New IT Solution Using Human-oriented Big Data Analytics

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OVERVIEW: There has been a shift in recent years toward innovation and the creation of new value being the wellspring of corporate competiveness. By working in collaboration with customers on big data analysis through its data analysis service, Hitachi is fostering creation of a series of services that extend from the discovery of new knowledge to the development of IT solutions that can put this knowledge to use in decision making in the customer's business. Hitachi is also investigating the possibilities of a new IT solution that analyzes quantitative data on human behavior (human-oriented big data) to consider unconscious behaviors and identify hidden opportunities or risks. Work is also proceeding on the use of behavior data collected from business-card-sized or wristwatch sensor nodes to support strategies in marketing or sport.

INTRODUCTION

THERE has been a shift in recent years toward innovation and the creation of new value being the wellspring of corporate competiveness, and this has drawn attention to the use of big data to uncover new value. Behind this is the ongoing collection of large quantities of different types of information in the form of digital data, a consequence of the spread of sophisticated portable devices such as smartphones or tablets and of social networking services such as Twitter* or blogs, and the extensive adoption of business management applications.

However, there are three problems in the way of turning this big data into something of benefit to companies.

The first problem is that big data is a mixture of both significant and useless information. Because there is a limit to how much data a single person can process, extracting the significant information is not easy. Instead, what is required is to define what is of value to the customer, namely the key performance indicators (KPIs), and to filter the data accordingly.

The second problem is that ad hoc attempts to take account of the knowledge obtained from data when implementing plans are insufficient. Instead, what are required are solutions that can utilize the extracted knowledge and make improvements on an ongoing and self-sustaining basis.

The third problem is that the results of analysis inevitably depend on the type of data able to be collected. To provide value to customers, it is important to keep looking for ways of unlocking fresh potential from new types of data.

Hitachi has introduced its data analysis service to deal with these problems, applying all of its strengths to the task of creating value. In the first step, a "meister" (expert) works collaboratively with the customer at an upstream process to clarify a vision before utilizing large storage systems, parallel and distributed processing techniques, and statistical analysis to extract meaningful data from big data. Next, the meister conducts analyses that consider the business system implementation. The aim is to support customer's strategy formulation and execution by providing an information technology (IT) solution that can perform continuous monitoring of the identified key indicators.

Furthermore, recognizing that more than 70% of workers in Japan are employed in service industries[(1)], Hitachi believes that extracting knowledge from multifaceted data on people is essential to improving competitiveness. Accordingly, Hitachi has been looking at the analysis of human-oriented big data (data on people's activities) and investigating its potential for developing service support solutions that take account of people's unconscious behaviors.

This article outlines the data analysis service and describes examples of human-oriented big data analysis and the potential for future IT solutions.

DATA ANALYSIS SERVICE

In its data analysis service, Hitachi has formalized the process of extracting the value inherent in big data (see Fig. 1).

* Twitter is a product name, trademark or registered trademark of Twitter, Inc.

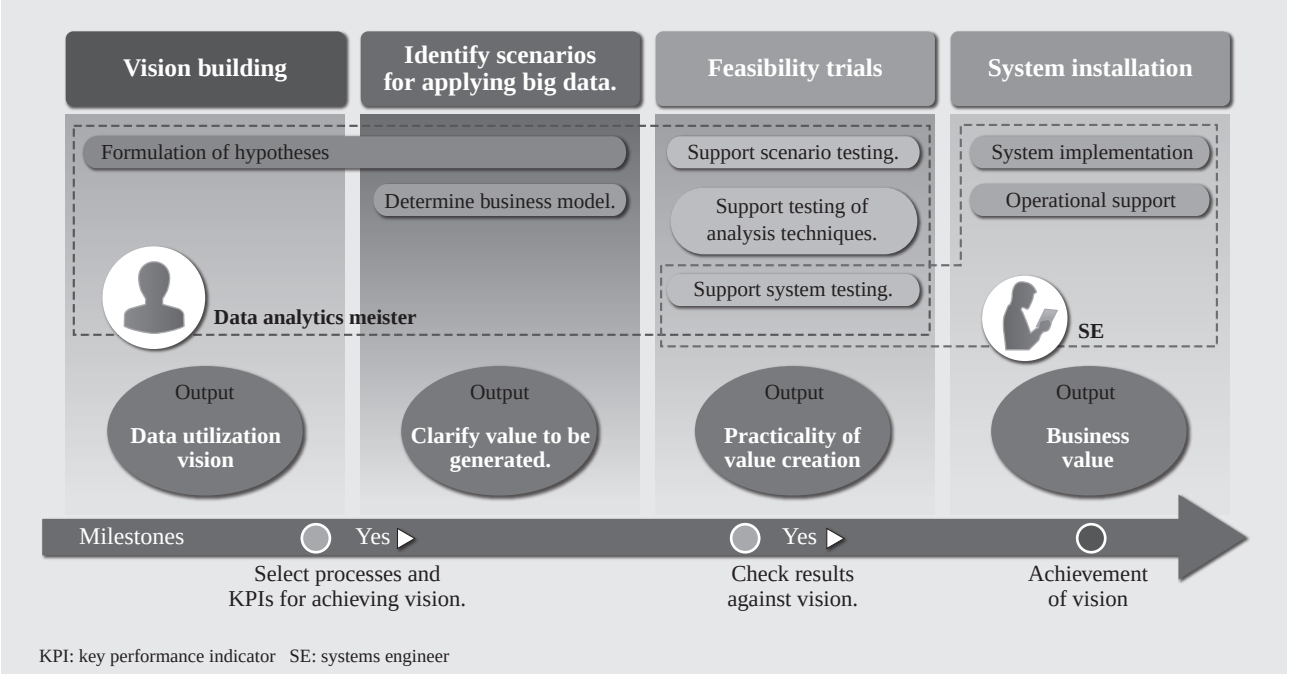

Fig. 1—Steps Handled by Data Analysis Service.
While working collaboratively with customers to propose and test hypotheses, Hitachi provides support for all steps up to system implementation and operation. The four steps are: (1) vision building, (2) identify scenarios for applying big data, (3) feasibility trials, and (4) system installation.

An important factor in the utilization of big data is to improve the efficiency of the processes leading up to and including feasibility trials that seek to demonstrate the relationship between business value and the results of data analysis. Accordingly, Hitachi seeks to help fully realize its customer's vision by employing data analytics meisters and focusing on working alongside the customer to propose and test hypotheses. Once it has been demonstrated that the vision can be realized using perspectives contained in big data, the meister and Hitachi systems engineers (SEs) work together on the system design in order to provide the customer with an IT solution. This service consists of the following four steps.

(1) Vision building

Hitachi works with the customer to clarify and agree on the vision for big data utilization. Examples include optimizing the paths taken by visitors to a website or bricks and mortar store, using the collection of comments from a customer service center or the analysis of reputation on social media to enhance customer satisfaction, or using preventive maintenance to improve the utilization of plant and equipment.

(2) Identify scenarios for applying big data

This involves formulating hypotheses on how to achieve the targets based on a thorough understanding of the customer's business. A series of hypothetical scenarios are devised, including deciding on the types of data to use as input, which data processing techniques to use, the likely results of data analysis, and how these results can be utilized in the company's activities.

(3) Feasibility trials

These are intended to verify whether the analysis of big data delivers valuable knowledge in terms of the vision. An experimental environment is established to test the hypotheses using mathematical and statistical analyses. This frequently involves obtaining data from the customer and conducting trials on Hitachi's cloud computing systems.

(4) System installation

The requirements for the customer solution are determined based on the results of the trials. This is followed by development, testing, installation, and operation, with the work being progressively handed over from the data analytics meister to the SEs responsible for system implementation.

HUMAN-ORIENTED BIG DATA AND ITS POTENTIAL

A broad definition of service industry includes not only retail workers but everyone who creates value through interaction with other people, including teachers, call center operators, medical professionals, and sportspeople. It is estimated that more than 70%

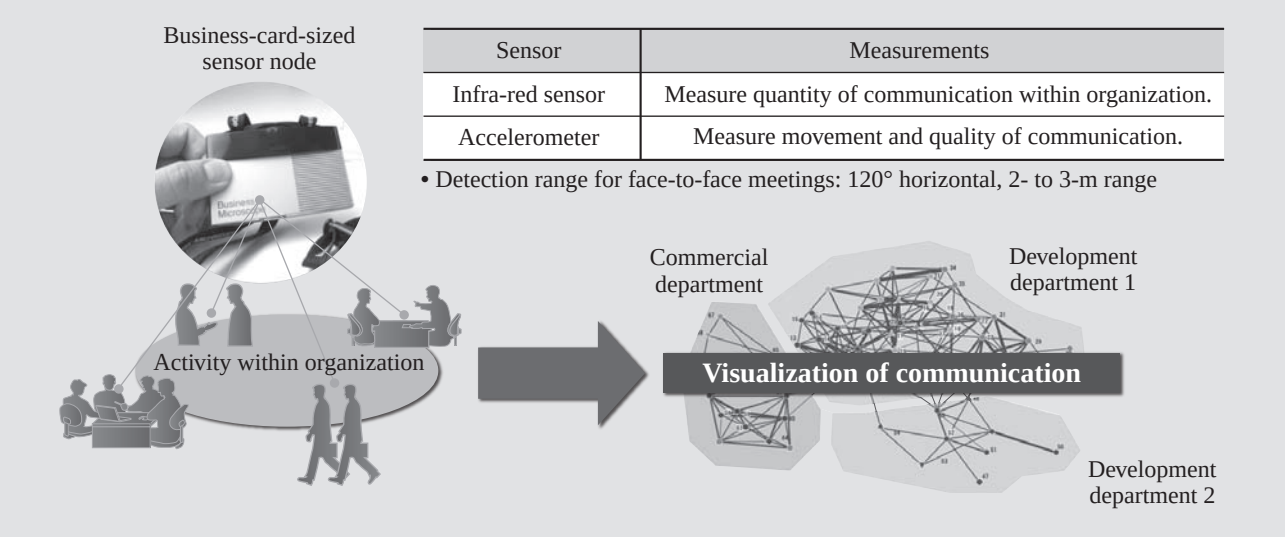

Fig. 2—Business Microscope.
This uses business-card-sized sensor nodes to obtain quantitative data on the quantity and quality of communication between wearers, and their activity patterns.

of the workforce in Japan is employed in services. Because people are both the creators and recipients of value in service industries, the extraction of knowledge and in-depth analysis of people are factors in business success.

This section uses the term human-oriented big data to refer to quantitative records of people's behavior, actions, and circumstances. While some initiatives have begun to emerge, such as analyzing the flow of information through Twitter or other social networking services and utilizing this in marketing[2], practical examples of the fully fledged use of human-oriented big data in business decision-making remain rare. In the future, the comprehensive analysis of human-oriented big data that has been collected from a variety of sources offers the potential to identify opportunities or risks inherent in services, and to do so in ways that take account of people's unconscious behaviors.

To collect this human-oriented big data, Hitachi is developing business-card-sized (business microscope) and wristwatch (wristband-based life recorder system) sensor nodes.

"Business Microscope" Business-card-sized Sensor Nodes

The "business microscope" business-card-sized sensor nodes provide a means for collecting data on the activity of a number of people[3]. Incorporating infra-red and acceleration sensors, the sensor nodes are worn around the neck and can detect communication between fellow wearers and identify activity patterns (such as working at a desk, walking, or attending a meeting). In the case of communication between fellow wearers, they can collect data on who is actively engaged in the communication based on bodily movement[4] (see Fig. 2).

Wristband-based Life Recorder System

The wristband-based life recorder system provides a means for collecting 24-hour-a-day data on the wearer's activities[5]. The sensor nodes are fitted with accelerometers to collect second-by-second data on activity patterns (such as walking, running, or sleeping), levels of activity [metabolic equivalents (METs)], and depth of sleep from small movements in the wearer's arm. For example, a visual representation of someone's lifestyle pattern can be presented by plotting their level of activity over the course of a day (see Fig. 3).

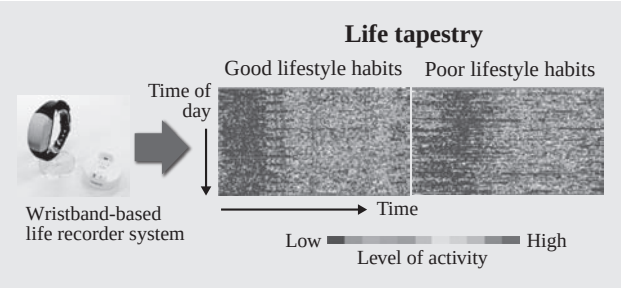

Fig. 3—Wristband-based Life Recorder System.
This uses an accelerometer to measure parameters such as actions, activity level, and depth of sleep. By collecting data over a long period, it can provide an overview of the wearer's lifestyle pattern.

SOLUTIONS FOR UTILIZING HUMAN-ORIENTED BIG DATA

IT solutions that unlock new potential in services can be implemented by utilizing human-oriented big data and applying the solution-building techniques of the data analysis service. This section shows what can be achieved by presenting actual examples in which the steps described above [(1) vision building, (2) identify scenarios for applying big data, and (3) feasibility trials] were put into practice.

Support for Marketing Strategies: Performance Evaluation of Dating Event

Shrinking and aging populations have become a major issue for outlying towns in Japan in recent years. In response, an increasing number of local governments are staging dating events to encourage couples, both from within the region and elsewhere, to meet and settle down.

This project involved working with the local government and using the business-card-sized sensor nodes to measure communication between participants. The aim was to obtain knowledge about the operation of the event in order to increase participant satisfaction and the number of successful couples that resulted. The analysis focused on the number of people engaged in conversation, who they spoke to, and whether they were speaking or listening. The results showed that conversations between people who were good talkers and attentive listeners went on the longest, and that while groups of a number of people formed naturally, there were some who were left out of the conversation.

This knowledge in turn provided ideas that helped improve the quality of the event, including recommending which participants were likely to have a good affinity and providing advice on how to increase the opportunities for conversation. It also indicated the potential for creating future solutions for supporting marketing strategies that are aimed at maximizing customer satisfaction at corporate exhibitions or inter-industry get-togethers, for example. Other similar examples include projects aimed at improving the sales performance of call centers and retail stores[6].

Support for Sports Strategies: Performance Evaluation for Football

It is becoming more common for sport to call on the capabilities of science and technology. Hitachi participated in a demonstration trial aimed at strategic team building and player development at the Kashiwa Reysol Academy, a training academy for under-18 players run by the Kashiwa Reysol team in the Japan Professional Football League.

The demonstration analyzed a week of wristband-based life recorder system data from each player to determine the relationships between their lifestyle rhythm and their training and match-day performance. In addition to energy expenditure, number of steps, and distance covered, the performance analysis also looked at the type of running, such as whether they were dashing or jogging. What it found was that the quality of activity differed depending on factors such as how the game was progressing or the player's positional role (see Fig. 4).

The analysis of lifestyle rhythm, meanwhile, considered daily sleeping and study schedules as well as the level of routine activity and the quality of sleep. It was found that performance was being affected by taking a nap before training and a lack of nighttime sleep due to having a long commute to school.

An issue for the staff of the Kashiwa Reysol Academy in the past has been that they have had no way of knowing about a player's circumstances off the field. The demonstration showed that having an understanding of the length and quality of sleep and

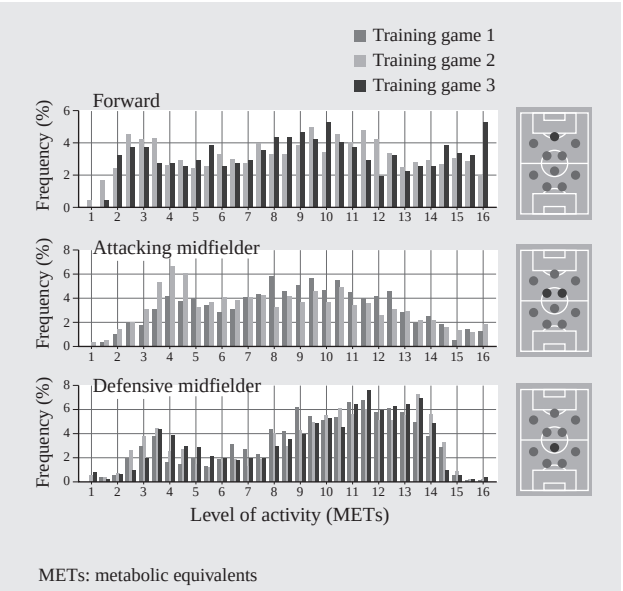

Fig. 4—Application to Under-18 Players at Kashiwa Reysol Academy.
The graphs plot the match performance of players in different positions acquired using wristband-based life recorder system. Their different characteristics are represented by the frequency of different levels of physical activity. This approach also helps with lifestyle management by analyzing lifestyle rhythms and sleep patterns over 24-hour periods.

the resulting degree of tiredness was valuable for providing lifestyle advice to these young players who are seeking to become professional footballers. By collecting data over longer periods of time to provide an insight into things like player and team growth or their cycle of peaks and troughs, this approach should also be able to help with deciding on game-day strategies.

These results show the way forward for implementing solutions for the sports and fitness sector that aid things like human resource development, condition management, and the formulation and execution of team strategy.

CONCLUSIONS

This article has outlined the data analysis service and described examples of human-oriented big data analysis and the potential for future IT solutions.

Hitachi has established the Smart Business Innovation Laboratory to facilitate the work of its data analytics meisters. The laboratory brings together the capabilities of specialists from a variety of fields, including data analytics researchers and consultants and SEs with expertise in the implementation and operation of systems in areas like business intelligence (BI) and high-volume data processing.

Hitachi's business divisions are domain experts who are deeply familiar with their specific industries. By utilizing the existing results of work by its research and development divisions, and through collaboration between these business divisions and Hitachi's customers and other partners, Hitachi is able to proceed with big data utilization in a wide variety of fields.

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