is expected to increase. In such a situation, user behavior (decisions and changes) and values tend to become complex, and traditional methods may lead to an increase in wasteful marketing measures and increased costs. In particular, users' intentions and intentions are often not clear in the SM era, so it is even more likely that they will proceed with their activities without narrowing down their focus. At such times, if the effects of measures can be visualized using data, waste will be eliminated, and marketing costs will be reduced.

Note 4. OODA Loop: Originated from research to generalize the decision-making process of fighter pilots, it is now being used as a framework that can also be applied to business. It is characterized by repeating four steps (Observe → Orient → Situation judgment → Decide → Act). The PDCA cycle is a means of managing large-scale systems, and it works effectively when planning a major path. On the other hand, the OODA loop uses only the "current situation" as a basis for making decisions, so it is said to be effective in situations of rapid change and in small teams. It's not that one is better than the other, but you can choose the one that's more

appropriate depending on your business situation and environment, or you might consider using a combination of both.

In addition, in a situation where the infection of the new coronavirus has become a social issue, we are shifting emphasis from traditional field sales to inside sales, where sales activities can be carried out without directly meeting users, and we are developing a new approach based on the after-corona virus. It can be said that we need to build digital contact points. In line with this trend, data-driven sales and marketing can be said to be more suited to the times.

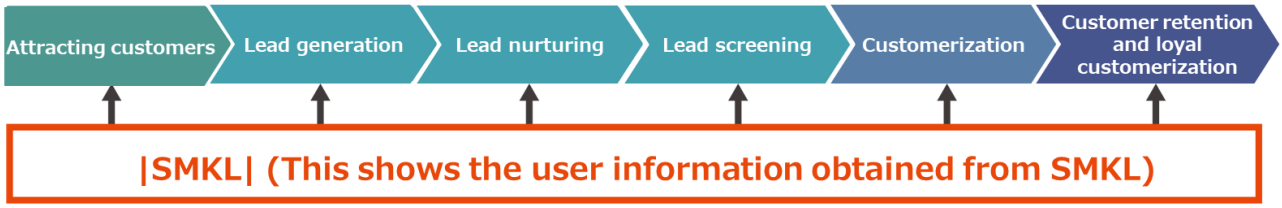

Figure17. Utilization of SMKL in sales flow in the SM era

Figure 17 shows the case where data is directly input into a dedicated data-driven application at each stage, but as shown in Figure 18, a BI (Business Intelligence) tool that performs general-purpose data processing once after analyzing the data, you might want to input it into a data-driven app. If you can provide the data obtained with SMKL to this BI tool and each data-driven application, it will be possible to reflect customer needs at each stage.

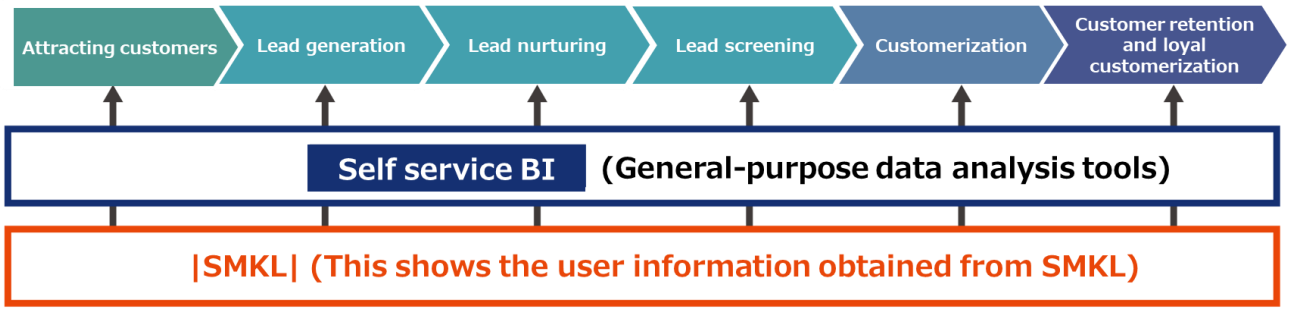

Figure 18. Utilization of SMKL and BI tools in data-driven sales

6.2 SMKL to connect users and vendors

Additionally, Figure 19 shows the typical relationship between users' SM needs and the vendors that serve them. The important point here is that the sales tools (data-driven marketing tools in the diagram) that vendors use daily alone cannot adequately express, analyze, and evaluate user needs. As shown in Figure 19, a system is needed in which simple evaluation values such as SMKL and data indicating user needs are obtained from users, and the vendor processes and analyzes them to return the processing results and solutions to problems to the users. In the past, salespeople and consultants interpreted user information using their own sensibilities, but it was not possible to share that information with users, other salespeople, and consultants. I am sure that those reading this white paper have experienced that this has been a hindrance to sales and order-taking activities.

In sales tools, records of individual sales and order-receiving activities are usually entered by the person in charge. There is always the subjectivity of the person in charge. This has a particularly big impact on the marketing stage. At the marketing stage, users' ideas about SM have not yet been finalized and the priority of their conditions has not yet been determined, so the purpose and intentions often differ each time we ask for opinions. As a result, it is not possible to measure the probability of receiving an order in marketing, and the accuracy of determining whether a user is a hot lead (a prospect with high interest among potential customers) decreases. SMKL eliminates such human subjectivity as much as possible and provides sales tools with information that reflects the user's intentions.

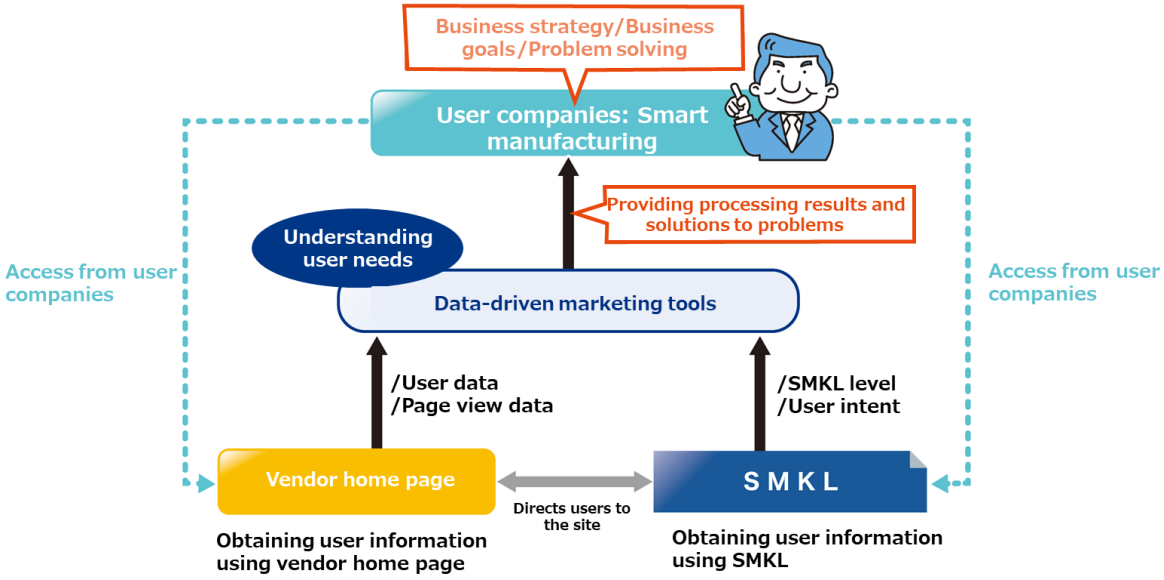

Figure 19. User problem solution framework around SMKL

Note) Obtaining user information must comply with international and domestic regulations.

SMKL in Figure 19 refers to sheets such as B: SMKL management sheet, C: SM investment plan, E: SMKL comprehensive management sheet, etc. in the appendices of the factory introduction edition. In addition to the functionality of the SMKL 4x4 matrix, the data-driven marketing tool also allows you to view products and services with SMKL values that apply to each level of the matrix. Furthermore, it refers to a tool that has a mechanism to obtain information about what the user has shown interest in.

6.3 Steps to proceed with SM

Figure 20 shows the steps to proceed with user SM using the user problem solving framework shown in Figure 19.

As a premise for vendors to proceed with user SM using Figure 20,

(1) The vendor has already identified the user as a customer or lead (customer candidate).

(2) In order to acquire customers and leads, vendors have already started marketing activities such as mass advertising, web advertising, holding exhibitions, and purchasing lists.

Assuming one of the above states, Figure 20 explains the vendor's subsequent activities.

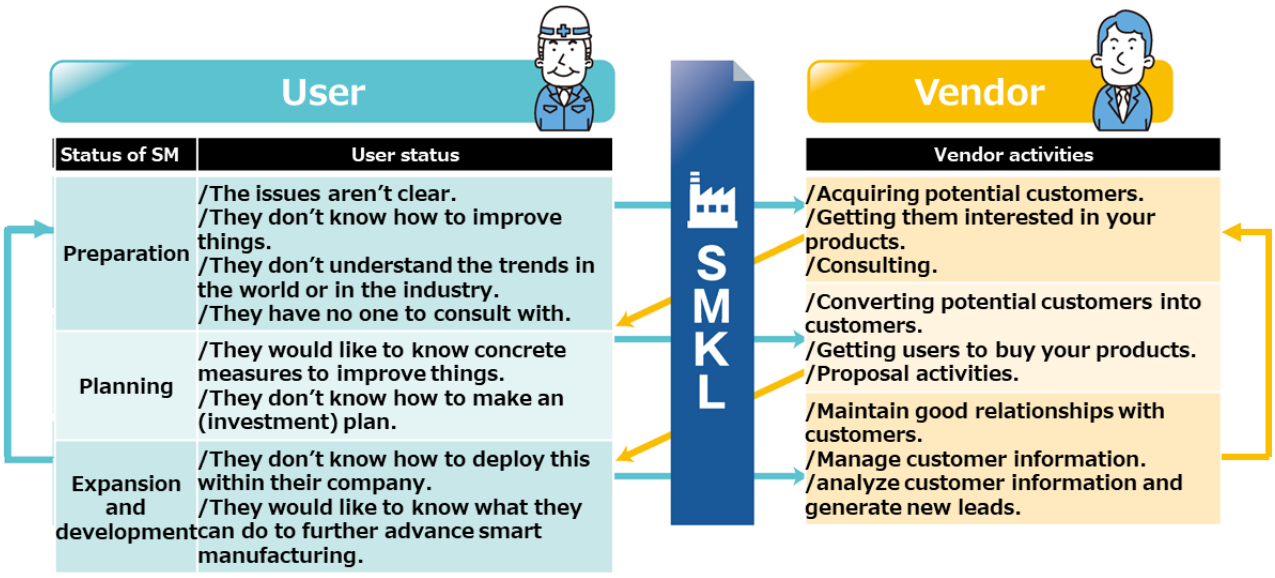

Figure 20. SMKL to connect users and vendors in the SM era

In Figure 20, the progress of the user's SM is shown in order from the top.

Describe the interaction between users and vendors at each stage.

・SM status = preparation stage;

In the same situation as in 5.1.1 above, vendors use SMKL as a consulting tool. First, vendors will introduce SMKL and ask users if they are interested and willing to use SMKL. For interested users, vendors can explain how to use SMKL and introduce their products and services mapped to each level of the 4 x 4 matrix. Since this user has not yet implemented digitization/networking and cannot attach an SMKL value to the user factory, we will approach level “1a” of the SMKL matrix. (However, for energy and security, it may be better to start with “3a” in terms of ROI.)

・SM status = planning;

In the same situation as in 5.1.2 above, vendors recommend users to promote digitalization/networking to obtain digital data in conjunction with the SMKL explanation. Vendors will mainly introduce products and services with visualization level “a” and will then use factory introductions to explain specific methods for improving management items. In user improvement projects, vendors can increase the number of users of SMKL within their companies and provide a variety of related content (a collection of sales and marketing information based on a series of stories) and <Appendix C> of this white paper. By doing so, the vendor will develop leads. Vendors present as many examples as possible and use the access status as data for lead selection. If there is not much traffic, the vendor should add products and services from partner companies to the list and see how it goes.

In addition, if the situation is the same as in 5.1.4 above, the vendor will promptly provide detailed explanations of SMKL to the user. Since the improvement items and management targets have already been decided, we will ask them to use SMKL to determine which level to introduce. Vendors have all their project members use SMKL to collect visualization-level or managed-level data of interest. To become a customer, the vendor presents the user with improvement steps in the factory implementation version. After that, the vendor will either have the user fill out the "SMKL Management Sheet" in <Appendix B> of the Factory Introduction Edition and the "SM Investment Plan" in <Appendix C> of the Factory Introduction Edition, or the vendor will do so themselves through a meeting.

・Status of SM = expansion/development;

At this stage, the user is already a customer of the vendor and has moved on to the next step. Vendors can infer that users are aiming to deploy or further develop the SM they have implemented internally. Vendors can roughly guess whether the user's intention is along the horizontal axis, vertical axis, or both axes of the SMKL matrix. If there are many inquiries about management targets shown on the horizontal axis and views of related content for sales and marketing (reference examples are shown in <Appendix C> of this white paper), it is likely that users are planning to expand internally or to the supply chain. The visualization level on the vertical axis can be expected to indicate that the progress of SM is being considered. If users are interested in both axes, it is expected that they will be aiming diagonally up on the matrix. When vendors have good control over their customers and have access to data like this, they can provide the right content and materials to them and build ongoing business relationships with them. In this way, vendors will be able to acquire "good customers."

Although we have explained the steps using Figure 20, it is important to correctly judge which stage the process is in, considering the individual relationship between the user and the vendor. As shown in Figures 17 and 18, rather than following the order, vendors need to be mindful of determining at what stage they are truly communicating with the user. For this reason, it is important to maintain a relationship with users. A specific strategy for this is to adopt a "subscription" type sales format, rather than just "one-time sales." Additionally, efforts must be made to improve the quantity and quality of content for users. ``Quantity'' refers to increasing the frequency of updates and creating content that is closely tailored to the user's situation. In addition, "quality" refers to the content that users will view first (such as information that is useful for the user's work or information that is difficult to obtain) and that is easy to understand. <Appendix C> provides examples.

6.4 Data input from SMKL

For this type of interaction between users and vendors, information obtained through SMKL and access information on the homepages of vendor companies that guide users are used. Using Figure 21, we will explain the provision of data from the SMKL side to the sales and marketing tools used by vendors (here we assume data-driven marketing tools).

On the assumption that users will be directed to the homepage of a vendor company that has adopted SMKL or to a special product introduction site from the link of the product mapped on the SMKL matrix.

These two sources feed data into vendor's sales and marketing tools.

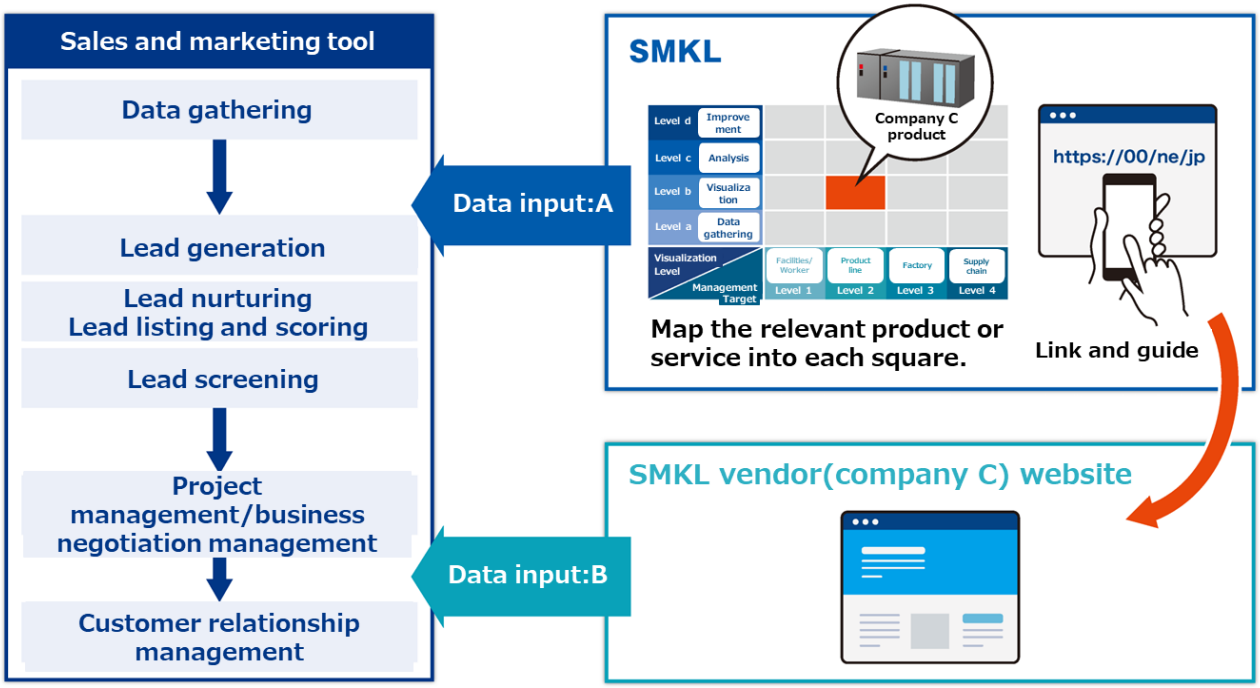

Figure 21. Data input from SMKL side

Next, Table 2 shows specific examples of data inputs A and B in Figure 21.

In Table 2, SMKL provides vendors with data about users' needs and interest in data collection. Vendor sites provide more detailed information on SMKL.

	Sales and marketing tools(Data-driven type)					
	Data Gathering	Lead Generation	Lead Nurturing	Lead Screening	Project/Business Negotiation Management	Customer Relationship Management
【Data Input:A】 Data provided by SMKL	■ User Information ✓Contact name ✓Company name ✓Job title ✓Telephone number ✓Mail address ■ Purchasing information ✓Past purchasing information ■ Current SMKL level	■ SMKL level(user's intent) Example: From 1a to 2b	■ Views by product ■ SMKL level according to the SMKL checklist	■ Views by particular product	■ SMKL investment plan (note 5) ■ SMKL management sheet (note 5)	■ SMKL checklist usage count (Time of diagnosis 1→2→3)
【Data Input:B】 Data provided by vendor website	■ Site access information ✓IP address ✓Provider domain ✓Connection environment ✓Country/area	■ Access log ✓Number of sessions ✓Time on site	■ Access log ✓PV ✓Bounce rate	■ Access log ✓Average time on page		■ Contents ✓Number of views ✓Viewing time

Table 2. Specific example of data input

Note 5. The SM investment plan and SMKL management sheet can be used not only for project management/negotiation management but also for all previous stages. However, since this information

ultimately leads to the conclusion of a project and the receipt of an order, it is listed as data provided at the project management/negotiation management stage.

The next stage, from "prospect acquisition" to "prospect selection", involves acquiring potential customers, nurturing, and educating them into customers who will lead to contracts and orders, and then determining whether they are likely to become customers. We provide various data that can be used to make decisions. The example in Table 2 shows data using access logs to the site, but reactions to exhibitions, DMs (Direct Mail), etc. are also important data.

In order to measure the probability of receiving an order in project management/negotiation management, it is necessary to obtain BANT information (Budget, Authority, Needs, timeframe), but these can be obtained from the SMKL factory introduction version such as the SM investment plan. It is possible to obtain the certificate based on the documents presented. Making users feel positive about making this SM investment plan is the most important issue in marketing and sales activities.

Finally, during the customer relationship maintenance stage, it states that vendors should pay attention to post-order user behavior and provide appropriate data. It is said that after receiving an order, users often look for positive aspects of what they purchased (ordered) to justify themselves. Based on this tendency, if vendors prepare new content for users to see when they visit SMKL or vendor's site, for example, they will become even better customers. There is also the possibility of promoting vendor’s product to others through word of mouth. The customer relationship retention stage provides data that indicates whether the customer remains interested in the vendor.

Note that not all input data is used only by the tools listed in Table 2; the data used by each previous tool is also used by subsequent tools. Table 2 shows the new input data used.

6.5 Cooperation with SMKL value automatic diagnosis using SMKL check sheet

A function to automatically calculate SMKL values using the "SMKL Check Sheet" introduced in Chapter 4 of this white paper will be provided as a software application (hereinafter referred

to as the "App"). This app will also have additional features such as case studies and related product introductions, which will be useful for the digital marketing described in this chapter.

Figure 22 below shows the functional configuration of the app and uses that diagram to explain the flow of collecting user information.

First, the vendor introduces SMKL to the user (① in the diagram). At that time, the vendor recommends that users use the "SMKL Check Sheet" to understand their current situation. After the user answers the questions on the check sheet, SMKL's automatic diagnosis function calculates the user's current level and communicates it to the user (② in the diagram). After users check their current level through automatic diagnosis, they will use case studies to consider their future direction. Therefore, vendors prepare a list of cases by level and respond to user requests (③ in the diagram). If there is a case that interests the user in the list of cases, they will want to obtain detailed information about the case and information about the products used in that case, so vendors can also use this app to provide that information. and wait for user access (④ and ⑤ in the diagram).

In ① to ⑤ above,

①: Level of interest in SMKL

②: Answers to the SMKL check sheet (information regarding the current situation at the user factory)

③: Case information that matches the user's intentions (policy)

④: Technologies and solutions that users are interested in

⑤: Product information necessary for users to reach the level they want to achieve

This app stores this marketing information in the database ⑥, so "Data Input A" shown in Figure 21 can be obtained from this ⑥.

The configuration shown in Figure 22 and how to proceed with digital marketing using it will be explained in detail in the SMKL White Paper Vendor Utilization Application Edition.

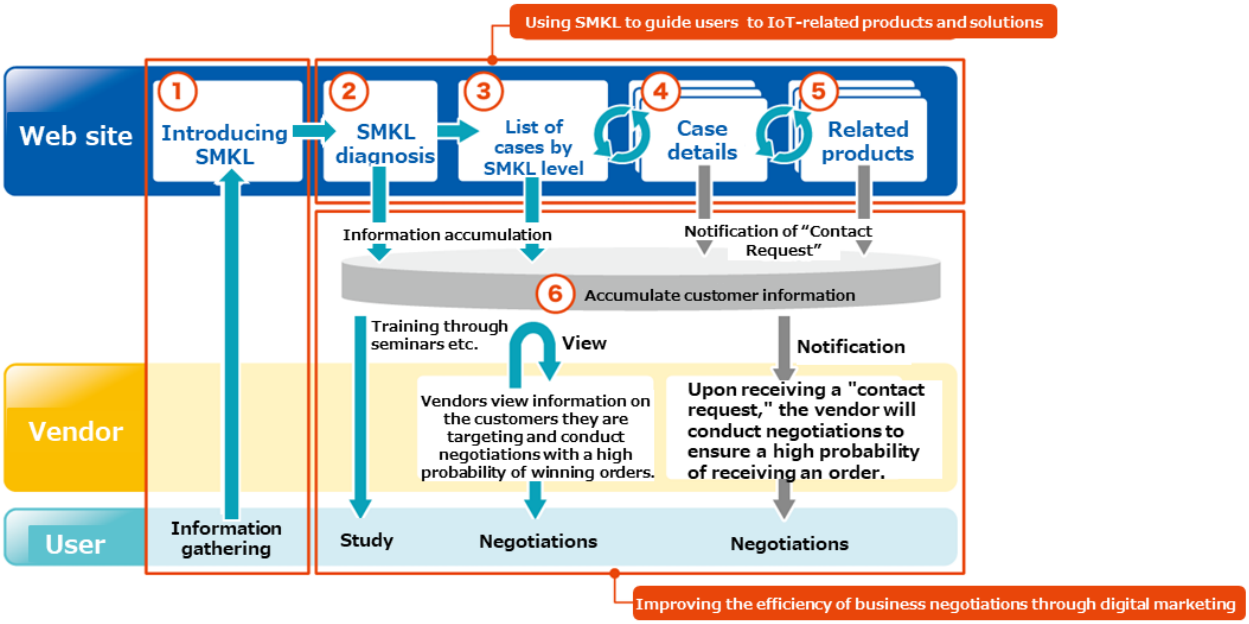

Figure 22. Example of building a digital marketing platform using SMKL

7. Summary

This white paper has explained how to easily and quickly provide SMKL, a simple index related to SM, to customers (users) in the manufacturing industry.

We explained that SMKL is a tool that activates communication between users and vendors, and between vendors, and that its characteristics make it a tool suitable for improving cost effectiveness in marketing and sales activities. In other words, as shown in Figure 23, SMKL is a mutual communication tunnel that cuts through the "barrier to information sharing" of the SM era that lies between "users" and "vendors."

In addition, SMKL can provide various user information to vendors depending on the user's current situation, issues, and policies. This demonstrated the possibility of fusion with DX in sales and marketing in the new normal era.

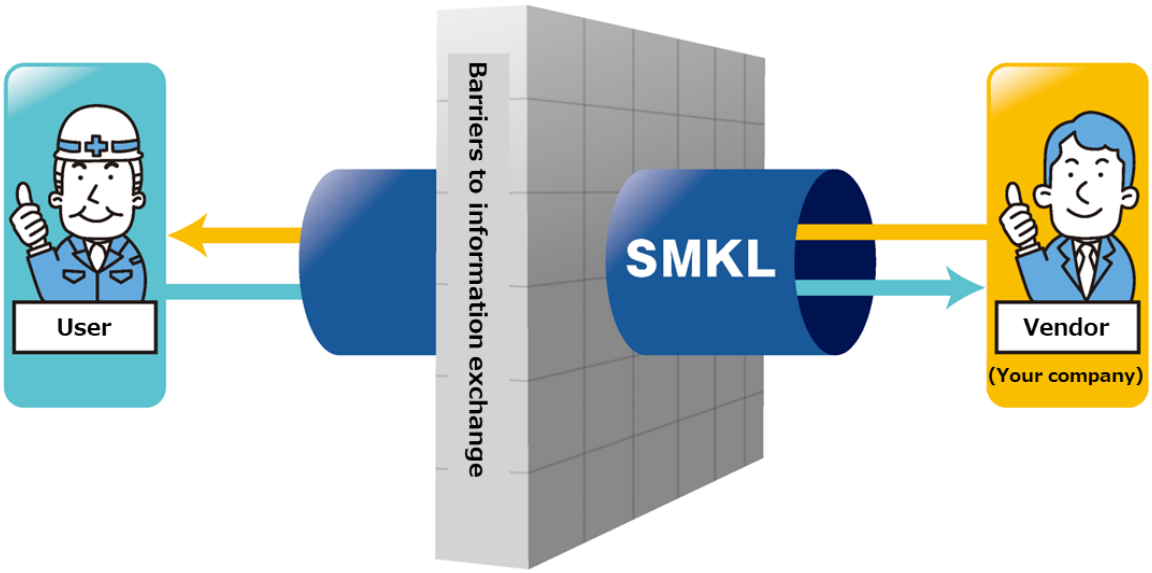

Figure 23. SMKL is a tunnel that opens the barrier to information sharing

In the business flow in the manufacturing industry shown in Figure 24, the scope of the SMKL factory introduction section is “manufacturing,” and this white paper covers “sales”, “service”, and “marketing”. However, SMKL can be used not only for that purpose but also for flows such as ECM (Engineering Chain Management). SMKL takes the management targets on the horizontal axis and the visualization level (maturity level) on the vertical axis. It seems meaningful to evaluate progress along the vertical axis.

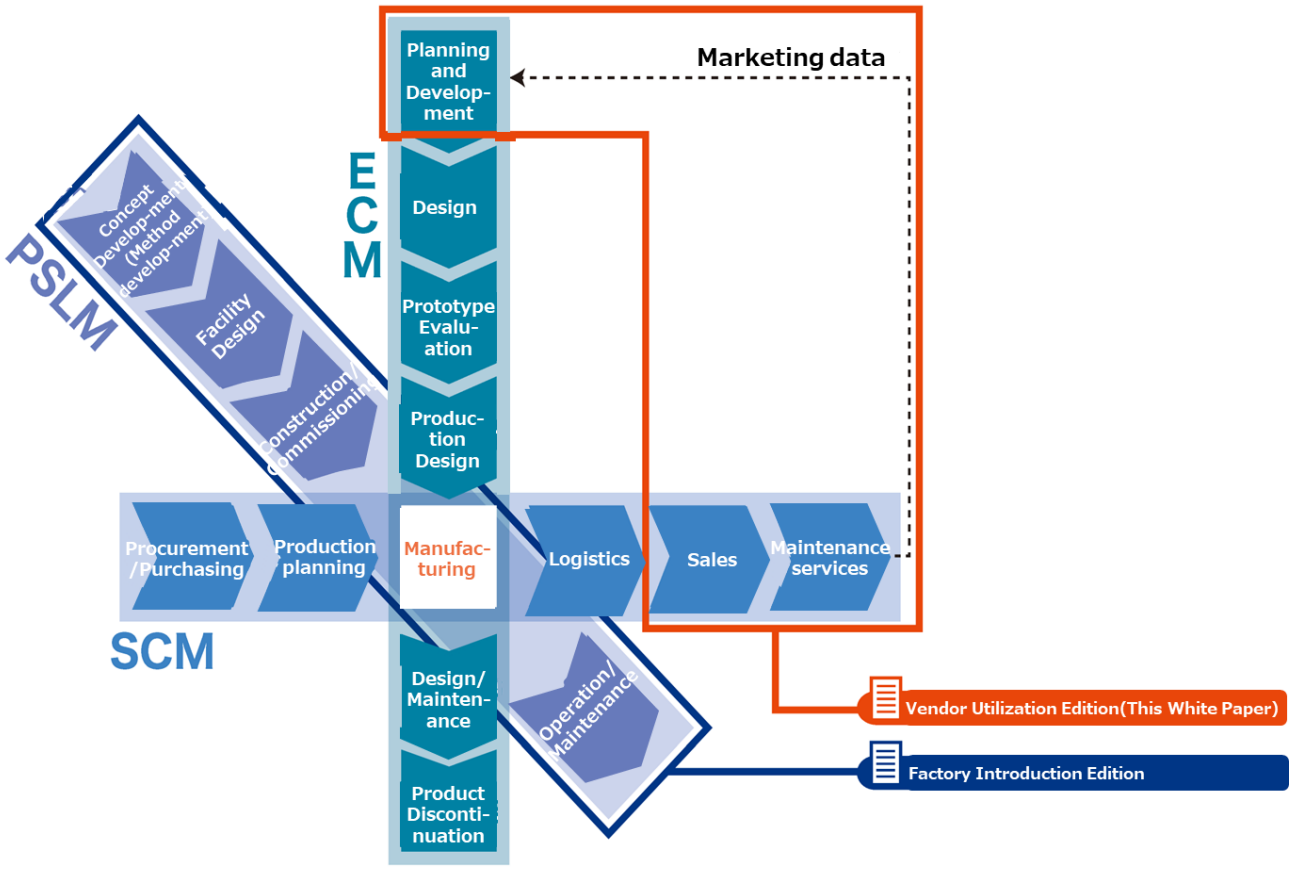

Figure 24. Scope of application of this white paper in the business flow of the manufacturing industry

Author added to ``Manufacturing Industry 2030, 2017 Edition'' by the Japan Electrical Manufacturers Association Smart Manufacturing Special Committee

Furthermore, it would be possible to use SMKL to extract only the level 4 in management objective (the entire supply chain), further classify that level 4 into several categories, and use it as an indicator to measure the maturity of distribution. In other words, by stretching or shortening the horizontal and vertical axes, users can express the state they want to evaluate without being limited to the 4x4 matrix of SMKL.

In this way, SMKL can be seen as a means of evaluating various businesses and industries, so its use as a vendor is not limited to manufacturing. This white paper was aimed at marketers and salespeople whose customers are in the manufacturing industry. In the application edition of vendor utilization, we plan to explain the possibility of business development by applying SMKL to SM-related solution and product development and consultants, system integrators, finance and insurance companies, and industries not related to SM.

8. References

[1] ISA-95 (ISO/IEC 62264) : Enterprise - Control System Integration

[2] ISO 22400：オートメーションシステム及びその統合ー製造操業マネジメントのキーパフォーマンス指標ーAutomation systems and integration - Key performance indicators(KPIs) for manufacturing operations management -)

[3] X. SHI, T. BABA, D. OSAGAWA, M. FUJISHIMA and T. ITO, "Maturity Assessment: A case Study toward Sustainable Smart Manufacturing Implementation," 2019 International Conference on Smart Manufacturing, Industrial & Logistics Engineering & 2019 International Symposium on Semiconductor Manufacturing Intelligence (SMILE & ISMI 2019), Hangzhou, China, 2019, pp. 67-70.「Best Faculty Paper Nomination」

[4] X. SHI, T. BABA, D. OSAGAWA, M. FUJISHIMA and T. ITO, "A Maturity Model for Sustainable System Implementation in the Era of Smart Manufacturing," 2019 24th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA), Zaragoza, Spain, 2019, pp. 1649-1652.

[5] IAF CLiC(制御層情報連携意見交換会),” 製造現場の IoT 化/見える化を推進する SMKL 指標について”, IIFES November 2019, http://www.mstc.or.jp/iaf/event/iifes2019s/SMKL_seminor.pdf, [Accessed: 03- April- 2020]

[6] DX 推進指標, 経済産業省, https://www.meti.go.jp/policy/it_policy/dx/dx_seisaku/dx_index/dx_index.html, [Accessed: 03- April- 2020]

[7]IAF ホワイトペーパー“工場のスマート製造化を”みえる化“する KPI を用いた SMKL(Smart Manufacturing Kaizen Level)に関する白書、https://www.mstc.or.jp/iaf/clic/SMKLv1.pdf

[8] IIFES 2019 SMKL Seminar Website in Japanese, http://www.mstc.or.jp/iaf/event/iifes2019s/SMKL_seminor.pdf, [Accessed: 03- April- 2020]

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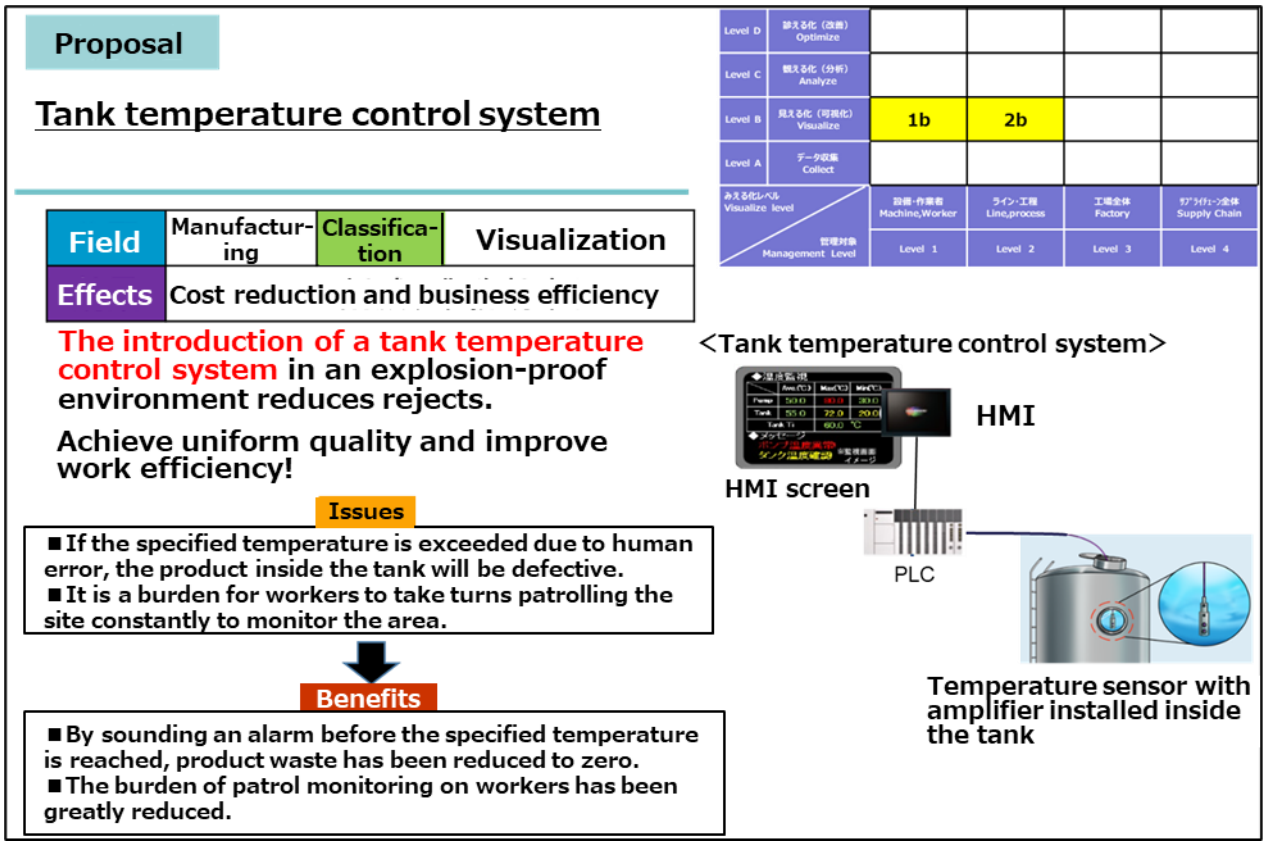
*SMKL (Smart Manufacturing Kaizen Level) is a registered trademark of Mitsubishi Electric Corporation. In addition, the organization names and technical names listed in this document are trademarks or registered trademarks of each company or organization.

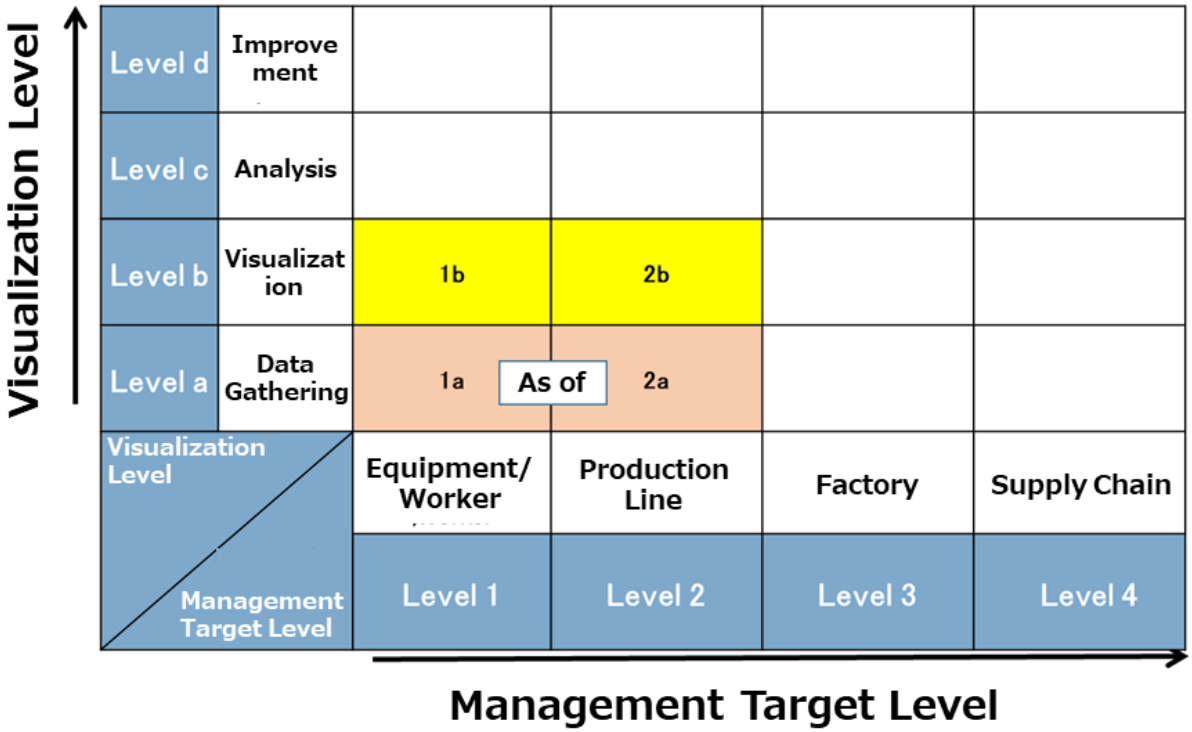
9. Appendix

<Appendix A> "Example of a sales tool with an SMKL matrix attached to a proposal"

In daily proposal activities to customers, by simply adding the SMKL matrix below to the proposal, you can clearly show to the customer "which area of the customer's factory" and "what level" of SM implementation. In addition, before making a proposal, it is necessary to have a discussion between technology and sales to determine the SMKL level of this system, which will help clarify the target customer and increase sales efficiency.



Furthermore, if you already know the current situation at the customer's factory, attaching a matrix that clearly shows how things will change from the "current situation" as shown in the figure below can be a good tool for persuading the customer.

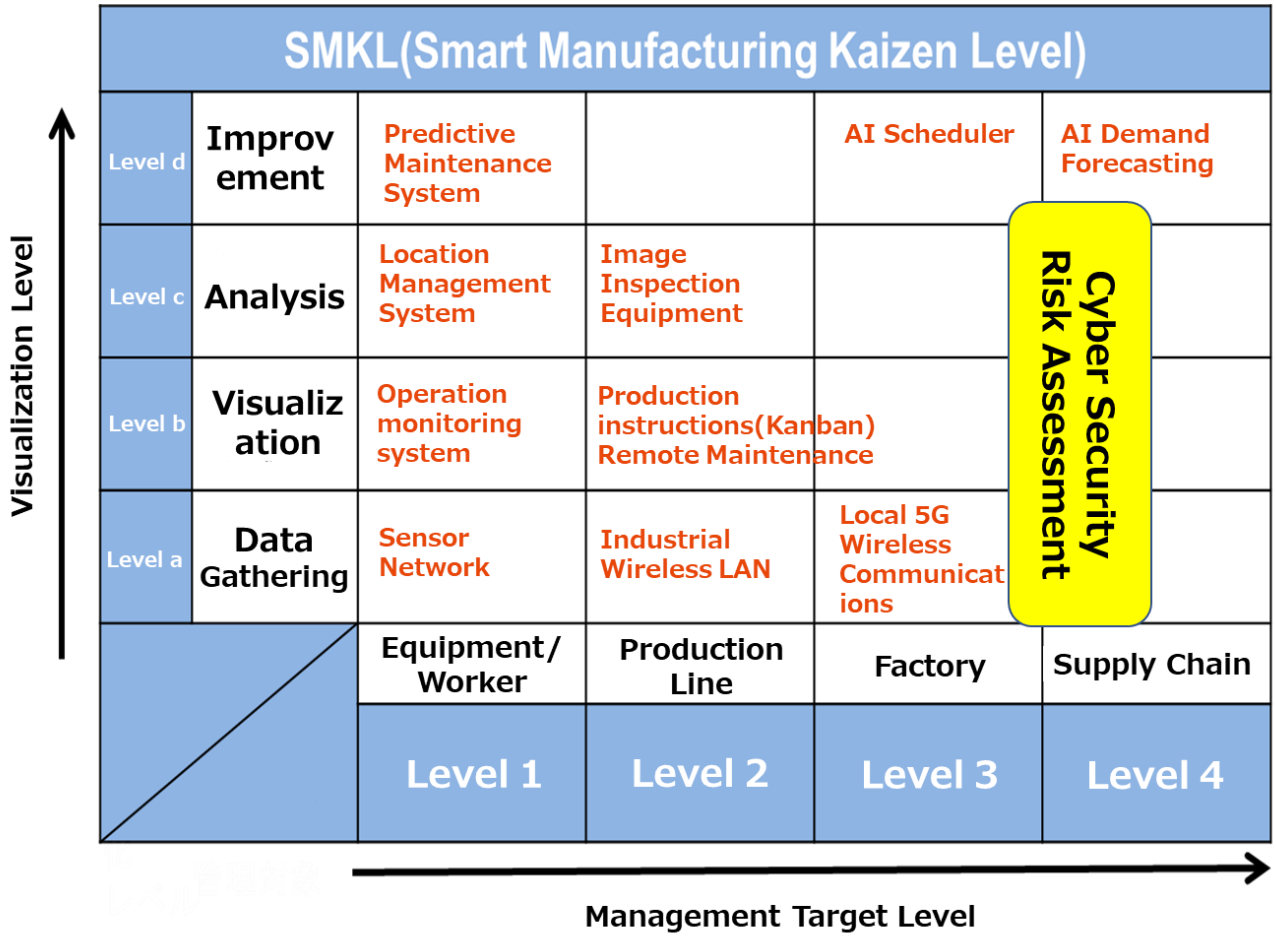

Visualization Level
Level d
Improvement
Level c
Analysis
Level b
Visualization
1b
2b
Level a
Data Gathering
1a
As of
2a
Visualization Level
Management Target Level
Equipment/ Worker
Production Line
Factory
Supply Chain
Level 1
Level 2
Level 3
Level 4
Management Target Level

<Appendix B>　"Product/Solution Mapping to SMKL Matrix"

By preparing a diagram that maps your company's products, solutions, and services to a 4 x 4 matrix representing the SMKL indicators shown in Figure 4 in the main text, you will be able to present specific information to users. If you create a table in Excel and provide it on paper, attach the materials for each product, solution, or service afterwards. When using an Excel spreadsheet on a device such as a tablet, link to the introduction site for each product. (We recommend that the link destination be a page that introduces each product, etc., rather than the top page of your company's homepage.)

When filling out the table, we recommend that you do not fill in the details of each product one by one, but rather summarize product groups as in the example below to make the table easier to read. Also, in the unmapped spaces, you may list other companies' products that you are affiliated with.

The figure below is an example of adding the "Security Risk Assessment" (yellow box) product group.



<Appendix C>　"Example of related content in SM progress"

Smart manufacturing status of users	Content and Service provided	Contents or Services
Preparation	Vendor's own website	A website or landing page to collect user information
	Brochure	Vendor-created brochures about smart manufacturing-related products, solutions or services
	Social and industry trends	Introducing a website that provides a wide range of information related to smart manufacturing in the new normal era (after Corona disaster or with Corona disaster).
	Information about SMKL	This white paper or other white papers such as the "Factory Introduction Edition", or documents that list the basics of SMKL such as Figure 3 of this white paper, or SMKL value determination according to Appendix B of this white paper, etc.
Planning	Case Studies	Collection of factory improvement cases using SMKL (Summary)
	Proposal	Provide estimates for vendor products, solutions, and services, or allow users to easily create quotes on their own website.
	Seminar	Holding seminars for users on the use of SMKL
Expansion and development	Information about SMKL	Detailed internal documentation on how to use SMKL
	Dedicated contact point	Establishment of a dedicated contact point for users (telephone, email, etc.)
	New Product Introduction	Providing information about new products, solutions or services from vendors
	Certification	In order to cultivate loyal customers, we will establish an "SMKL Certification System" so that users will have more accurate and detailed knowledge and can be entrusted with promoting SMKL within their companies.
	Collaboration	Propose collaboration on vendor products, solutions or services.

<Appendix D> Utilization for “overall optimization” and “value creation”

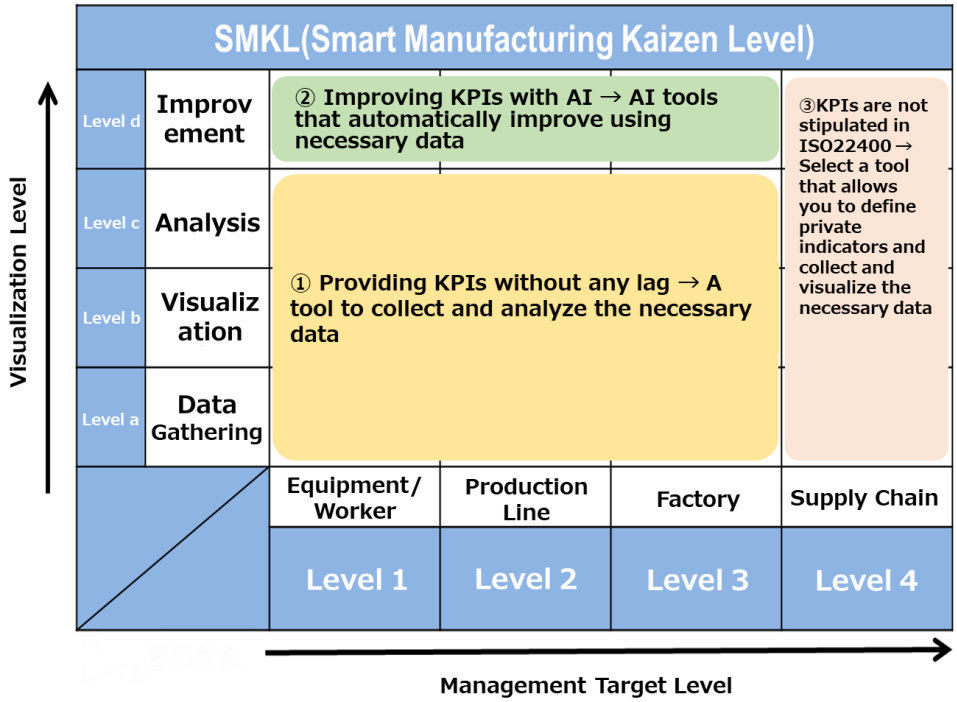
So far in this white paper, we have focused on "improvements" by utilizing SMKL to "solve problems" for users. However, users carry out their corporate activities not only to solve problems, but also for the following two important purposes. In this appendix, we will explain how you should utilize SMKL as a vendor.

- “Overall optimization” for improving the current situation
- "Value creation" through business creation and business strategy

Companies continue to pursue what universal things they should pursue in their corporate activities. While there are many companies that are implementing or planning to solve problems, there are also companies (or divisions within those companies) that are focusing on "overall optimization" and "value creation." For these companies, vendors should consider how their products, services, and solutions can be applied to SMKL.

1. Relationship between KPI and SMKL

When thinking about these things, it is important to review the relationship between KPIs (key performance indicators) and SMKL. The figure below shows the relationship between KPI and SMKL.



Part ① in the diagram;

The management object level is up to level 3 and the visualization level is up to C. In this area, by equipping systems that can collect electronic data, visualize collected data, and analyze data to calculate KPIs, users can quickly control production systems and change settings. This allows users to achieve their desired KPI values. They can evaluate the speed, accuracy, and cost of improvements as they progress. Among the KPIs, those related to Equipment Effectiveness, Finished Good Ratio, First Pass Yield, Mean Operating Time between Failures, Operating Efficiency, etc. are performed manually (Visualization level 0) by increasing the visualization level of SMKL from a to b to c. KPI calculation is clearly faster. In order to improve accuracy, it is necessary to increase the amount of data, but this will slow down the calculation manually. In addition, the need for manpower leads to increased costs. In the end, increasing the visualization level of SMKL allows faster calculation of KPI values than when level "d" processing is performed manually. This allows for faster feedback and control and is a way to change KPIs for the better.

Part ② in the diagram ;

In ① of the same figure, tools are selected to automatically analyze data, but humans decide how to feed back the data analysis results and control the system. In ② of the diagram, automation and AI are used in the decision-making part to replace the part that was traditionally made based on human experience and intuition. If users can use the data coming from the production system and make decisions based on the analysis results of that data with accuracy or speed that is at least as accurate as humans, this will lead to improvements in KPIs.

Part ③ in the diagram ;

This part begins by considering KPIs not just for one company, but for multiple companies or groups of companies that make up the ecosystem. ISO22400 defines KPIs within manufacturing plants, so the scope does not extend to the supply chain. Therefore, users must define their own private KPIs. For example, it is assumed that management items include supply chain efficiency and product traceability. Even with such management items, the user can do the same as ① and ② by figuring out how to acquire data on moving objects, visualizing the acquired data, analysing it, and making improvements (automatically making decisions). This can lead to improvements in KPIs.

Based on the above, we will investigate how to utilize SMKL in "overall optimization" and "value creation."

2. Use of SMKL on overall optimization

We assume that users who are considering "overall optimization" are those who are about to proceed with SM, or those who have already started but are wondering whether they are stuck in partial (local) optimization. For users, whether it is a "part" or "whole" can be thought of as a difference in the scope of management being evaluated. It is easy to predict that the results of the evaluation will be different.

First, let's consider what "optimization" means.

Optimization can be described as "a state in which the best performance can be achieved for a specific goal." This "specific goal" can be said to be the management items and their values expressed in the KPIs mentioned above. From this, optimization is judged by how much has been achieved for the management items, which can be expressed by the SMKL evaluation value. KPIs are calculated as the ratio of actual results to plans, but plans are targets, and SMKL can be thought of as a means to bring actual values closer to targets.

We explain the above by a simple example.

Suppose there are multiple production lines within a factory. Let's say you're considering optimizing the equipment utilization rate for each line. Assume that currently, computerization has not yet been implemented (the visualization level of SMKL is zero) so that the operational results of each line can be obtained as data. From this situation, let's assume that you have invested in equipment that will allow you to acquire electronic data only for line A, visualize that data, and analyze it further. (SMKL visualization level c) As a result, line A will be able to detect equipment abnormalities and analyze the causes of line stoppages, creating the possibility of higher operating rates than other lines. (In order to increase the operating rate, workers must stop the equipment before it breaks down or change the setting conditions.) This means that increasing the visualization level of SMKL This means getting closer to achieving the target of improving equipment utilization (a state in which the equipment is at its peak performance).

In the above example, line A has been optimized, but only line A has been optimized; in other words, only partial optimization has been achieved.

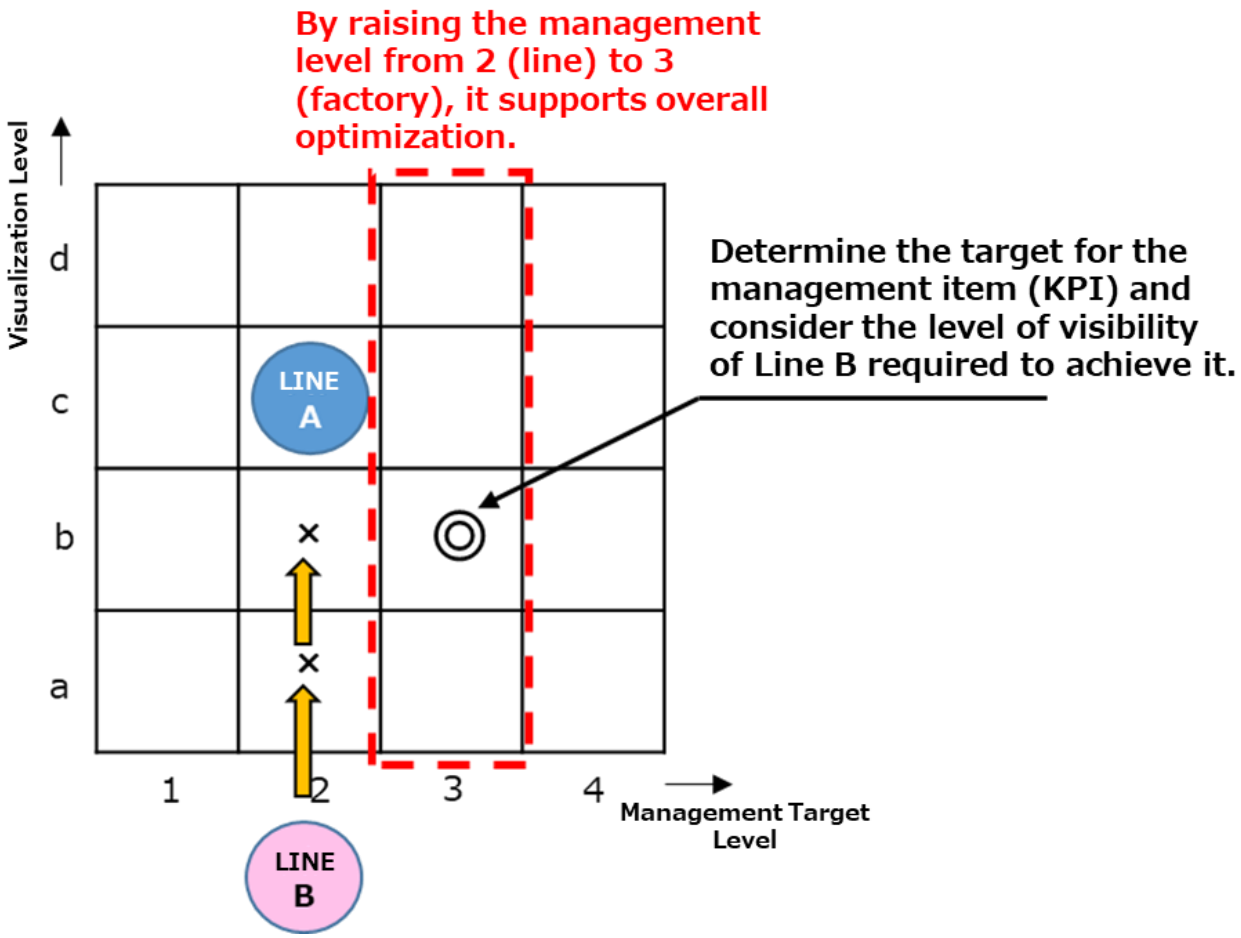
Assume that this factory has a configuration in which products produced online A are turned into finished products online B. Online A, downtime is reduced, resulting in higher equipment utilization. However, the subsequent process, Line B, is expected to experience unexpected line stoppages, resulting in a pile of work-in-progress (products produced on production line A).

In such a case, what kind of approach would be desirable for the users (staff at this factory)? Users may want to proceed with optimization in stages. They may have been thinking about installing the latest equipment in Line B after Line A. The best solution is to use the smart manufacturing (SM) investment plan in <Appendix C> of the SMKL Factory Introduction Edition before introducing the latest equipment to Line A and set the management target level to "3" (entire factory) or " 4" (the entire supply chain) and calculate and judge the return on investment. However, what should users do after they have already introduced the latest equipment to Line A?

First, we ask the user to determine target values for the entire factory regarding the optimization items (KPIs specified in ISO 22400 or indicators determined by the user) that they would like to achieve as overall optimization. For the entire factory, this means raising the SMKL management level to "3". Next, we suggest the user to evaluate the current situation. Therefore, for Line B, we propose a method to raise the SMKL visualization level from "0" (zero) to "a". Since the work contents of Line B and Line A are different, it may not be necessary to raise them to level "C" all at once, so it is necessary to carefully examine the cost-effectiveness, etc. By setting it to at least level "a", you will be able to measure the equipment utilization rate for line A and line B. Naturally, line A will be high and line B will be low. This makes it possible to measure the current value of the equipment utilization rate for the entire factory. Then, for example, if the target value for the equipment utilization rate of the entire factory is 80%, but the measured value is 50%, the following suggestions may be made to fill the gap. This flow is shown in the figure below.

As you can see from the example above, overall optimization begins by focusing on one (or two) higher management targets. Furthermore, "overall optimization" is achieved by determining target values for management items as a whole, including the equipment that has

already been introduced (in the example above, the latest equipment installed online A), and revaluating the entire system.



3. Using SMKL in value creation

We think the word "value creation" has various meanings, but here I will define it as "the intentional creation of goods, services, etc. that achieve discontinuous development by introducing something new and different." The word "different" here means "difference from others," and the premise is that this difference has great potential to change the game.

What role can SMKL play in this "value creation"? Since it is completely different from continuous development such as improvement in problem solving, can SMKL be used as an indicator of something?

First, considering the above-mentioned "difference", it seems necessary to focus on management items (KPIs) in SMKL. This is because to intentionally create products, services, business structures, etc. with specifications that are clearly superior to the conventional level, it is necessary to drastically change the evaluation criteria. The setting of evaluation criteria will determine whether what you create will be much the same as before, or whether it will be a breakthrough. So, how should we decide on the management items that will realize value creation? Basically, there are two possibilities:

(1) Select new management items that have never been seen before.

(2) Although the management items selected are conventional, the target values are set overwhelmingly high.

Regarding (1) above, if you decide on completely new management items and try to implement them, you will need to research and develop new technologies with ideas that have never existed before or come up with new operating methods and business models. By accomplishing this, value creation will be achieved.

For example, suppose a user company has set a goal of contributing to building a sustainable society to improve consumer trust. Now, let's assume that you have decided to select ISO 22400's "total energy consumption" as a management item and monitor the power consumption of your factory, aiming to create a decarbonized society. In this case, it probably won't lead to "value creation." This is because energy monitoring is already being carried out in many factories. However, let's assume that we have added a new management item, “waste reduction and recycling'' at the factory, in addition to total energy consumption. In this case, a system must

be introduced to reduce or recycle not only the water and gas disposed of from the factory, but also the amount of concrete, cables, metal plates, etc. generated during construction. yeah. To achieve this, it becomes necessary to review the entire factory structure and process, and to introduce new technology and equipment.

On the other hand, (2), taking the total equipment utilization rate as an example, means that in a certain industry, the total equipment utilization rate is approximately 50%, and that it is raised to 90% at once. Dramatically raising the target values for management items in this way will induce corporate activities that, if realized, will create new value, such as a change in thinking and the development of new technology.

As mentioned above, "value creation" depends on the setting of "management items" in SMKL, so SMKL can be said to be an indicator. However, it may be necessary to review the visualization level (vertical axis) for SMKL.

White paper on SMKL (Smart Manufacturing Kaizen Level) using KPIs to “visualize” smart manufacturing in factories

～ Basics of vendor utilization Edition～

- English Version -

Publication date: December 1, 2024

Publisher: Industrial Automation Forum (IAF)
Control layer information coordination opinion exchange meeting (CLiC)
SMKL project

Writer: Shinobu Ueda (Tachibana Eletech Co., Ltd.)

Supervisor: Mitsushiro Fujishima (Mitsubishi Electric Corporation), chief of the SMKL project,
Shinichiro Chino (Mitsubishi Electric Corporation),
Osamu Asai (Obayashi Corporation),
Terukazu Yamaura (Another-ware),
Yuuta Otsuka (Another-ware),
Yoshifumi Murakami (Ad-Sol Nissin Corporation),

IAF Secretariat: Tetsuo Shiroshita(In the Manufacturing Science and Technology Center)

Contact: 4th floor, Shinbashi Planning Building 3 -4 -10, Shinbashi, Minato-ku, Tokyo 105-0004

E-mail: jim-iaf @mstc.or.jp

TEL: 03-3500-4891

URL: http://www.mstc.or.jp/iaf/

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