

Yokogawa's Initiatives for Data-driven Management

Takao Katou ^{*1}

Companies around the world are working on digital transformation (DX) to strengthen their competitiveness. Yokogawa is also striving to foster a data-driven culture in the company and make decisions based on actual data, not on experiences and hunches.

Yokogawa has established a group-wide Virtual Data Analyst (VDA) program that can develop citizen data analysts. Different from data scientists with professional data analytics knowledge and skills, this kind of analyst uses the Self-service Business Intelligence (Self-BI) and Self-service Machine Learning (Self-ML) tools for data utilization. This article describes Yokogawa's efforts to develop citizen data analysts and create a data-driven corporate culture.

INTRODUCTION

Many companies are working hard to utilize the data in their organizations to improve operational efficiency and draw up business strategies and measures. However, they face various difficulties such as not knowing how to proceed with the activities, how to roll them out, and how to obtain substantial results. Although these activities require human resources who can prepare, analyze and expand the use of data, it is time-consuming and costly to train or hire experts such as data scientists and AI engineers.

For a company to utilize its own data, its employees must thoroughly understand their own business and operations. For this reason, we set up a virtual organization to train employees in business departments (non-R&D and non-IT departments) as citizen data analysts and foster a data-driven (data-based decision-making) culture (Figure 1). This organization consists of employees from business departments who are

interested in data analysis and those from the information systems department. It started activities as a Center of Excellence (CoE) by Virtual Data Analysts (VDA) in the second half of fiscal 2018.

In this article, a “citizen data analyst” is not a data scientist with specialized data analysis knowledge and skills, but an ordinary worker who can utilize data with the help of the Self-service Business Intelligence (Self-BI) and Self-service Machine Learning (Self-ML) tools.

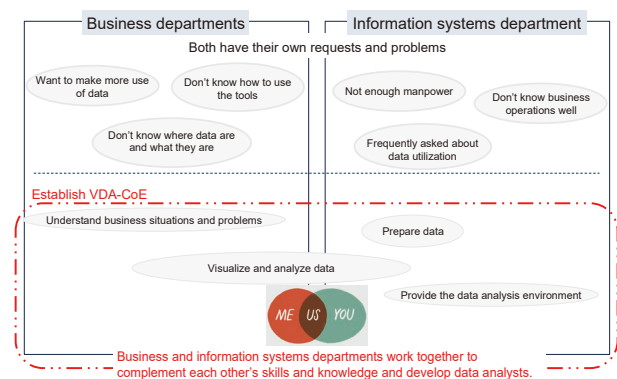


Figure 1 VDA-CoE

^{*1} Strategic System Solutions Department,
Global Application Data Management Center,
Digital Strategy Headquarters

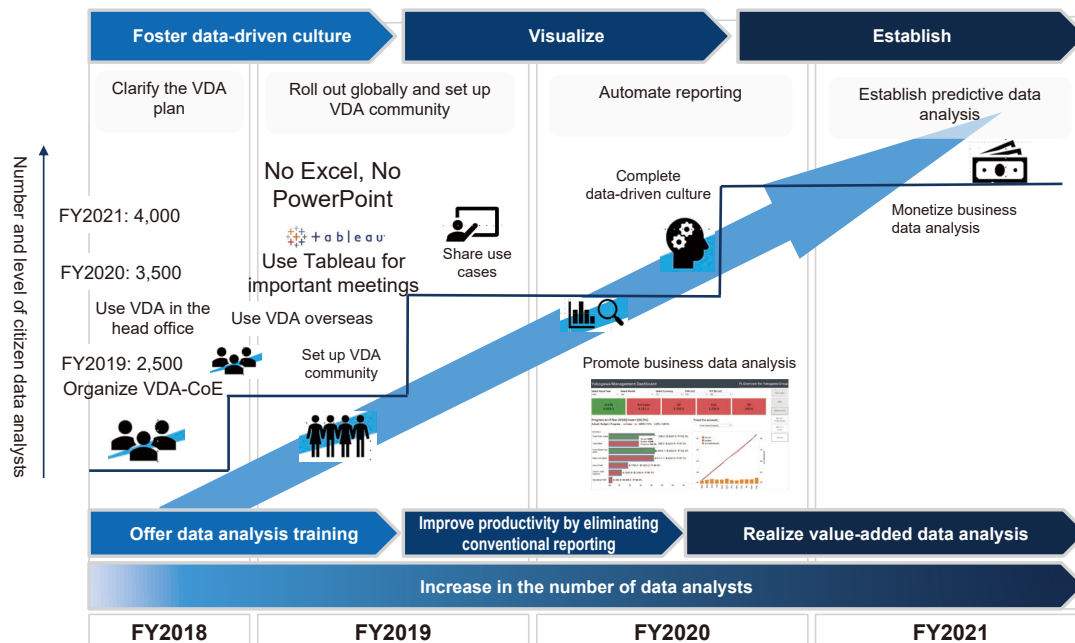


Figure 2 Roadmap for VDA activities

This paper introduces Yokogawa's approach to data-driven management. We hope it will help organizations tackle similar challenges.

HISTORY OF VDA ACTIVITIES

From The Second Half of Fiscal 2018 to The End of Fiscal 2019: Period for Raising Awareness

First, we set a goal of having 4,000 employees, or about 25% of the employees in the entire Yokogawa Group, become citizen data analysts by the end of fiscal 2021. The initial stage of the activities was to make people aware of VDA activities and the effects of visual analysis using Self-BI. We carried out these activities while providing candidate analysts with opportunities for experiencing small successes (Figure 2).

After obtaining approval from the Management Board, we set up the VDA-CoE and started its activities. Our initial goal was to stop using Excel and PowerPoint for preparing documents for reporting and instead use dashboards created with the Tableau BI tool. We started organizing the VDA-CoE in Japan, where the head office and products and services business headquarters are located, and then gradually expanded the VDA activities to overseas bases close to customers, which have sales, engineering, and service functions (Southeast Asia, ASEAN countries, Europe, and the Americas).

Fiscal 2020: Period for Utilizing Dashboards

In the second year, we encouraged use of the dashboards that had been created in the first year, focusing on how they are actually used in operations. We defined key performance indicators (KPI) to measure whether the data utilization cycle (data analysis → planning → discussion and decision making

→ action → data accumulation → data analysis) was carried out, and the VDA-CoE in each region set their own goals (Figure 3).

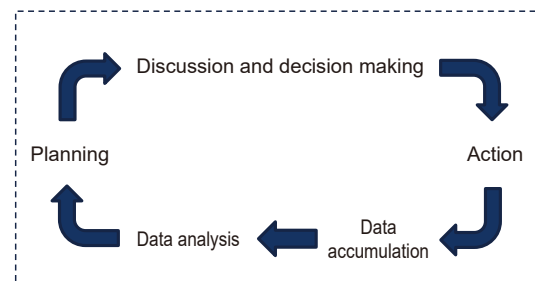


Figure 3 Data utilization cycle

It is also necessary to use the data more efficiently and effectively for next year's goal of monetization (earning profits from data analysis). So, we concluded that Automated Machine Learning (Auto-ML: a tool to automate the task of creating predictive models) would be useful as a Self-ML tool (a tool with which users create predictive models by themselves) in the VDA activities, in order to develop and train citizen data analysts. We conducted a Proof of Concept (PoC) with members from business departments to see if this tool can help citizen data analysts who do not have specialized analytical skills. Assuming that some customers are leaving Yokogawa, we asked the citizen data analysts to use Auto-ML to identify such customers. The results show that they successfully identified these leavers with 80% accuracy and took appropriate measures.

Fiscal 2021: Period for Earning Profits from Data Analysis (Monetization)

As the culmination of the three-year roadmap, we will pursue the goal of monetization; citizen data analysts use data to earn profits from their own tasks and operations. The activities and measures for this purpose are as follows.

Utilizing predictive analysis

We will shift predictive analytics using Auto-ML from the hypothesis verification and trial phase to actual use.

Giving freedom to each region

To allow each region to carry out VDA activities freely, we will expand training for members to improve their analysis skills and acquire data literacy. We will also transfer authority from the global promotion team to each region so that any activities can be carried out quickly within the region.

Utilizing Internal DX experience in External DX

As part of internal digital transformation (Internal DX), we will conduct VDA activities and gain skills, knowledge, and experience. We will apply them to digital transformation for customers (External DX), in order to contribute to Yokogawa's business.

APPROACHES TO FOSTERING A DATA-DRIVEN CULTURE

Having organizations make decisions based on data rather than experience and intuition, in other words, changing their mindset to a data-driven culture, is a radical change in the corporate culture. This chapter explains how we have been working to do this in Yokogawa (Figure 4).

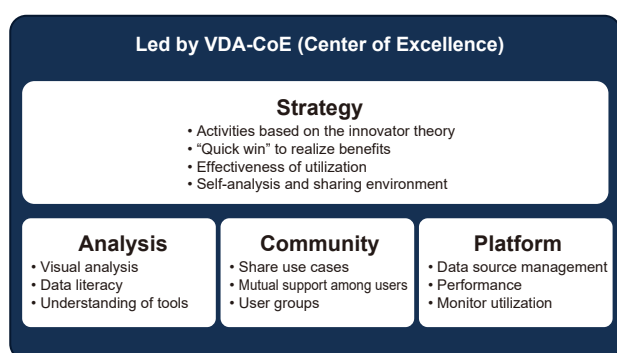


Figure 4 Elements necessary for fostering a data-driven culture

Small Start & Quick Win

To change the corporate culture, it is necessary to change the mindset of employees. When they experience even small successes in the early stages of an activity, they become more positive in the later stages; they achieve results more quickly, accelerate the activities, and have a positive impact on the people around them.

Based on this strategy of “Small Start & Quick Win,” we organized the VDA-CoE, provided analysis training, built

communities, and created a data utilization platform.

Organizational structure of VDA-CoE

The organization for VDA activities consists of the Global VDA-CoE Promoter, which plans and promotes global activities, Region VDA-CoE Units, which promote VDA activities in each region under the Promoter, and the Steering Committee, which is the top management for final decision-making (Figure 5).

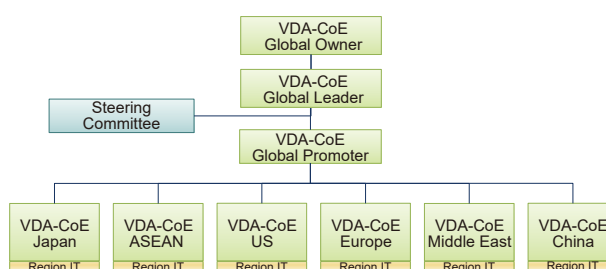


Figure 5 Organizational structure of VDA-CoE

The Global VDA-CoE Promoter consists of members from the Digital Strategy Headquarters (DSHQ). Meanwhile, we set up VDA-CoE units in each region to stimulate the activities across the Group. This organization consists of members selected from the IT department and business departments. The latter members are expected to become drivers of data utilization in their own departments, such as sales, procurement, logistics, engineering, service, accounting, and personnel affairs. Data scientists need three abilities: analytical skills, data engineering skills, and business skills⁽¹⁾. Since the Region VDA-CoE Unit is composed of IT members with data engineering skills and business department members who understand the company's business and operations and have business skills, this is the ideal organizational configuration that enables members to complement each other's capabilities. To improve their analysis skills, we arranged education and training sessions and also used BI tools.

Training

A kick-off meeting was held at the start of the VDA activities in each region. In the meeting, we explained the background and purpose of the activities and the role of the Region VDA-CoE Unit. We also explained that each Region VDA-CoE Unit is responsible for promoting and establishing a data-driven culture in the region, and that VDA is an important activity for which there are high expectations as part of Internal DX, which is set forth in Yokogawa's mid-term business plan.

Next, we explained the importance and effects of data visualization, and had the members experience it through a simple game. Each member was given a table containing many randomly arranged single-digit numbers (1 to 9), and were asked to count the 9s within 30 seconds. No one was able to count exactly, and some gave up counting halfway through. Then, they were given a similar table with only the 9s in red

and asked again to count them. In this setting, all members were able to count correctly and easily. We also got the members to use theory, not sense, to create a dashboard full of graphics. Such dashboards are intuitive and help people to understand and remember the contents.

In the hands-on training of BI tools, the participants understood that Self-BI tools are easier to use than conventional BI tools and that they can create dashboards by themselves without asking the IT department to do so.

The members of the Global VDA-CoE Promoter offered education and training sessions to the members of Region VAD-CoE Units, who then took the responsibility for user education and training in each region.

Community

Since DSHQ members alone do not have enough manpower to support all users, we have created a community where users can interact with and help each other to complement their skills and knowledge, and to maintain and raise their motivation. This place was useful for the VDA-CoE team not only to improve users' skills but also to understand their concerns and requests.

We held a global conference to conclude the year's activities, where we reviewed the activities, awarded members who conducted outstanding activities, and announced plans for the following year. VDA-CoE members and key users in each region participated in the conference. They seemed to be motivated and stimulated by presentations from other regions and opportunities to learn new skills.

Data Utilization Platform

We built a global platform that allows everyone involved to view the same dashboard, use data, and make decisions (Figure 6). The platform consists of a data lake (a storage area for raw data collected from data sources), a data warehouse (a storage area for detailed data that have been processed for ease of use), a data mart (a storage area for summary data according to the purpose of use), and a BI tool (in this case, Tableau).

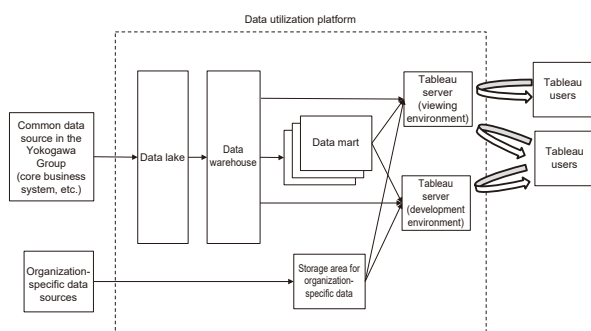


Figure 6 Data utilization platform

The data lake stores order, sales, procurement, logistics, and engineering data from the core business system, as well as customer inquiries and other information from the customer relationship management (CRM) system. The stored

data are converted or combined, and then stored in the data warehouse and the data mart. The BI tool offers two functions: the dashboard development environment and the viewing environment. Users can create dashboards in the development environment using data sources created based on metadata (definitions of data digits and types, and the meaning of data in business) applicable to the entire Group. In addition, we have prepared an environment in which local data of each region can be handled on dashboards, eliminating the need to create reports in Excel, which is time-consuming and tends to differ among individuals. This approach successfully promoted the use of Self-BI.

The dashboards created in the development environment are uploaded to the server of the viewing environment and made public. To manage the scope of disclosure and usage, we set access rights to data sources and dashboards according to the business roles and authorities of users.

Use of Self-ML

Auto-ML is a useful tool for citizen data analysts. It does not require advanced programming skills or an understanding of machine learning techniques to create predictive models. It automates tasks such as feature value engineering (determining what to use as feature values) and predictive modeling (creating and evaluating the model).

To select a commercially available Auto-ML tool, we evaluated them in terms of operability, support system, price, etc. In particular, we put priority on how easily prediction results can be interpreted and explained because we thought that prediction models created by the Auto-ML tool would be used only when people in business departments believed in logic of the predictions.

However, Auto-ML is not perfect. When creating a forecasting model, this tool needs to repeat trial and error to determine what kind of data to be used as inputs. To carry out this process efficiently and effectively, not only the skills of those in the information system department who handle the data but also the business knowledge and experience of users are required. Therefore, it is reasonable that citizen data analysts use Auto-ML as a Self-ML tool.

Furthermore, we linked Auto-ML's prediction results to BI tools and visualized them in dashboards, providing better usability for users who are familiar with BI tools.

We will use the Auto-ML tool to improve the quality of data-driven decision-making. At the same time, we are planning to increase the number of citizen AI engineers by using the scheme we have established to spread VDA. Under the slogan of "Small Start & Quick Win," we will provide opportunities in which users can experience small but immediate, tangible results. This successful experience will increase the number of such engineers. As a first step, from among the members of the VDA activities (citizen data analysts), we will select those with strong knowledge and skills in data analysis and who are interested in predictive data analysis, and then offer training to make them citizen AI engineers.

ACHIEVEMENTS TO DATE

The target numbers of Self-BI users are 2,500 in the first year (fiscal 2019), 3,500 in the second year (fiscal 2020), and 4,000 in the third year (fiscal 2021). We are steadily achieving these targets; the number of Self-BI users has exceeded 3,500 in the second year. We also expect to achieve 50 KPIs for the data utilization cycle as shown in Figure 3.

The initial goal of stopping using Excel for counting and reporting has been achieved. It was replaced by Tableau dashboards and automated, reducing annual costs by 160 million yen.

Although the data lake contains about 1,000 tables occupying more than 6 TB, it is expanding in response to requests from business departments. The data lake is widely used as common data for reports and data analysis in the Group companies both in Japan and overseas.

CONCLUSION

This paper introduced Yokogawa's approach to

developing a data-driven culture, which aims to train citizen data analysts using Self-BI and Self-ML tools. This project is led by the information systems department, but it does not end simply with installing the tools; this company-wide activity involves working with the business departments to change the corporate culture. We hope that readers find this paper helpful as an example of a DX initiative.

Although VDA promotion activities are part of Internal DX, we are planning to introduce them to users of Yokogawa products and services in practice. This is a showroom approach toward External DX.

REFERENCES

- (1) Information-technology Promotion Agency and the Japan DataScientist Society, Skill Checklist & Task List Overview for Data Scientists, 2020, <https://www.ipa.go.jp/files/000083733.pdf> (in Japanese)(accessed on April 30, 2021)

* All company names, organization names, product names, and logos that appear in this paper are registered trademarks or trademarks of Yokogawa Electric Corporation or respective holders.

