Make the Invisible Visible™

A Practical Guide to Assessing Your Digital Transformation Needs

An ICONICS Whitepaper

May 2024

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Summary

This guide provides a no-nonsense practical method for assessing the best solutions to begin or advance your company's digital transformation by applying the Smart Manufacturing Kaizen Level (SMKL) method established by Mitsubishi Electric. This guide explains the SMKL method which looks at your company's pain points and where your company is today with its digital transformation (i.e., determines your digital transformation baseline). Then, based on your company's wants/needs to progress its digital transformation, the SMKL method suggests straightforward general hardware and software solutions to realize the outcome. Additionally, to illustrate how the SMKL method is used, this guide walks you through two typical customer examples with an additional example of how the method can be used to assess a transportation need. Lastly, this guide directs you to specialists you can partner with to achieve your digitalization goals.

Please follow this link Choosing Digital Solutions Using SMKL if you would like to watch a video that explains the SMKL method and covers a majority of the information presented in this guide.

Introduction & Problem Description

Most industrial manufacturing and infrastructure process organizations need to improve productivity, operational and energy efficiency, and asset health/life to reduce downtime or simply to understand where the bottlenecks are in their processes to take corrective measures to improve the overall process. Whatever the case, these organizations continue to demand digital solutions to achieve operational optimization. Of course, it can be daunting to understand how to advance your digital transformation. For this reason, we will introduce a method that will ease this challenge: the Smart Manufacturing Kaizen Level method or SMKL method.

At the end of the day, no matter your industrial manufacturing or infrastructure process, your company has to collect data, and then traditionally, you will either visualize, analyze, or optimize your process based on this data. You might only be visualizing your data at this point, or you might be performing a combination of all three. To help you find the best digital solutions for your situation, you must first identify your pain points, current digital ability, and goals. And this is where the SMKL method comes into play because it can be used to assess your digital solution needs and help direct you to the appropriate solutions very simply and easily.

At a high level, the SMKL method revolves around a simple matrix as shown below in Figure 1. The SMKL matrix consists of the scope of work on the bottom, whether that be a single machine or an entire facility, and the digital stage of the customer on the left, whether that consists of collecting data, or visualizing, analyzing, or optimizing their process.

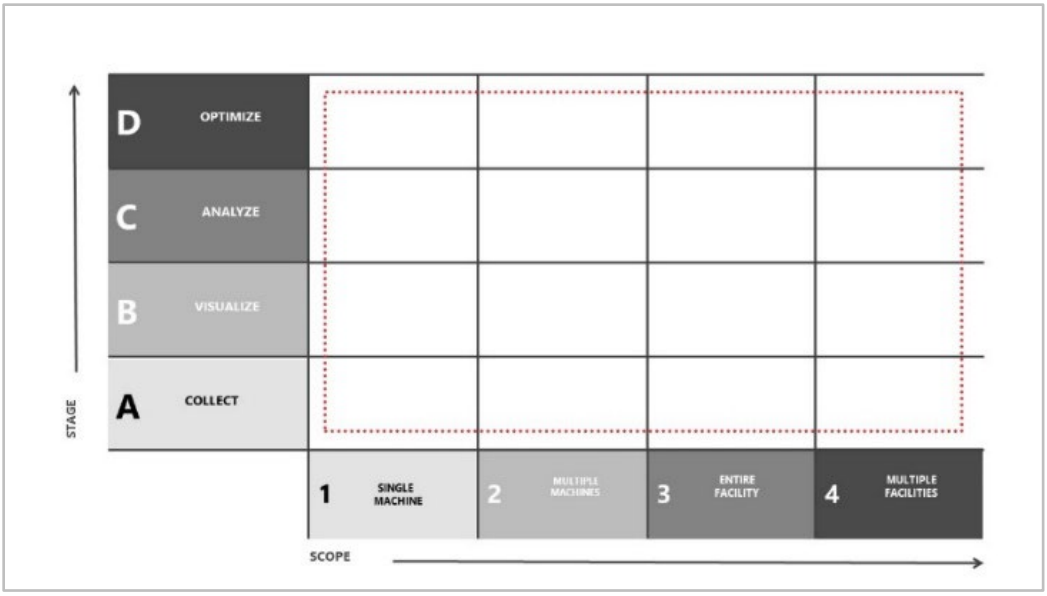

Figure 1. The Smart Manufacturing Kaizen Level (SMKL) Matrix

Source: Mitsubishi Electric

However, before we get into the detailed explanation of the SMKL method, let's go over some important definitions relevant to digital transformation.

Definitions of Key Terms

Below are the key terms commonly associated with digital transformation and digital solutions. Being familiar with these terms will provide the context you need to understand the aim of this guide and might very well help you understand what you need for your own digital solutions.

Artificial Intelligence – the development of computer systems/technology capable of performing tasks that typically require human intelligence like solving problems, making decisions, recognizing patterns, and understanding languages.

Big Data – the immense and complex datasets captured from industrial manufacturing and infrastructure processes and characterized by the "3V's": volume (massive amounts of data), velocity (high speed of data processing), and variety (diverse types of data).

Big Data Analytics – the use of advanced technology to extract patterns and trends for valuable insight to be used for problem-solving, predictions, and decision-making.

Cloud Computing – the delivery of various computing services offered by Cloud providers including storage, processing, and software through the Internet.

Cloud Storage – the storage of data on remote servers accessible over the Internet.

Digital Solutions – the solutions that help organizations run their business more efficiently and effectively by digitalizing their manufacturing processes through data collection and management. Digital solutions use data to create a synergistic loop between industrial automation hardware and software.

Digital Transformation (DX) – the use of digital solutions to change and improve an organization's operational procedures to bring about efficiency and savings. DX delivers value and a competitive edge to customers by leveraging technology to modernize processes.

Digital Twin – the virtual representation of a physical object, process, or system created by using real-time data and simulations to mimic the behavior and characteristics of the real-world counterpart. Digital twins are used quite successfully for monitoring, analyzing, and optimizing physical assets and processes in industrial manufacturing and infrastructures.

Edge Analytics - the collecting, processing, and analyzing of data at or near its source, which is typically at the "edge" of a network or device. The approach allows for real-time data analysis and decision-making without the need to transmit the data to a centralized server or cloud, making it suitable and highly beneficial for applications where low latency and immediate insights are critical.

Industrial Internet of Things (IIoT) – the network of connected sensors and devices within industrial settings like factories, manufacturing plants, industrial infrastructure process facilities, and supply chains. The objective is to collect, visualize, and analyze operational data to improve efficiency and productivity based on data-driven decision-making.

Industry 4.0 – the fourth industrial revolution that is characterized by smart interconnected environments of sensors and devices that collect and relay data through the Internet of Things to bring about smart factories with infrastructures for information integration and interoperability. This approach has resulted in truly transformative industrial manufacturing and industrial processes.

Internet of Things (IoT) – the network of physical objects or "things" that contain embedded sensors, devices, connectivity features, and software to collect and exchange data with other devices and systems over the Internet.

Machine Learning – the development of algorithms and models that enable computers to learn and make predictions or decisions from data. Machine learning models use data to improve performance over time.

Smart Manufacturing – the use of advanced technologies to enhance manufacturing processes and operations through real-time data collection and analysis for production optimization, increased efficiency, cost reduction, and improved product quality.

> Mitsubishi Electric calls smart manufacturing "automating optimization", which makes sense since it involves optimizing your machines and processes. However, instead of manually optimizing, you will optimize automatically with smart technology. For example, data will be collected through IoT solutions and visualized through an HMI or SCADA. The data will be analyzed through analytics or some type of artificial intelligence, which in turn will be used to optimize operations. Ideally, this can all be done in the cloud, but it can also be monitored remotely. (Figure 2.)

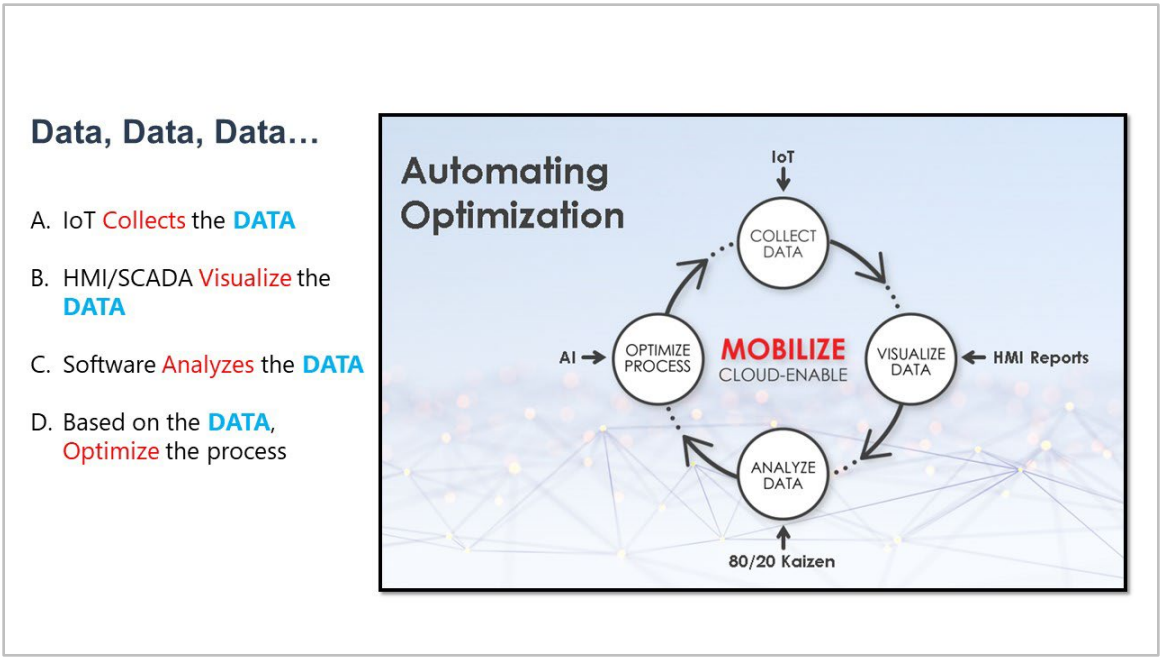

Figure 2. Smart Manufacturing is Automating Optimization
Source: Mitsubishi Electric

Smart Manufacturing Kaizen Level (SMKL) Method - the Mitsubishi Electric digital solution method used to assist customers with assessing their digital transformation needs and the subsequent implementation of the digital solutions that fit these needs. Additionally, the SMKL method helps customers to visualize the next steps in their digital transformation journey. One of the words in SMKL is Kaizen, which is a Japanese term that roughly translates to “continuous improvement.” Essentially, the Kaizen mindset is associated with the PDCA cycle of plan, do, check, action, and repeat in a continuous orb to constantly improve.

Regardless, smart manufacturing revolves around data - the collection, use, and management of data, which entails digital solutions. To know which digital solutions are best for your situation, you can use the SMKL method. That said, let us look at the SMKL method and how it works to get you up and running or moving forward with your digital transformation.

The SMKL Matrix & How It Works

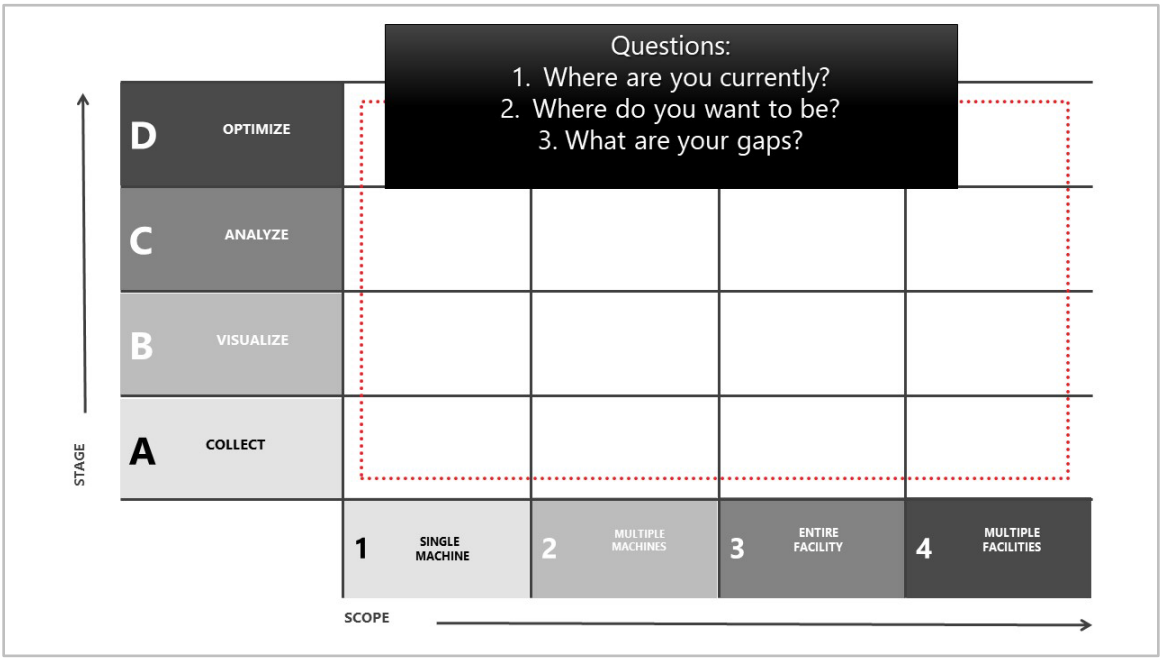

Figure 3. The SMKL Smart Manufacturing Adoption Evaluation Index
Source: Mitsubishi Electric

Through decades of talking with customers and helping them find the best digital solutions for their situations, Mitsubishi Electric developed their Smart Manufacturing Kaizen Level (SMKL) method to help customers find the most suitable digital solutions for their digital transformation needs (Figure 3). The SMKL matrix consists of the scope of work on the bottom, whether that be a single machine or an entire facility, and the digital stage of the customer on the left, whether that consists of collecting data or visualizing, analyzing, or optimizing their process.

To use this, we ask customers these three questions and apply their answers to the matrix to determine the possible solutions:

1. Where are you currently (in your digital transformation)?
2. Where do you want to be?
3. What are your goals and targets?

What a Typical Conversation Might Look Like

1. **Where are you currently (in your digital transformation)?** We ask this question because we want to know if the customer has started along their digital transformation path and is currently using some type of digital solution. For example, a customer might say, “We have a test pilot on one machine. We're doing some data collection, but we don't know what we want to do with the data.” So, using the SKML matrix, we draw an “X” at one machine and data collection which signifies where they are currently at the beginning of their digital transformation. (See Figure 4).

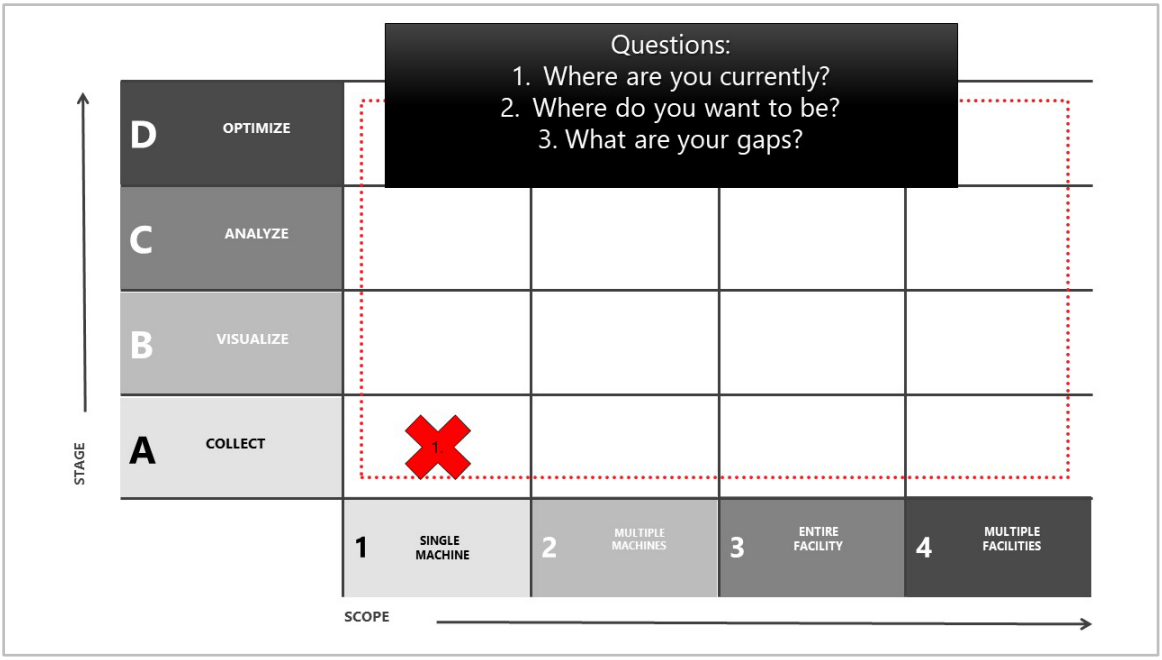

Figure 4. Question 1: Where are you currently (in your digital transformation)?
Source: Mitsubishi Electric

2. **Where do you want to be in your digital transformation?** The customer might say, "We don't just want to collect data from one machine, but for our entire facility. And besides collecting data, we want to visualize that data and do some analysis, so that we can react to it." At this point, they might not be ready to fully optimize their process. Maybe they're just looking to analyze in addition to visualizing. So, we draw another "X" where they want to be. (See Figure 5). The next step is to learn their goals and targets to understand how to fill the gaps between where they are and where they want to be.

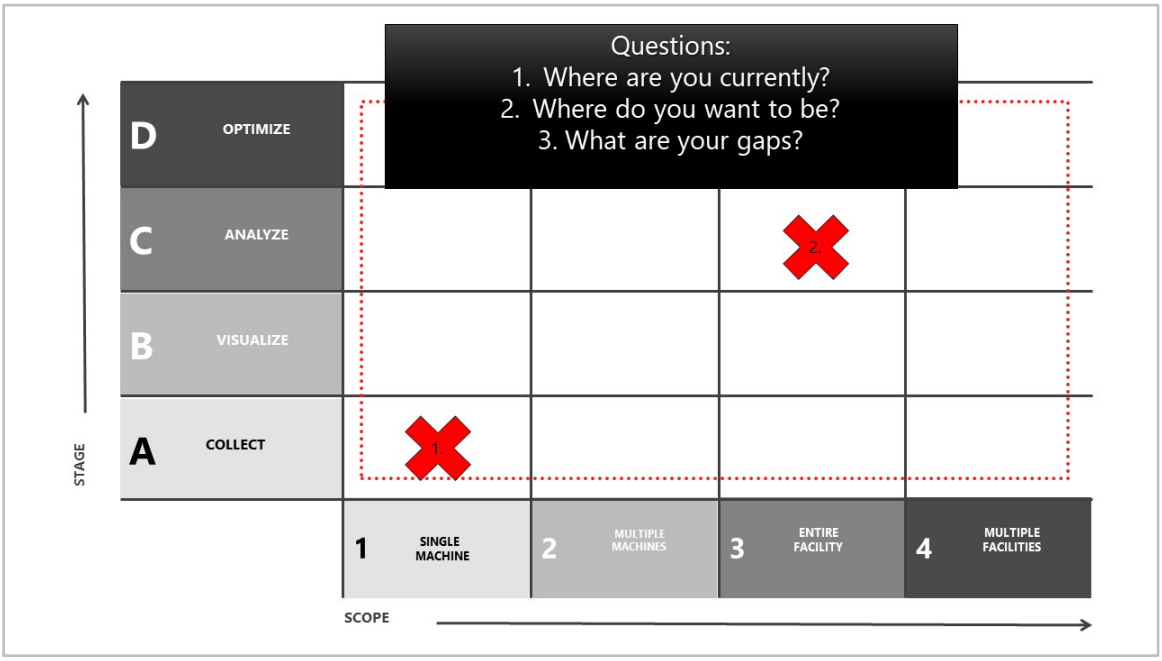

Figure 5. Question 2: Where do you want to be in your digital transformation?
Source: Mitsubishi Electric

3. **What are your goals and targets for your digital transformation?** Here, the customer tells us their goals, so we can determine how best to assist them (Figure 6).

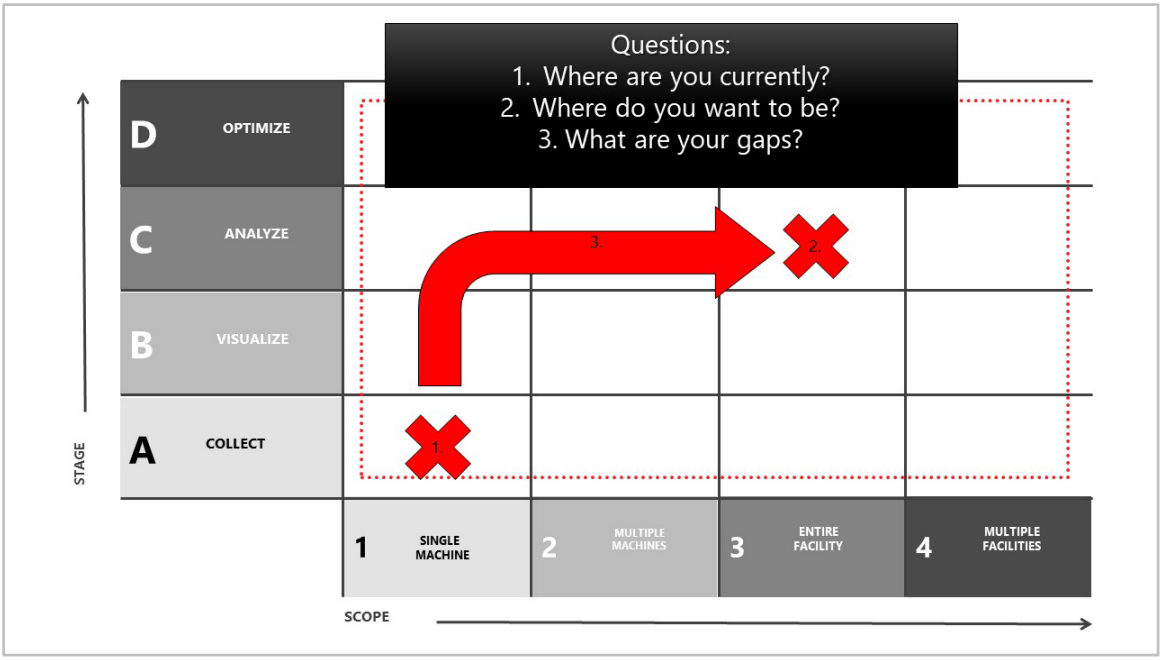

Figure 6. Question 3: What are your goals and targets for your digital transformation?
Source: Mitsubishi Electric

From these three questions, we can see what products/solutions might work. From Figure 8, we see that the customer was collecting data with one machine but wants to collect, visualize, and analyze data for the entire facility. Looking at an entire facility, it might make sense to jump right to an HMI/SCADA solution, like ICONICS' GENESIS64. The point is that the SMKL matrix quickly and easily suggests the optimal options for the customer.

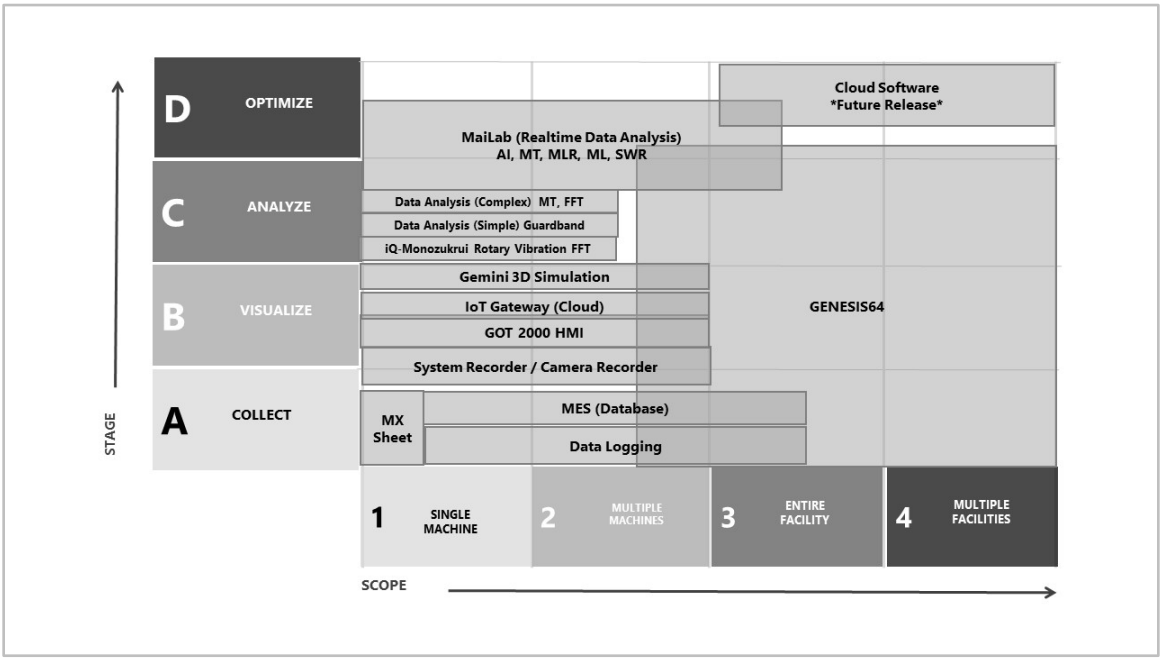

Figure 7. Products & Solutions Available to Collect/Visualize/Analyze Data for an Entire Facility
Source: Mitsubishi Electric

The Beauty of the SMKL Method

If we had not used the SMKL chart, we might have suggested a solution that was not optimal. For instance, the customer said they had a test pilot and that they were collecting data and maybe wanted to do something with the data. This incomplete understanding of the situation might have led us down the wrong path since we might have said, "OK. We have a PLC or an HMI that can do this for you very cheaply." But then a month later the customer might come back to us saying, "Now we're ready to expand to our entire facility and do more than collect data. We want to visualize *and* analyze." Well, the initial local solution may not necessarily scale for an entire facility, which would have complicated the situation.

However, by using the SKML method, we would have known from the start that we were going to include the entire facility because we initially asked all the right questions. Then we would have known to go from the test pilot, using one machine directly, to a solution like an HMI/SCADA for the entire facility (Figure 8). This is the beauty of the SMKL method.

Examples of How to Use the SMKL Matrix: Customer A & Customer B

We will look at two typical customer examples that illustrate how to use the SMKL method.

Customer A

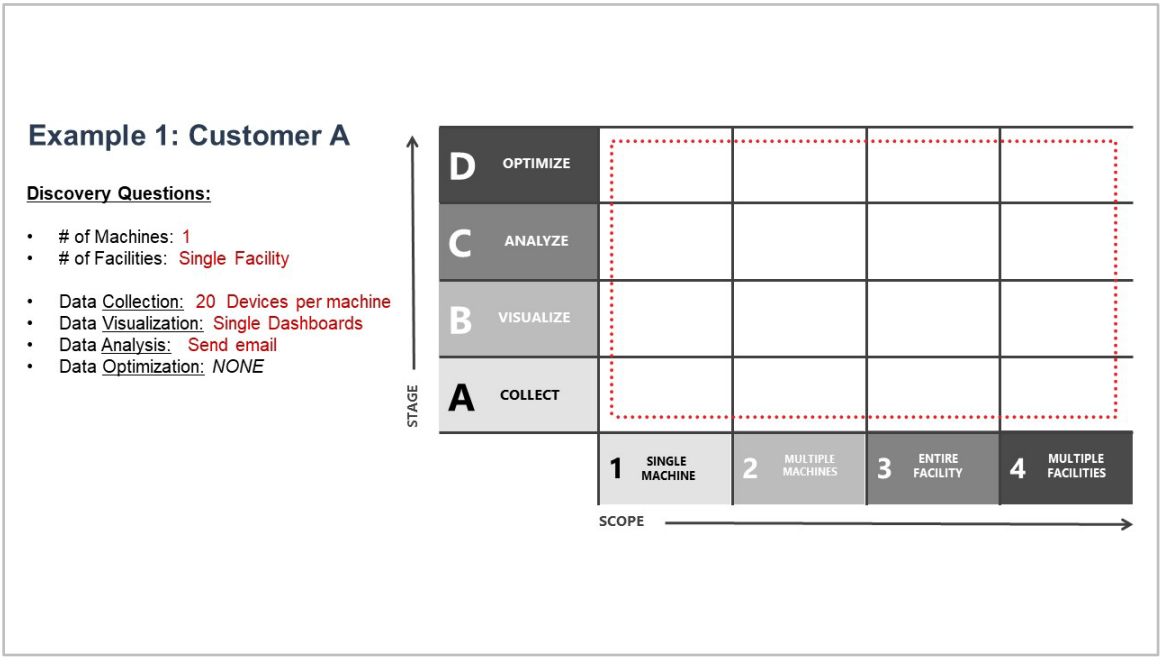

Figure 8. Customer A Set Up
Source: Mitsubishi Electric

As you can see from Figure 8, Customer A has a single facility with only one machine with 20 devices, and their visualization is just a single dashboard.

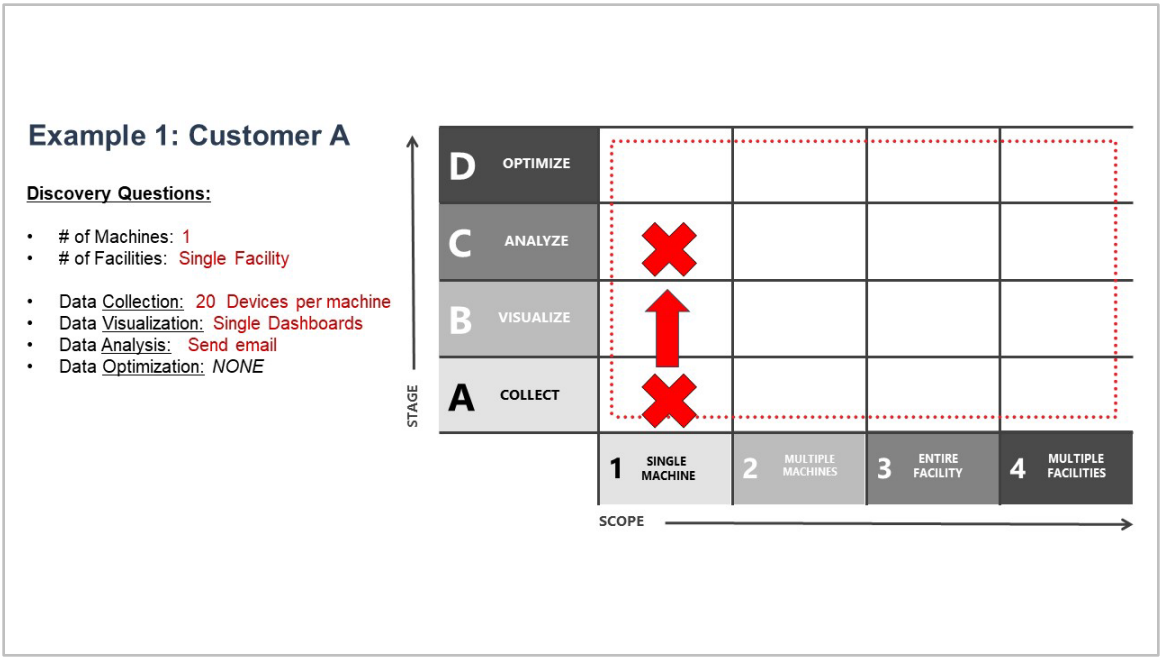

Figure 9. Where Customer A Wants to Be
Source: Mitsubishi Electric

While meeting with the customer, we would use the SMKL chart to determine their digital solution needs. In this case, they want to do basic analysis so want the ability to send an email when there is an alarm (Figure 9). We would mark an "X" where they are and another "X" for where they want to be and then discuss what hardware/software options are available to satisfy their needs.

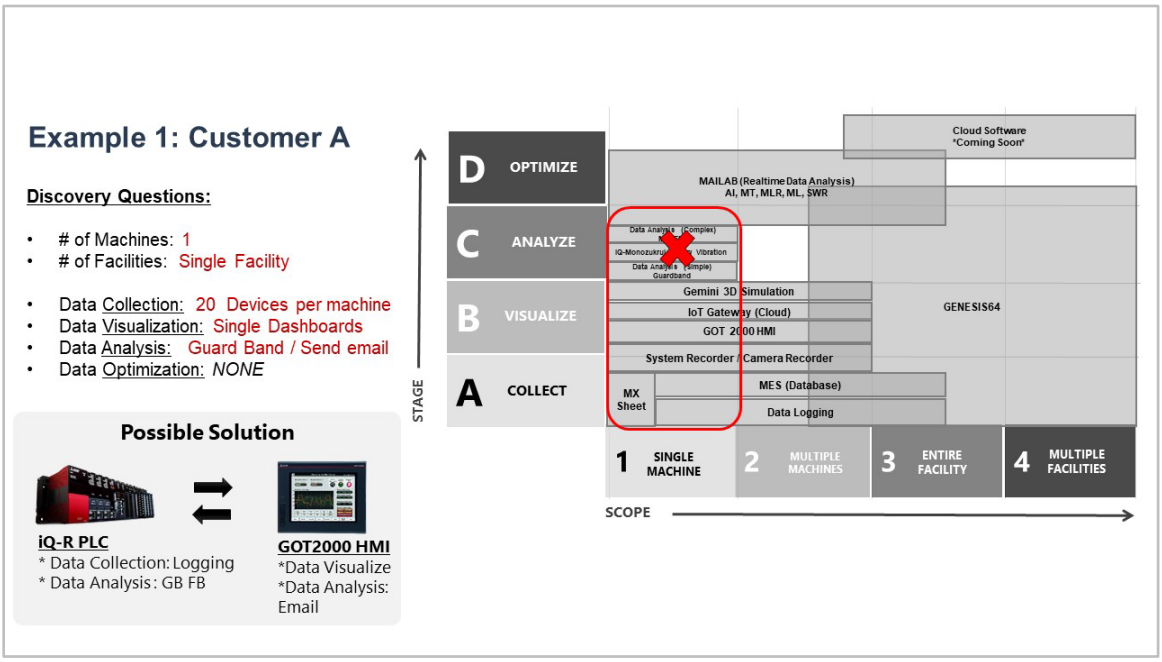

Figure 10. Possible Solutions for Customer A
Source: Mitsubishi Electric

We would look at all options for components and possibly go down the path of an IQR PLC for data collection with the high-speed data logging module or a built-in logging module of the PLC. We would want to visualize with an HMI that can visualize the PLC log data. Figure 10 shows the possible solutions for Customer A. These solutions work since the customer is not going to scale up. They do not have an entire facility, so we can keep it small with just hardware. Now let's review an example for a customer with a different situation, but one we more commonly see.

Customer B

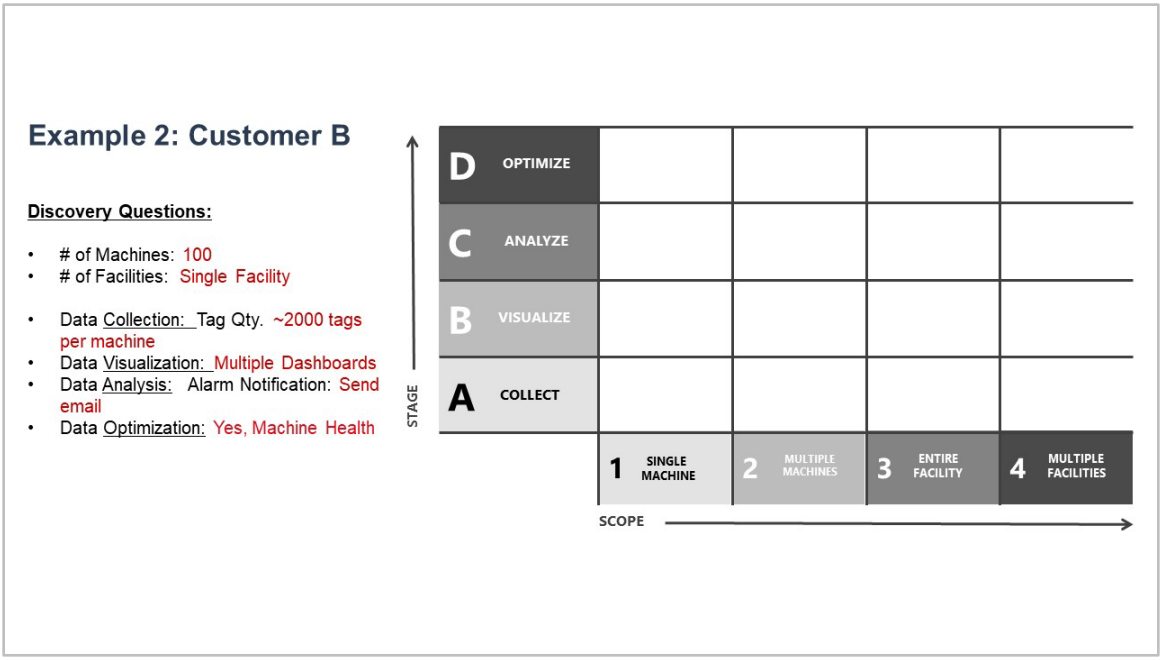

Figure 11. Customer B Set Up
Source: Mitsubishi Electric

More commonly, customers may have 10, 20, or 100 machines with a single facility or possibly multiple facilities. There could be around 2000 tags per machine, which is normal for what we see today, and multiple dashboards. These customers want to send emails, and then in the future, they might want to optimize to be able to look at machine health and analyze. For example, maybe they want to keep a check on the vibration of a motor. And when the vibration exceeds a maximum limit, they can slow down the machine automatically. At this point, an email will be triggered that lets them know the machine needs to be checked. So, they are currently at one machine that collects data but want to monitor the entire facility and go through all the stages to the optimization phase (Figure 11).

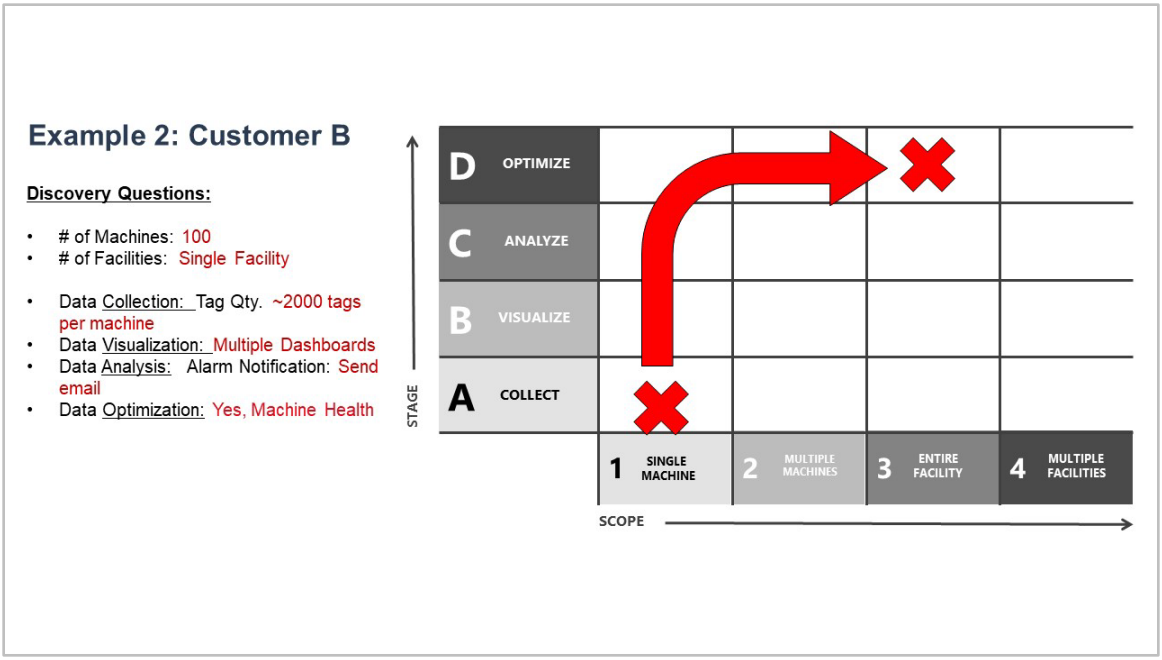

Figure 12. Customer B: Where They Want to Be
Source: Mitsubishi Electric

The next step is to see which products/solutions correspond with the second "X" at the entire facility and optimization stage (Figure 12). This "X" points directly to an HMI/SCADA, like ICONICS' GENESIS64, for a possible solution for that customer (Figure 13).

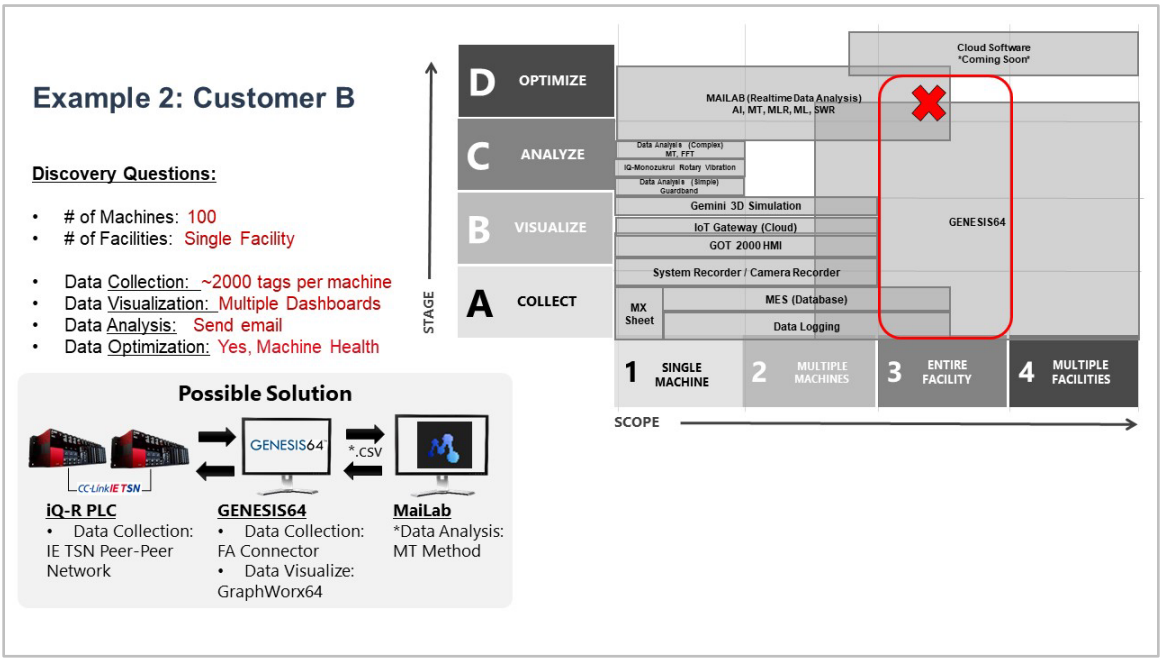

Figure 13. Possible Solutions for Customer B
Source: Mitsubishi Electric

The key point here is to understand that instead of starting the customer down the path of hardware alone, we asked them upfront where they want to eventually be with their digital solutions. Because we knew what they

wanted upfront, we could recommend the right solution for them. It would be much more difficult to scale if they had started with just hardware. Now, when they do their test pilot, they will have the proper solution, one that they can scale easily.

Example of Using the SMKL Method to Assess a Customer's Transportation Needs

To show how practical, versatile, and solid the SMKL method is, we will show you how it can be used to assess a customer's transportation needs. Customer T tells us, "I need a transportation solution that gets me to work." Referring to the modified SMKL chart for transportation (Figure 14), we have for the scope: one person, two people and luggage, an entire family, and a family on a campout. For the stages, we have transport, visuals, metrics, and self-driving.

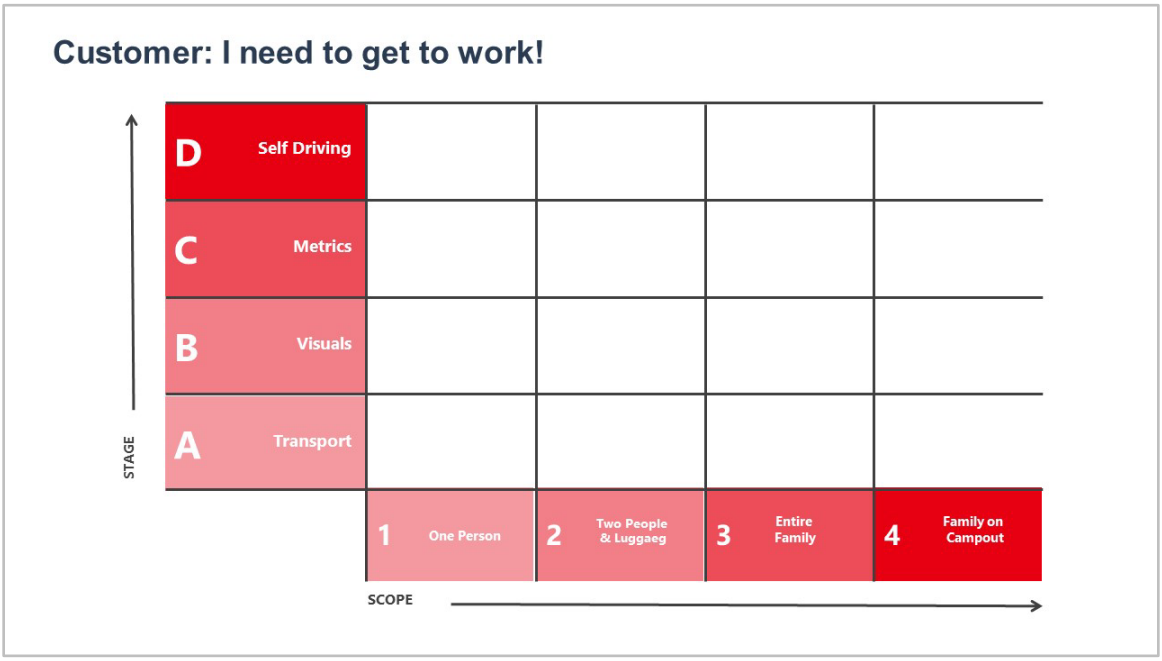

Figure 14. Modified SMKL Chart for Transformation
Source: Mitsubishi Electric

To start, we need to know the customer's transportation criteria. What are they looking for in a transportation solution? Maybe they "just want to get there," and they do not care how they get there or how fast. But there are definitely other transportation possibilities. For instance, maybe they want some visualization, some feedback; for example, they might want Google Maps to be shown the whole time they are traveling. They might also want some metrics; for example, they might want to know the efficiency of the trip and to know if they took the correct and most direct route. They might also want to know if there will be traffic on the chosen route, so they could choose an alternative route to avoid the traffic. And at the upper level, maybe they might want self-driving transportation, so they would not even have to pay attention.

Let's say at first, the customer says, "I just need to get to work." We answer, "We have the perfect solution - a bicycle. It's low cost, and it'll get you to work." This sounds great but does not consider any changes or advancements in the transportation level, so it might not scale. For example, in relation to digital solutions, customers will ask us what we have for IoT, or edge, or big data, and we immediately think, "Well, we could provide the cheapest solution possible, which would be a PLC. And we could just collect and visualize data with an HMI." But the cheapest solution will not necessarily scale to provide for the customer's next digital solution need/stage.

Now back to the transportation case: six months later, the customer says, “The bike is working just fine. I'm getting to work, but I want my transportation mode to allow for multiple passengers, my luggage, and my sports bag. I've also been running late to work, so I want to optimize my route. Since I want my transportation solution to automatically show me where I am going and ideally, I would like to be on my phone the whole time, could you make the transportation mode autonomous?”

Well, that is a different story. If we had had that discovery with the customer at the start of finding a transportation solution, we could have used the SMKL chart to suggest a proper solution. With the SMKL method, we would have known that the transportation mode needed to accommodate not one person, but two people with luggage. In addition, they do not just want to get to work, they want to have feedback and metrics and optimize their route. They also want self-driving transportation.

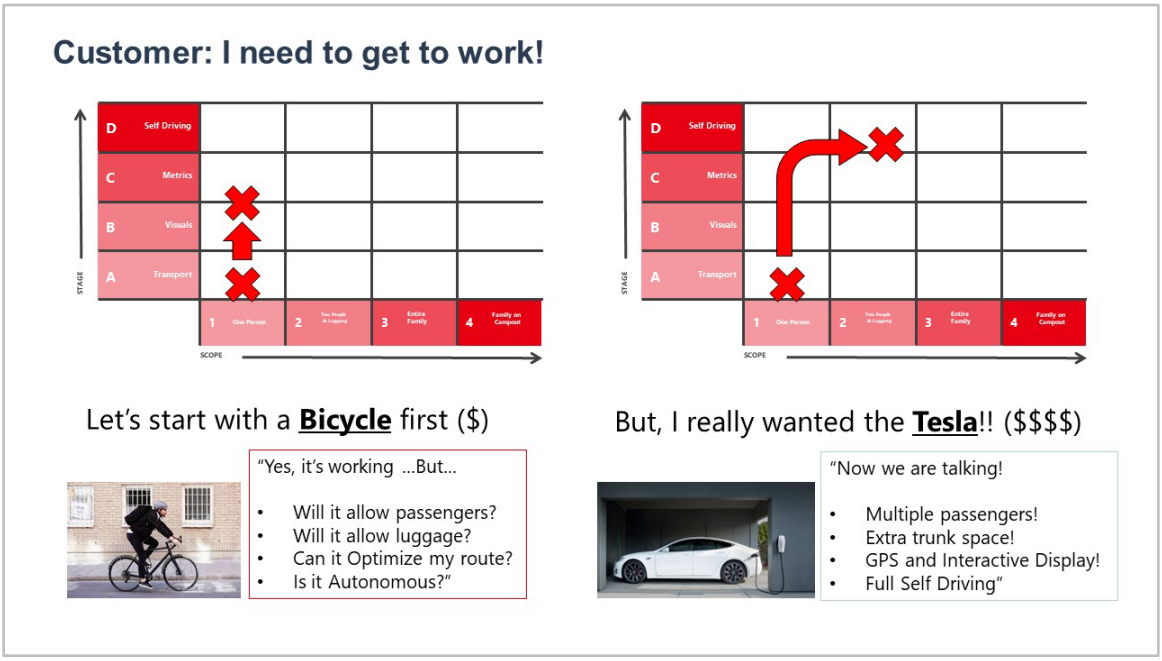

Figure 15. Possible Solution for a Transportation Need
Source: Mitsubishi Electric

Referring to Figure 15, they want to be in the quadrant in the second column of two people and luggage and self-driving. If we had used the SMKL chart, then we would not have suggested the bicycle but would have said, “Really what you want is a Tesla. We know it's more expensive, but ultimately, that's the solution to give you all that you want from a transportation solution.” So, we would have started there. It is that simple.

Recommendations for Specialists to Provide the Digital Solutions Best Suited for Your Needs

Now that you understand the SMKL method, you might want to talk to a specialist. Both Mitsubishi Electric and ICONICS have experts that can guide you to find the best solution for your digital transformation needs.

For Mitsubishi Electric, you can follow this link: us.mitsubishielectric.com/fa/en/about-us/contact/contactsales/

For ICONICS, you can contact one of our experts to assist you at iconics.com or follow this link to learn about our System Integrator Program iconics.com/Partners/SI-Program and this link to find the best suited system integrator for you iconicsinc.my.site.com/partners/s/sidirectory.

Conclusion

We come to the end of our digital transformation guide. We hope by now you realize that you can use the Smart Manufacturing Kaizen Level method to very easily and simply assess where you are in your digital transformation and understand how best to advance to where you want to be. We also hope that you realize that there are many options for hardware and software solutions to get you to that place.

To really drive home all the information we've presented, you can watch this video, which this guide is based on.

But it's always good to talk to experts, those with the necessary experience and knowledge to guide you, and our experts are available and ready to help you. Please contact Mitsubishi Electric at us.mitsubishielectric.com/fa/en/about-us/contact/contactsales or ICONICS at manufacturing@iconics.com if you have any questions or if you just want to talk through your digital transformation goals. You can also sign up for a for a complimentary digital transformation assessment. Whichever route you choose, we'll get you started toward achieving your production or process optimization.

Learn More About Digital Transformation

If you're not at the point to talk to an expert about your digital transformation goals and are still researching and learning, that's OK. Mitsubishi Electric has an entire website dedicated to digital solutions to help you find the best fit solution for your needs: Digital Manufacturing from Mitsubishi Electric.

You can also find a treasure trove of information on the ICONICS website, especially in the Resources section, that will help you in your search for the best digital solution.

About the Companies

About Mitsubishi Electric

Offering a vast range of automation and processing technologies, including controllers, drive products, power distribution and control products, electrical discharge machines, electron beam machines, laser processing machines, computerized numerical controllers, and industrial robots, Mitsubishi Electric helps bring higher productivity – and quality – to the factory floor. In addition, our extensive networks around the globe provide direct communication and comprehensive support to customers.

About ICONICS

ICONICS, a group company of Mitsubishi Electric Corporation, is headquartered in Foxborough, Massachusetts USA and is a global software developer of visualization, HMI, SCADA, and energy solutions. With installations running in over 100 countries worldwide and in over 70 percent of Global 500 companies, ICONICS software is recommended for automating, monitoring, and optimizing a customer's most critical assets. ICONICS offers competitive software products for various business sectors, such as manufacturing, industrial, and building automation, and it possesses advanced technology and remarkable industry leading knowledge in the development of industrial software.

ICONICS, a group company of Mitsubishi Electric Corporation, serves as the software center of excellence for Mitsubishi Electric's Factory Automation Systems Group. Its visualization, analytics, mobile, IoT, and cloud solutions improve productivity, reduce integration time and operating costs, and optimize asset utilization. ICONICS solutions, combined with the knowledge and industry expertise of Mitsubishi Electric, maximize value to the customer by monitoring and controlling automation processes. ICONICS award-winning software boasts over 375,000 installations in Factory Automation, Process Automation, and Building Automation customers in over 100 countries worldwide.

ICONICS is leading the way in cloud-based solutions with its HMI/SCADA, analytics, mobile and data historian to help its customers embrace the Internet of Things (IoT). ICONICS products are used in manufacturing, building automation, oil and gas, renewable energy, utilities, water and wastewater, pharmaceuticals, automotive, and many other industries. Delivering information anytime, anywhere, ICONICS' solutions scale from the smallest standalone embedded projects to the largest enterprise applications.

ICONICS promotes an international culture of innovation, creativity, and excellence in product design, development, technical support, training, sales, and consulting services for end users, systems integrators, OEMs, and channel partners. ICONICS solutions are installed in 70 percent of the Global 500 companies around the world, helping customers to be more profitable, agile, efficient, to improve quality, and to be more sustainable.

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