Site-Driven Service Innovation of POS Systems

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Systems for distribution, finance, and other sectors of the economy (so-called "BtoBtoC" products and services) must deliver value from the different perspectives of purchaser of the system, employees responsible for operating the system, and customers who benefit from using the system since all of these stakeholders relate to information and communications technology (ICT) in different ways. It is exceedingly important in designing BtoBtoC products and services to adopt a comprehensive approach that incorporates advantages for the business in addition to user-friendliness and aesthetic appeal. The business environment of companies that buy these systems has changed enormously in recent years even as the social environment has changed, and companies now expect these systems to enhance productivity, entice shoppers into the store, boost sales opportunities, and help the bottom line in other ways. The role of design is singularly important, for it holds the key to shaping revolutionary new services that create value and address the various challenges faced by companies in providing enticing new products and services. Taking the example of a point-of-sale (POS) system for retail businesses, this paper introduces a novel product and service creation process based on combined efforts of sales, development, and design divisions. It also describes a simulation technology-based approach used to convert a conventional proposal-type business negotiation into a consultation-type negotiation.

1. Introduction

Fujitsu offers a range of product lines and solutions developed specifically for the retail distribution industry that are optimized for a wide range of retail businesses including department stores, volume retailers, specialty shops, food service and grocery stores, shopping centers, and many more. They include, for example, point-of-sale (POS) systems that enhance the customer service experience while improving store management efficiency. POS systems not only affect how physical products are sold in a store but also how shoppers navigate the store, so these systems greatly affect whether the customer's shopping experience is good or bad, are closely linked to store sales, labor costs, and customer satisfaction, and are a key factor in store operation and sales space reformation across the retail sector.

The POS system is thus an extremely important design element in creating a check-out style that matches the desired image and use of the store and must be designed from a holistic point of view encompassing the installation space and operation in addition to user-friendliness and aesthetic aspects of the equipment. For this reason, Fujitsu not only develops POS products but also offers consulting and support regarding the deployment (installation) and operation of POS systems and creates value in a host of other ways to enhance the convenience of shoppers and address the business challenges of retailers.

This paper begins with a quick overview of Fujitsu's human-centered approach to design and innovation creation for developing POS systems and other products targeted at different business sectors. Next, it describes how a Human-Centered Design (HCD) approach can be implemented by adopting three measures. It then introduces Fujitsu's approach to developing a highly innovative self-payment check-out system (TeamPoS/SP) that is well adapted to the changing business environment of supermarkets and other modern businesses. It wraps up by describing a simulation tool developed

for business consultation, mentioning future work, and summarizing the key points.

2. Human-Centered Design

A number of factors are involved in optimizing a business in an integrated fashion: ease of use and comfort for users, workability and communications at the site, and the actual equipment and installation space. The POS system and other systems for different business applications are designed by Fujitsu on the basis of the following design principles, which are illustrated in **Figure 1**.

1) Customer centric design

The ideal form for a business application system is dictated by the point of view of the business customer. The design of systems, products, and services for different businesses must capture customers from three different perspectives—the view of the business customer who purchases them, of the people who operate them, and of course of the users who use them. This is because these stakeholders have different relationships to the system: the purchaser is looking for management benefits derived from implementing them, the operators are seeking better workability and motivation, while consumers are mainly interested in convenience and ease-of-use.

2) Total design

To offer the optimum solution for all stakeholders (purchaser, operators, and users), we make use of total optimized design that factors in people, things, and place in a way that takes full advantage of information and communications technology (ICT) and ideal positioning—location and setup within the store.

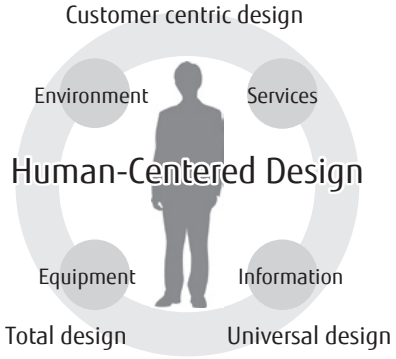


Figure 1
Human-Centered Design at Fujitsu.

3) Universal design

One way to achieve an ICT society in which the vast majority of people are able to participate is to make systems available that are obvious, intuitive, and easy to use by everyone. Furthermore, Fujitsu is driven by a sense of corporate social responsibility to provide products and services that are helpful and beneficial to society and the environment.

3. Innovative design initiatives

With increasing demand for convergence of products and services, *monozukuri*—skilled manufacture and craftsmanship—has become increasingly difficult. An HCD approach could be implemented by adopting the following three measures. This, we believe, opens the way to innovation that overcomes this *monozukuri* predicament.

1) Creating innovative products and services

Do the vast changes in the business environment and commodification of products really spell the end of the need to provide customers with the value they need? For example, retail and other businesses have witnessed tremendous diversification of consumption styles as a result of the prolonged economic downturn and penetration of the Internet, and the role expected of ICT has also changed dramatically. In these vastly changed circumstances, we must learn to think of product development outside the box and envision how ICT will look to businesses of the future. To create innovative new products and services, we must put the following knowledge creation processes into practice.

- Gain insight into potential needs from dialog with clients and observation of sites.
- Promote emergent design through exchange of collective intelligence.
- Visualize solutions and gain better understanding early in the process.
- Complete the business model through repeated testing.

2) Advanced consulting support based on simulation technology

Up to now, we have mainly relied on empirical values and individual skills in determining how to match the needs of a client's environment, arrange equipment, and deploy personnel, but our approach now is to collect data from the store site and use simulation tools for analysis to enhance our consulting skills

in starting up and developing a business. By substituting this kind of scientific judgment, we are able to implement ICT plans that give the client the greatest value for the client's investment, as well as promoting optimal decision-making.

3) Strategic design management

In product development and consulting talk, key designer skills to create and implement new value can be summarized as follows.

- Observation to discover needs
- Ideation to create value
- Facilitation to engender neutral cooperation
- Visualization to cast ideas into shape
- Evaluation to assess usefulness
- Integration to wrap up and bring to a close

In-house design work has conventionally involved a narrow concept of design creation, but now we must focus on building a wide-ranging systematic support structure that cuts across processes and organizations in order to take full advantage of design resources from upstream processes in product development and consultation.

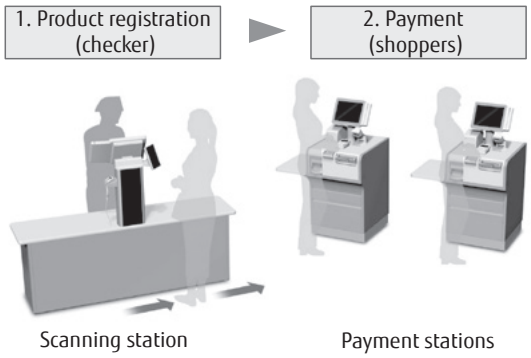


Figure 2
Self-payment POS system (product name: TeamPoS/SP).

4. Development of a self-payment POS system

We developed a self-payment POS system (hereinafter, self-payment system) designed for supermarkets and other retail stores. As illustrated in **Figure 2**, after a store employee scans an item to be purchased, the customer pays for the item at a payment station. This has three advantages: it reduces the long queues at the check-out, it lets shoppers pay without worrying about holding up the line, and it frees employees from the stress of handling cash, enabling them to focus on scanning the merchandise.

Although we did not start with the idea of developing a POS system, the design evolved on the basis of three thought processes (summarized in **Figure 3**) defining how we might create new value for supermarkets on the basis of site-driven considerations and the customer's point of view: First, through dialog and observation (abduction), we formulate an intuitive hypothesis as to what the client wants based on an onsite inspection. Then, by conceiving ideas and formulating concepts (deduction), we visualize specific solutions as we construct a prototype. And finally, through a business formation (induction) process, we define the actual business based on facts and fact checking. Using this approach, we assembled a project team and followed through with an actual supermarket deployment in 2013 based on the following process steps.

4.1 Identify what the client wants through onsite dialog

Development of the self-payment system was put on the right track through onsite dialog with the

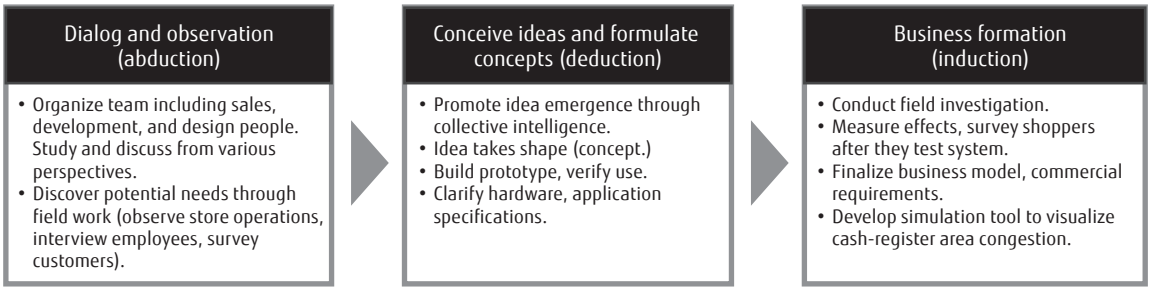


Figure 3
Process from abduction to induction.

sales department of Fujitsu. The sales staff gets feedback from the supermarket on a daily basis, they have weathered changes caused by the economic downturn and deflation affecting the store, and they are well aware of demand from management for better efficiency and profits per worker hour. We organized a forum that brought together the people from the sales department who are most familiar with conditions at the supermarket and development people for practical talks. The idea was to identify potential needs by exploring the question, "Looking ahead, what fundamental value can we offer to you, the client, and to your customers?" These talks opened up new measures for Fujitsu to consider in designing and developing POS systems that we could offer to retail businesses.

4.2 Identify needs through field work

The primary objectives of field work are to observe and interview actual users through an onsite study in order to understand "human behavior, experience, and values" and then to use those findings to uncover new needs that have not been considered. Field work for gathering first-hand information is especially important for developing systems in which service style, work flow, installation space, and other ways in which people, things, and space interact are brought together in complex ways. The key point of field work is to identify the ideal "what you want to end up with" (not "to probe current defects") and to identify the steps needed to reach the ideal situation. Developing a self-payment system involves first identifying the needs of management, employees, and shoppers. This is done by observing store operations, interviewing employees, and surveying consumers and then focusing in on those needs that are shared by all stakeholders.

4.3 Promote idea emergence through diverse collective intelligence

Ideas toward a solution begin to emerge as needs are clarified through field work. With end users and a specific deployment environment in mind, we then turn our attention to service scenarios (scenarios for creating value), ICT activities to implement those scenarios (how to use ICT resources), and interaction (how to operate). Emergence of a rich collective intelligence experience from different fields is the wellspring of knowledge creation, and that is precisely why we brought specialists in both business and development together for the development of the self-payment system. After assessing existing traffic flow patterns, we came up with a novel check-out style self-payment system that not only shortens check-out queues but also reduces the number of checkers and payment systems. It thus satisfies employees and shoppers alike. To obtain feedback from store employees and shoppers, we built a prototype self-payment system so users could visualize how the system works, the usage flow, the advantages for shoppers, and so on.

4.4 Prototype the system

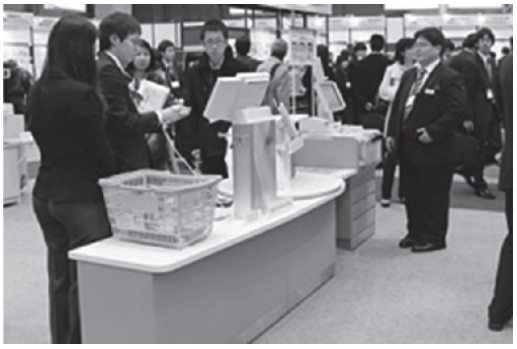
Since proving the usefulness of a groundbreaking idea is difficult, we adopted a "trail-and-error" process; that is, we took a "Let's go ahead and do it!" approach, which is a key aspect of Fujitsu's corporate DNA. We did this through prototyping: we built a prototype early on and then let representative stakeholders experience the reality of what we were proposing through first-hand interaction and experience.

After developing a prototype self-payment system, we ran it through a series of verification tests to compare it with a modified prototype of a conventional system to measure efficiency (wait time at check-out) and other variables [**Figure 4(a)**]. The tests demonstrated that a self-payment system with a single checker and a single payment station was as productive in terms of shopper throughput as a conventional system with two cash registers and two checkers. They also revealed that our proposed equipment placement and shopper flow yielded the best solution from both functional and psychological standpoints in terms of operational setup, hardware, and application specification requirements. After fine-tuning the specifications, we constructed another prototype that closely resembled the envisioned final system for demonstration to potential clients and for display at exhibitions. The feedback received from various stakeholders was used to further enhance the system [**Figure 4 (b)**].

4.5 Conduct experimental field tests

Working with a supermarket operator that was making every effort to slash store operating costs, we installed the system in one of its stores (as illustrated in **Figure 5**) for experimental testing in November 2011. We made a few additional refinements to the

(a) Verifying use in trial room



(b) Gathering feedback at an exhibition

Figure 4
Hypothesis testing through prototyping.

Figure 5
Store demonstration.

specifications on the basis of customer feedback and then proceeded with final planning for full-scale deployment by calculating the number of self-payment systems needed to fit the scale of the store, laying out traffic patterns to promote smooth check-out, and planning the signage. Next, we tested the equipment, and, after the system was fully installed, we calculated the productive efficiency from POS data and actual measurements and collected traffic pattern and error status data using fixed-point video observation. We also stopped shoppers as they exited the store and asked them to fill out a short questionnaire assessing the acceptability of the new system. Survey results showed that the operating efficiency was roughly 1.5 times better than that of the old system, and about 80% of the shoppers gave the system high marks with comments such as, "shorter wait at the cash register," "I could pay at my own pace, which was nice," and "equipment was user-friendly and very easy to operate."

After the experimental tests were completed, we identified the best features of the system for general commercialization, organized requirements, evaluated business models, and finally proceeded with full commercialization. To sum up, we successfully developed an innovative self-payment system by first envisioning what the system should be like through a process of diverse collective intelligence creation and then assessing the viability and usefulness of the new design through a process of prototyping and demonstration testing.

5. Simulation tool for business consultation

To expand sales of the self-payment system and promote business consultations, Fujitsu developed and verified a simulation tool (**Figure 6**) that enables us to assess cash-register efficiency and shopper movement before the system is implemented.[1),2)] Before this tool

was available, we estimated the number of cash registers needed on the basis of the number of transactions and the average time required. This made it practically impossible to visualize formation of queues at the supermarket because the movement of shoppers and the number of items purchased fluctuated tremendously. By using social simulation techniques and methodology to model the movement of people out in society, we are now able to visualize the movement patterns of multiple shoppers as they head toward cash registers in stores as well as the back-up and movement of people at scanning and payment stations. We can now accurately assess the effect of adding or removing a cash register on congestion.

By simply entering the variables that define conditions, Fujitsu can now offer clients advanced business consultation based on sound scientific assessments of what would be the likely result of adding or removing a cash register even before any of the hardware has been implemented.

6. Future Development

By creating an innovative new check-out style, Fujitsu's POS systems provide outstanding check-out solutions (from full-service to self-service systems) tailored to any scale or type of store that not only improve service but also provide more efficient store management. Looking to the future, we are already working on next-generation services such as those illustrated in **Figure 7** that go far beyond the check-out environment

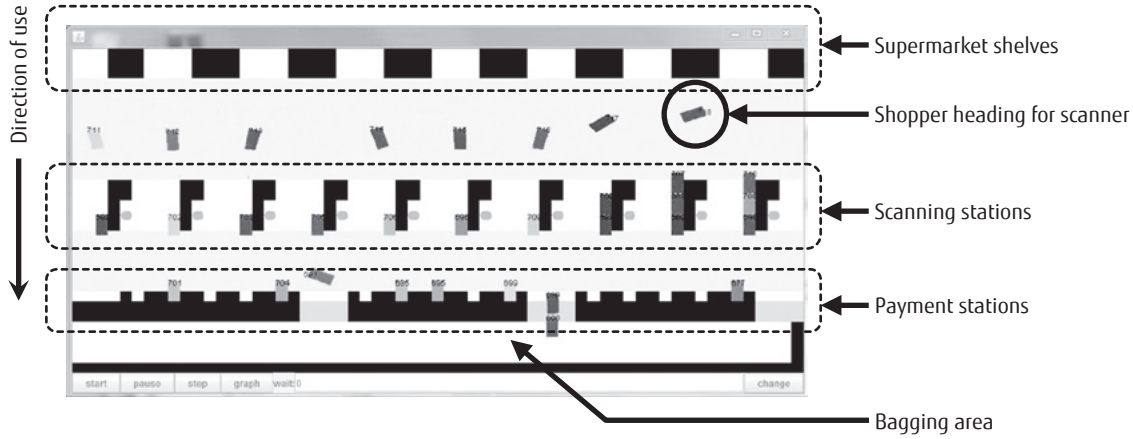


Figure 6
Simulation tool for visualizing complex situations.

Figure 7
Vision of next-generation supermarket.

to provide a total store solution that exploits ICT throughout the store. We also plan to use our simulation tool to optimize store remodels and to upgrade solutions based on collected data that will serve to enhance the community and society at large.

7. Conclusion

Amid calls for more ICT-based convergence of products and services, this paper described the importance of site-driven knowledge creation innovation design based on a human-centered approach. Even for products as commonplace as POS systems, this paper has shown that truly remarkable new services can be conceived by redirecting the perspective of management and the experience values of shoppers. In this age when ever more development efficiency is called for, this sort of trial-and-error approach may seem wasteful. Yet the slogan "Let's go ahead and do it!," which is inextricably part of Fujitsu's corporate DNA, has served us well. Indeed, the ability to take up new challenges without fear of failure is more important today than ever before for conceiving new value.

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