Fujitsu's Activities for Human-Centered Design

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Information technology (IT) has become an indispensible part of our lives from work to everyday living. It has also become extremely complex as it attempts to support a variety of objectives at the same time. Therefore, it is becoming increasingly important that IT systems, as an indispensible element of modern society, be designed so that a wide variety of people can use them with ease. To provide customers with quality IT systems on an ongoing basis under such conditions, attention must be focused on the people that use these systems. First, problems in the field must be analyzed comprehensively in a human-centered way taking into account user sentiments, work and communication in the field, and equipment and space. Next, operations and facilities in the field must be optimized taking into account the characteristics of the people who will be using the system. This paper introduces Fujitsu's approach to human-centered design and current activities supporting its use.

1. Introduction

It has been said for some time that *monozukuri* (producing products and services of exceptional quality and cost performance) has become difficult and that products and services are not selling well at all. It has also been said that problems in the field are difficult to understand, making system design difficult and troublesome, and that sometimes hardly any effects at all can be observed after a new system has been deployed, which can leave system operators dissatisfied and lacking a sense of accomplishment. Nevertheless, information technology (IT) has come to penetrate all aspects of modern society from daily work to everyday living, becoming a major part of our lives. However, it is becoming increasingly difficult to use IT well and to design IT so it is easier to use.

One reason for this situation is purported to be the diversity of users. This diversity appears not only in the form of individual physical characteristics, cognition, and experience of users, but also in their values and viewpoints. On the other hand, advanced IT systems have also become extremely complex in themselves. Under these conditions, it is essential that we return to the starting point and focus once again on the people that use IT systems in order to provide quality products and services. Development should be based on design that treats the user as the starting point, i.e., human-centered design (HCD), which aims to decipher what the user wants to do and what the user desires, and then determine what operations to give the IT system based on current problems and the experience and knowledge of users.

This special issue introduces Fujitsu's HCD activities related to developing IT systems that customers need and will take pleasure in using while taking into account important social trends surrounding HCD.

2. Background of HCD

Promoting design that starts with the people that will use the target product or service is not really a new idea—it's the basic approach to

monozukuri.

In the 1980s, the relationship between man and machine underwent a complete transformation with the appearance of the computer for general users. Up until then, a machine was something that one could understand relatively easily in terms of how some kind of manual input would appear as output after undergoing some kind of conversion. The user could use the machine while predicting to some extent what the output would be. With the appearance of the computer, however, this relationship was suddenly transformed into a black-box type of interaction. Computers promoted dramatic changes in the way we worked and lived and provided a variety of benefits including faster and more efficient processing and "borderless" access to information. At the same time, the burden on the user side in using the communication network increased, creating a new issue of concern. As systems continued to evolve, there was an ongoing need to learn new operation methods, and pressure was applied to achieve an advanced state of computerization to support business processes efficiently by adopting a system managed by a relatively small number of people. As a result, users came to experience excessive stress and the scale of damage generated by human error only increased, spawning new problems that could not be ignored.

To prevent such problems from occurring, a movement centered on the IT industry arose to pursue design from the viewpoint of the people that will actually use the systems to be developed. This movement gave birth to the concept of HCD. To achieve design from the viewpoint of users in HCD,

1) problems must be discovered and solutions studied at the users' site by observing behavior,
2) the product-out approach must be replaced by an approach that aims to meet the users' objectives in using the system, and
3) ongoing improvement centered about the user must be supported.

The ideas behind HCD were first proposed at the International Organization for Standardization (ISO) in the form of ISO 13407 "Human-centered design processes for interactive systems", which became an international standard in 1999.[1)]

3. HCD activities at Fujitsu

The concept of HCD has been in general use at Fujitsu since 1995, promoting the development of equipment and systems that are easy to use from the standpoint of the user. The 1980s saw the introduction of computers at business work sites in conjunction with the move toward office automation, and to ease the customer's anxiety associated with using visual display terminals, Fujitsu incorporated the idea of "ergonomics" into system development, marking the beginning of HCD activities.

One problem with computer terminals at that time was that they were not suitable for long hours of work because their technical specifications were still quite immature. In addition, computer terminals used for work in specialized fields were widely deployed all at once despite the fact that aspects like work design, working environment, and operator training were given insufficient attention. This situation gave rise in many cases to uncomfortable work postures and excessive stress. To deal with this problem and provide an optimal computer system from the viewpoint of ergonomics, Fujitsu proposed an approach that considers the form that a system should take from the viewpoint of humans as opposed to thinking about humans from the system side. Based on this approach, Fujitsu has come to put great importance on the following policies:

1) plan and design equipment in accordance with human characteristics
2) plan and design the work environment in accordance with human characteristics
3) plan and design work and operate and manage systems in accordance with human characteristics.

Fujitsu aims to optimize the interface between the computer system and users from the aspects of system, environment, services, and information (**Figure 1**).[2)]

4. Role of HCD in supporting monozukuri

As described at the beginning of this paper, the renewed interest in HCD and efforts to promote it originate in the state of monozukuri that has been becoming increasingly difficult for some time. It is thought that HCD can play an important role in resolving this problem and providing customers with greater value. The following three points may explain why monozukuri is becoming more difficult. First, users are becoming more diversified and so are their core values; second, IT systems themselves are becoming huge and complex; and third, advanced development skills are needed on the human side to deal with the above trends.

4.1 Diversification of users and their values

The diversification of users is said to be correlated with advances in universal design in IT systems.[3),4)] IT contributes to a variety of activities in daily life, and at present, it is closely intertwined with the network. We have already reached the stage at which everyday life cannot not be sustained without IT. When IT does become temporarily unavailable, lost benefits and opportunities can be immeasurable depending on what it was that could not be used or accessed. The point here is that everyone who has a need for IT systems should be able to use them in the same way. A move to eliminate this digital divide is taking place on a global scale under the name universal design. At present, this movement is pressing forward, but severe obstacles remain. Another movement that has appeared aims to enable all people, even those who have had difficulty obtaining academic or work opportunities in the past, to make their way in society through active use of IT.

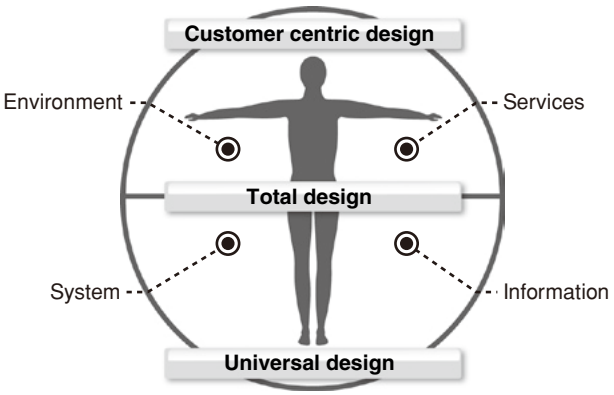


Figure 1
Human-centered design at Fujitsu.

We here give a specific example from Japan. It appears that one fourth of the population of Japan will soon be over 65 years old, making Japan a super aging nation. In the e-Japan Priority Policy Program of 2002, the Japanese government set a goal for Japan to become one of several IT nations in the world within five years, and to this end, it clarified what would have to be done to rectify the digital divide (in terms of physical and geographical characteristics) in Japan. Then, in the same year, the government released basic plans for persons with disabilities, promoted Japanese Industrial Standards (JIS) standardization of guidelines for older persons and persons with disabilities, and highlighted efforts to procure equipment and systems for public services in conformance with the proposed guidelines. In line with these developments, JIS X 8341-1 "Guidelines for older persons and persons with disabilities—Information and communications equipment, software and services, Part 1: Common guidelines"[5)] was released in 2004, followed by Part 2: Information processing equipment, Part 3: Web content, Part 4: Telecommunications equipment, and Part 5: Office equipment (**Figure 2**). Next, in 2006, the "IT New Reform Strategy—Reforming Japan through IT—(Draft)" was presented. This restated the goal of "a society with no digital divide".

As an example from another country, the Rehabilitation Act Amendments of 1998 (Section 508) in the United States have been in force since June 2001. These amendments make the universal design requirements described in Section 508 obligatory when IT equipment is introduced in federal agencies. Making universal design in IT a legal obligation in this way guarantees that persons with disabilities will have the opportunity to work and get ahead in society. There is currently a move to revise this law even further to make it more compatible with international standards.

Even without observing universal design activities, this sort of user diversification demonstrates the need for design work that takes into account an even broader set of human traits including physical characteristics, cognitive characteristics, experience, and culture. In short, a broad range of human understanding is needed.

Furthermore, in Japan and a number of other countries and regions, high-performance and high-function products and services have become omnipresent in our daily lives, with many being quite similar to each other. To give a simple example in the case of automobiles, a prospective buyer may first consider what kinds of basic functions he or she needs and choose among a sedan, sports utility vehicle, sports car, etc. But then, without making a detailed comparison between specifications of different cars, that buyer is likely to select a vehicle in an intuitive manner based on personal preferences for appearance, interior design, and other characteristics. This reflects a trend in which people are placing more weight on what something does and the benefits that it can provide than on simply possessing something. In short, the criteria for making value judgments are changing. Under such conditions, monozukuri must recognize the need to appeal to the values and sensitivities of individual users, and to that end, human characteristics must be understood and applied.

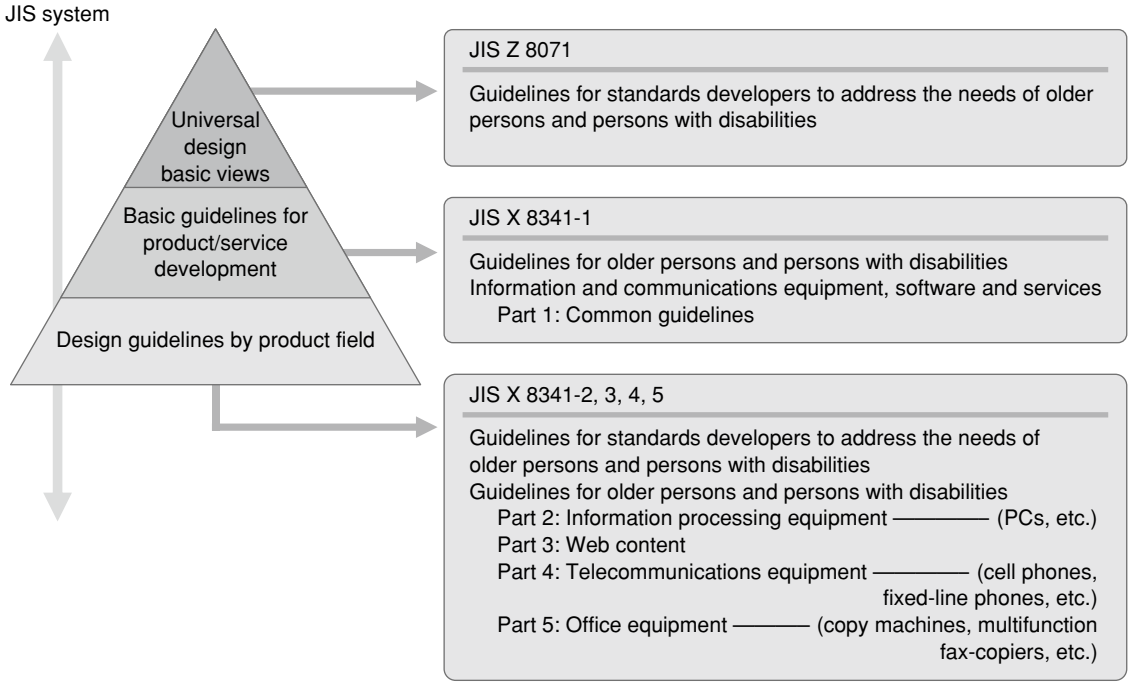


Figure 2
Guidelines for older persons and persons with disabilities.

4.2 Bigger and more complex IT systems

One result of the progress made in IT is that services have become extremely sophisticated with most of them operating under a very complex system having multiple intermediate systems. Under these conditions, it is not easy to satisfy diverse needs by the product-out approach that begins with conventional function design followed by the fixing of specifications and proposals for services that can be provided by those functions and specifications. What is needed here is a market-in approach that begins with the user's ideal image of a needed service and then performs function design based on that image. However, in today's business environment where new services are being provided one after another, users themselves can find it difficult to define what service they really need. In such a situation, the user's awareness of problems and the problems themselves should be objectively determined, those problems should be visualized so that they can be shared with the user, and the service should be designed appropriately in cooperation with the user. Here, attention should first be focused on the site where users will be using the future service so that problems can be uncovered by observing user behavior, and the gap between the present situation and the user's ideal service can be identified. The direction that the solution should take can then be established, problems to be addressed can be clearly defined, and system design requirements can be established. Human-centered activities are of prime importance here.

4.3 Need for advanced skills

The design and development of today's systems, which are becoming increasingly complex, as described above, require the combination of various kinds of technical elements. As a result, developers involved with such complex systems are often required to possess extensive know-how. Attempting to solve this problem by relying solely on the human efforts of developers has already proven to be difficult. At the same time, technology is progressing and services are changing at an ever faster rate. This state of affairs underscores the importance of passing down and sharing development technology efficiently. Here, as well, HCD know-how can be put to use in establishing a development process and development organization as a development infrastructure so that a technology development system can be passed down and shared for widespread use.

5. Achieving practical products and services

Providing quality products and services to customers based on the HCD concept requires a uniform service-oriented design process executed from an HCD viewpoint from the product/service planning stage to development and post-delivery follow-up. In the Fujitsu Group, HCD activities can be divided into three steps—survey, concept formulation, and development—with an HCD infrastructure underlying each step (**Figure 3**).

5.1 Survey step

First, in the survey step, the work site is surveyed and analyzed from an HCD viewpoint. The results obtained in this step should be faithfully conveyed to developers in the following processes. In the past, a work site was understood in terms of numerical data such as the number of tasks to be performed and processing time. However, if some of the business processes performed at the user's work site were prone to delays, there was no way of knowing for sure whether the cause was a problem in system design, operator motivation, or office space design, for example. To decipher such problems, a qualitative approach, which cannot be expressed in terms of numbers, has become important as opposed to an approach relying solely on numerical data.

In the survey step, the focus is on the workplace, and techniques that use ethnographic methods to find out what actually happens in the workplace and to uncover problems have been effective. In combination with numerical data such

as number of tasks to be performed, these techniques use operator characteristics obtained from observation techniques like "shadowing" and the results of qualitative surveys of workspaces to see problems from many angles and to determine the direction to take to implement effective solutions. However, considering that an observer as an outsider can only view and comprehend so much, it is entirely possible that proposed improvements may not truly match the direction that on-site users want to take, even though such proposals may provide a solution or improvement for a problem that was directly observed at that time. For this reason, what the user regards as the ideal situation must be shared. But it is also difficult for users to accurately convey their needs because they tend to depart from actual conditions and describe matters in a somewhat abstract fashion. In response to this problem, Fujitsu has developed the AIm Interview as a qualitative design methodology. This interview can extract the true nature of things from the interviewee in a framework consisting of present state, core values, source of motivation, strengths, idealized vision, gaps, and business concept. When combined with on-site problems, the AIm Interview can lead to effective improvements (**Figure 4**).

5.2 Concept formulation step

Next, the results obtained as described above can be used as a basis for formulating a product or service concept. Even if problems can be identified by on-site surveys and analyses, they are essentially worthless if they cannot be accurately conveyed to those in charge of subsequent HCD steps. Here, on-site problems that must be solved should be shared with users in a form that reflects reality. To this end, Fujitsu uses the Persona and Scenario Writing methods as techniques for sharing the features of interviewees among concerned people based on the knowledge obtained from the survey step. The Persona method describes an imaginary character based on features shared by interviewees in a way that makes that character appear like a real person (**Figure 5**). In addition, the behavioral characteristics of that character

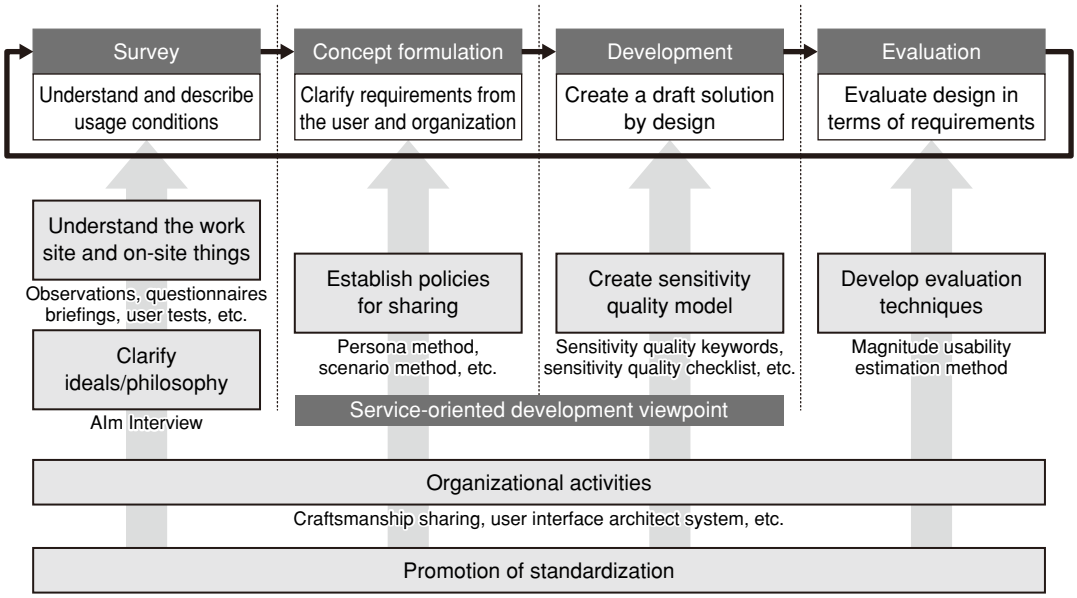


Figure 3
HCD activities at Fujitsu.

can be used to predict a lifestyle and create scenarios so that people related to the development process can be keenly aware of the interviewees in question. Depicting users in a realistic, tangible manner like this can help clarify development policies, which in turn can facilitate the creation of advanced designs and prototypes. Then, by again using the persona created earlier, one can evaluate those designs and prototypes, enabling more accurate design of products and services.

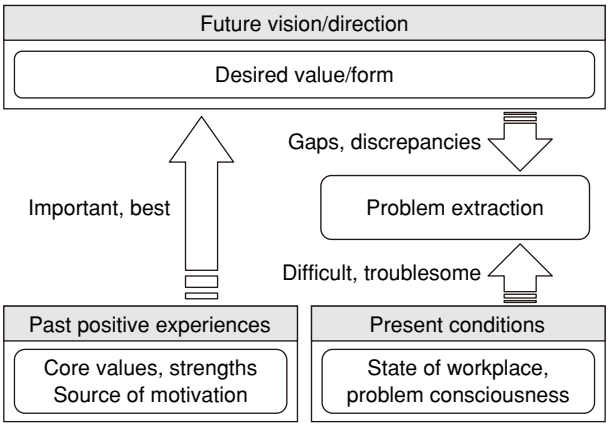


Figure 4
Model of AIm Interview.

5.3 Development step

In the development step, the importance of sensitivity rises, and qualitative elements of sensitivity must be quantified for use at design sites and incorporated into the design process. At present, a sensitivity quality model is being created and studies on the quantification of sensitivity continue. Furthermore, in cases of totally new development in which there are no similar objects for comparison, or cases in which the system scale is so large that any evaluation performed on it would be difficult to put into words, it should be possible to perform an accurate evaluation in terms of sensitivity and operability according to the degree of sensory impressions felt by the user.

Misaki Sato,
10 years old, 5th grade

Family details	Four-person household. Father works at a major manufacturer and mother is a full-time homemaker; has a younger sister.
Personality	Cheery and mild-mannered, she is popular in class. She always does homework and gets excellent grades. Being full of curiosity, she'll keep asking questions and looking for an answer about something she's not sure about until she understands.
Activities	She plays a lot with Moe, a girl in the same grade as her living in the neighborhood. She also plays with Haruka, her friend since she was small, who is one year ahead of her. She has been going together with friends in the neighborhood to a private cram school (*juku*) since the fourth grade. She is thinking about taking a middle-school entrance examination. Homework is somewhat difficult, but by going to juku, she can meet friends who go to different schools; the teacher is very pleasant and going to juku can be fun. She has been studying piano since she was three. She practices classical music in her lessons, but she also buys sheet music on her own and practices popular music that she hears on TV and music from movies too. She participates in a recital once a year and looks forward to it, especially now that, since the 5th grade, she has been able to choose her own pieces. On free days, she visits friends in the neighborhood at their houses. Her father sometimes drives the family to the shopping mall to do some shopping.

Figure 5
Example of Persona method.

Here, an effective means of obtaining improvement indexes would be an evaluation technique that can be applied across diverse products and services and provide comparative indexes that are as simple as possible. To this end, Fujitsu has developed the "Magnitude Interface UX Index Scale", which has already been put to use (**Figure 6**).

5.4 HCD infrastructure

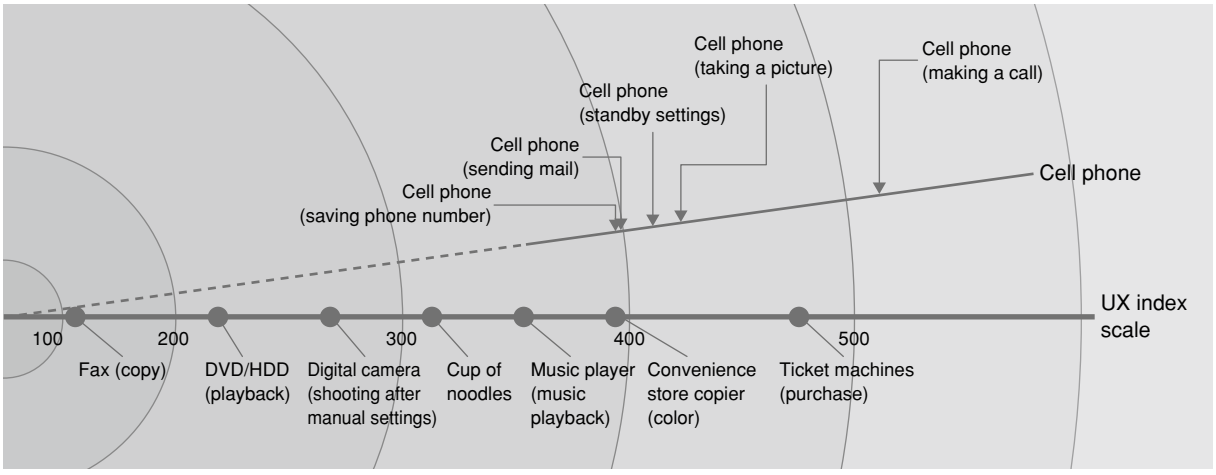
Organizational activities also play an important role in promoting the HCD viewpoint at development sites and in sharing the know-how possessed by individual development sites. This special issue presents a mechanism for widespread sharing and passing of takuminowaza (craftsmanship) possessed by individual system engineers developed by focusing on user work sites and analyzing problems, plus a user interface (UI) center and UI architect system for widespread application of advanced usability to middleware.

Through activities such as the ones described above, Fujitsu aims to provide true value as envisioned by customers, to add value to business and life, and to contribute to the creation of products and services that customers can appreciate.

6. Conclusion

This paper described the background to renewed interest in HCD and outlined joint efforts by Fujitsu and its customers to create an IT society that anyone can participate in. Promoting HCD requires close attention to the current state and to the sentiments of individual customers, and innovation must be pursued in conjunction with customers. These activities are synonymous with the concepts of customer-focused design and field innovation, upon which the Fujitsu Group places great importance.

Our plans for the future are to develop cutting-edge techniques and enhance existing ones toward more advanced forms of HCD and to use the know-how so gained to construct a foundation for providing products and services of even higher quality that can be used anytime and anywhere on a global basis. Through HCD activities, the Fujitsu Group aims to obtain an even higher level of trust from its customers.



DVD: Digital versatile disc
HDD: Hard disk drive

Figure 6
Example benchmarks on UX index scale.

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