

# Developing a Policies and Procedures Manual for a Consumer Lending Department: A Design for Six Sigma Case Study

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**Abstract:** This case study describes how a financial institution successfully used the Design for Six Sigma (DFSS) methodology to create a policies and procedures manual to eliminate compliance gaps and improve the lending process for its bankers and customers. The Define, Measure, Analyze, Design, and Verify approach was used to define the process, identify and evaluate critical user needs against defined metrics, and develop design attributes/features used in the manual's development. The acceptance of the manual by the bankers demonstrates the effectiveness of DFSS in establishing a value-enabling element for the banking process that fully addresses the needs of its users.

**Keywords:** Design for Six Sigma, DMADV, Policies and Procedures, Consumer Lending

**EMJ Focus Areas:** Building Engineering Management Actionable Knowledge, Operations Management, Quality Management

Policies and procedures are a staple of any organization and are used by companies to indicate what its employees should or should not do as a matter of practice (Brodbeck, 2002). In this sense, policies and procedures provide instruction and guidance toward the completion of a task and help to minimize the consequences of an employee's personal limitations (McCarthy, Wright, Monk, and Watts, 1998). They also act as a guide for employees who must step into functions and roles they may not be formally trained for, such as covering for a coworker who falls sick unexpectedly. This level of internal support is only possible if appropriate instruction is provided to employees (Rathie, 1990). But more than that, policies and procedures may also support a company's strategy and help it to achieve its mission and vision (Caldwell, 2002).

In the banking industry, policies and procedures help financial institutions, such as banks, maintain a standard of excellence (Boaden and Dale, 1993). For example, without a published set of policies and procedures, financial institutions run the risk of improperly providing services to their customers, which may expose a customer to potential security issues, such as phishing attacks (Angelakopoulos and Mihiotis, 2011). Bank policies also impact customer satisfaction (Rabino, Onufrey, and Moskowitz, 2009). Good customer service is critical for customer retention, both current and new (Roberts and Campbell, 2007). In addition, policies and procedures support an employee's adherence to a bank's code of conduct, which impacts their service efforts, as well as their ethical and professional conduct at work (Canary and Jennings, 2008).

For banks and other financial institutions, policies and procedures also provide a framework for compliance and

auditing controls (Grubb and Burke, 2008). For instance, policies and procedures help a bank's consumer lending department avoid compliance violations with the U.S. federal government (Bates and Bates, 2006) and with laws and regulations passed to protect consumer interests, such as the Truth in Lending Act and the Home Ownership and Equity Protection Act (Maman, 2008). It is the responsibility of banks and their consumer lending departments to demonstrate their due diligence toward upholding federal regulations (Koker, 2006). Banks that fail to meet federal compliance standards risk fines and other penalties (Palmer, 2004).

This research specifically focuses on designing a policies and procedures manual for a regional bank. Using an action research approach (Reason and Bradbury, 2008), researchers worked closely with the consumer lending department of one regional bank in the greater Houston metropolitan area to develop a policies and procedures manual to support their operations. In the past, young, less experienced bankers within this organization were simply mentored by experienced bankers who had a thorough understanding of the consumer lending process. To help close the gap on compliance and other financial risks, the bank decided to codify its policies and procedures into a formal structure/repository. They felt this measure would help to improve the performance of new bankers and provide all bankers with a reference guide about the consumer lending process. To develop this manual, the team of researchers and employees used the Design for Six Sigma (DFSS) methodology, a structured method for design activities aimed at building quality into products/services in order to achieve Six Sigma (i.e., virtually defect/error free) performance (Schroeder, Linderman, Liedtke, and Choo, 2008; Hasenkamp, 2010). While the literature contains several examples about how DFSS has been used in services, this case study demonstrates how it can be applied to value-enabling elements within service-based operations such as a consumer lending process. This research, therefore, provides further evidence about how to address the challenges associated with translating improvement methods for use in service environments (Antony, Antony, Maneesh, and Cho, 2007).

In the next section, a review of the literature provides background information regarding development practices for policies and procedures and the DFSS approach. The methodology section then explains in further detail the DFSS process used in this case study, including accompanying tools, techniques, and outcomes. Finally, some concluding remarks are given that summarize how this research benefited the organization, the implication of this research for engineering managers, and some areas of future research.

## Background

Procedural instructions are the heart of most policies and procedures, and they explain how to complete a task by

describing the steps or methods of what needs to be accomplished (Eiriksdottir and Catrambone, 2011). This concept is similar to one proposed by Konoske (1985) who considered that procedural tasks consist of an ordered sequence of steps performed for a specific situation. Kemeny (1996) proposed that policies and procedures manuals define the standards that employees will be measured against. He later built on this by offering that policies and procedures manuals play a pivotal role in defining quality assurance and compliance requirements (Kemeny, 1999).

Previous research suggests that when developing a policies and procedures manual, one option is to first establish a style guide, and then later validate any procedures written to the guide (Bridges and Williams, 1997). Another approach is to use Pareto analysis to develop procedures for the most frequent actions taken (Setchi and White, 2003). Collaborative work has also been shown to be beneficial to the development of policies and procedures manuals. For instance, Langford (2000) found that working with managers and staff was important when developing procedures. In another study, brainstorming sessions and interviews with experts were found to be invaluable development tools (Rupert and Loudermilk, 2002). Additionally, when designing procedures, the needs of the users should also be considered (McCarthy et al., 1998). In an earlier study, this was done by interviewing users and noting their needs (Hackos, Winstead, Gill, and Hartman, 1995). While prior research demonstrates the use of some of the techniques used in the DFSS methodology, there is little to no research indicating that this approach has been used previously to develop a formal structure/repository for policies and procedures.

The DFSS approach has grown out of the Six Sigma methodology, which has been shown to be effective as a tool for reducing redundant procedures (Matson and Stauffer, 2009). As an approach to quality improvement, Six Sigma may be used to improve a process by reducing process variability and removing waste (Banuelas and Antony, 2003). However, because Six Sigma is focused on process improvement, it does not address the design of a new process/system (Tjahjono, Ball, Vitanov, Scorzafave, Nogueira, De La Calleja, Minguet, Narasimha, Rivas, Srivastava, Srivastava, and Yadav, 2010). Instead, DFSS is “an established, data-driven methodology based on analytical tools that provide users with the ability to prevent and predict defects in the design of a product, service or process” (De Feo and Bar-El, 2002, p. 62). While originally developed to aid in the design of products, more recently DFSS methods have been developed for use in service environments (Brue and Launsby, 2003; El-Haik and Roy, 2005; Yang, 2005). For example, Cudney and Furterer (2012) discuss several examples of DFSS projects in healthcare and Long, Kovach, and Ding (2011) demonstrate how this approach was successfully applied in information technology services. In addition, Six Sigma, as well as DFSS, has been used previously to improve and/or design processes within financial service operations (Lin, Sung, and Lin, 2009).

The power of DFSS lies in its ability to organize the tools included in this methodology into a strategy that allows for better success than similar approaches that lack the DFSS structure (Mader, 2002). The tools and methods used in DFSS have a strong emphasis on determining and then meeting the needs and expectations of the customer, and include customer surveys, benchmarking, and affinity diagramming (Brue and Launsby, 2003). Through DFSS principles, the needs of the users are translated into design elements (Cole, 2011). One version of DFSS involves the five-step DMADV (Define, Measure, Analyze, Design, and Verify) methodology (Franza and Chakravorty,

2007). “At the broadest level, [DMADV] means identifying and clarifying what will be worked on, deciding how it will be measured, analyzing the situation, detailing the design, and testing and deploying the new process, product, or service” (Cavanagh, Neuman, and Pande, 2005, p. 27).

The first step in the DMADV approach is to understand the customer’s requirements (Gitlow, Levine, and Popovich, 2006). The Define phase accomplishes this by establishing the goals and scope of the project and setting the roles and responsibilities of the project team (Neagu and Hoerl, 2005). One method of defining the project’s scope and objectives is through the development of a project plan (Gitlow, Levine, and Popovich, 2006). DFSS is driven by critical to quality (CTQ) characteristics, which are the issues or factors that are critical to the customer (Franza and Chakravorty, 2007). It is within the Measure phase that the needs of the customer are used to create CTQ measures that guide development of the new process (Stefanko and Peloquin, 2009). The Analyze phase focuses on developing creative approaches to address CTQs while meeting the needs of the customer (Senturk, LaComb, Neagu, and Doganaksoy, 2006). Within the Design phase, a new process is designed by converting CTQs into specific requirements, or critical to process (CTP) elements, and then by incorporating the CTPs into the new process (Johnson, Gitlow, Widener, and Popovich, 2006). The Verify phase evaluates the acceptance and effectiveness of the new process, and involves the development of a control plan to maintain improvements (Johnson et al., 2006). The case study presented in this article illustrates how DFSS helped one regional bank develop a policies and procedures manual for their consumer lending process in order to help assure high quality customer service. The specific actions undertaken by the research team at this bank using the DMADV process are discussed in detail in the following section.

## Approach

The regional bank in which this case study was performed has a strong reputation within the community as a bank that is deeply committed to customer service. Developing strong personal relationships with their clients and making the banking process easy to navigate are just a few of their leading tenants. This bank offers programs and products that range from personal banking to mortgage loans in order to serve the needs of their community. As their product and service offerings have grown, they have hired new bankers to serve their expanding customer base. As part of the bank’s on-going efforts to close compliance gaps and reduce financial risks, they wanted to formalize the policies and procedures for the consumer lending process to ensure all requirements were being met. However, they were somewhat unsure about how to go about doing this, as the majority of their employees are not formally trained in design methods. They feared that if, for example, the structure or features of the policies and procedures manual were not easy to use, the personal bankers would not use it. So, the bank performed a DFSS project to help them to develop a manual that would meet the needs of the personal bankers working in the consumer lending process. The goal of the project was to use a systematic design approach to produce something useful for the personal bankers as a way to engender their buy-in. The bank felt that if the new manual was used as a reference guide for bankers to use while doing their work, it would help to maintain the quality of their customer service and control risks for many banking processes. Hence, the overarching questions guiding this research were “what does the policies and procedures manual need to do to support the work

done within the consumer lending process?” and “how should those needs be fulfilled?”

The bank conducted this DFSS project through a participatory action research method of inquiry that involved employees and researchers working together to create the policies and procedures manual (Reason and Bradbury, 2008). This approach provided an opportunity for researchers to function as project participants through meetings with and visits to the bank. Researchers, along with employees from the consumer lending and retail banking departments, were involved in identifying the needs that the policies and procedures manual should fulfill and then designing the structure and features of the manual to address those needs following the DMADV approach. Within this framework, the action research process of planning, taking action, and evaluating the action, which leads to planning for further action, was used to ensure that what was learned from one phase of the project was then used as the input to the subsequent phase (Coughlan and Coghlan, 2002). The specific details regarding each phase of the DMADV process used in this project are described in the following sections.

### Case Study

#### Define

To better understand the requirements of this project, the design team developed a project charter and a project management plan. The project charter defined the project scope and objectives at a high level, and provided a basic understanding of the roles and responsibilities of the project team members. The goals of the project were further defined in the following problem and mission statements:

**Problem statement:** Personal bankers at this regional bank do not have a formal policies and procedures manual (i.e., structure/repository) for the consumer lending process, which has led to missed banking opportunities, financial risks, and compliance gaps.

**Mission statement:** Develop a consumer lending policies and procedures manual that personal bankers can use to improve the customer experience, thus reducing missed banking opportunities, financial risk, and compliance gaps.

The project charter was then used as the foundation for the development of a project management plan, which provided management and governance for the project throughout its lifecycle. Relative to the use of the DFSS approach, the project plan involved the following steps:

1. Map the consumer lending process using a SIPOC diagram and a service blueprint
2. Survey users (i.e., bankers) and identify their needs
3. Organize users' needs into an affinity diagram
4. Survey users to determine a priority rating for each need
5. Develop metrics that address the top-rated users' needs
6. Establish baseline measurements for each metric
7. Identify possible design features for the consumer lending policies and procedures manual through brainstorming and benchmarking
8. Organize ideas regarding design features into an affinity diagram
9. Evaluate and determine which design features to use in the consumer lending policies and procedures manual
10. Create the manual
11. Deploy the manual in the workplace
12. Evaluate how well the manual meets the needs of the users

As an initial step toward designing the policies and procedures manual for the consumer lending process, the design team first worked on understanding the process/work environment in which the manual would be used. To do this, they discussed the work that is done in the consumer lending department and began by documenting it at a high level using a SIPOC (Suppliers, Inputs, Process, Outputs, and Customers) diagram, as shown in Exhibit 1. The tasks listed in the center

**Exhibit 1.** A High Level View of the Consumer Lending Process

Suppliers	Inputs	Process*	Outputs	Customers
Call center Internet bank Banker Customer Document underwriter Direct consumer loan center	Client personal and loan information Client feedback Loan specifications Customer documentation Loan documentation Funding information	<ol style="list-style-type: none"> <li>1. Receive customer request</li> <li>2. Interview the customer</li> <li>3. Determine the loan product best suited to the customer's needs</li> <li>4. Complete and submit the loan application</li> <li>5. Resolve any stipulations and outstanding conditions to the loan</li> <li>6. Close the loan with the customer</li> <li>7. Fund the loan with the customer</li> </ol>	Loan application Loan decision Loan stipulations Outstanding loan conditions Loan closing package Loan disbursement Client relationship	Customer Banker Document underwriter External bank Seller Direct consumer loan center

\*The process steps are numbered in this diagram to indicate the consecutive order of steps in the process.

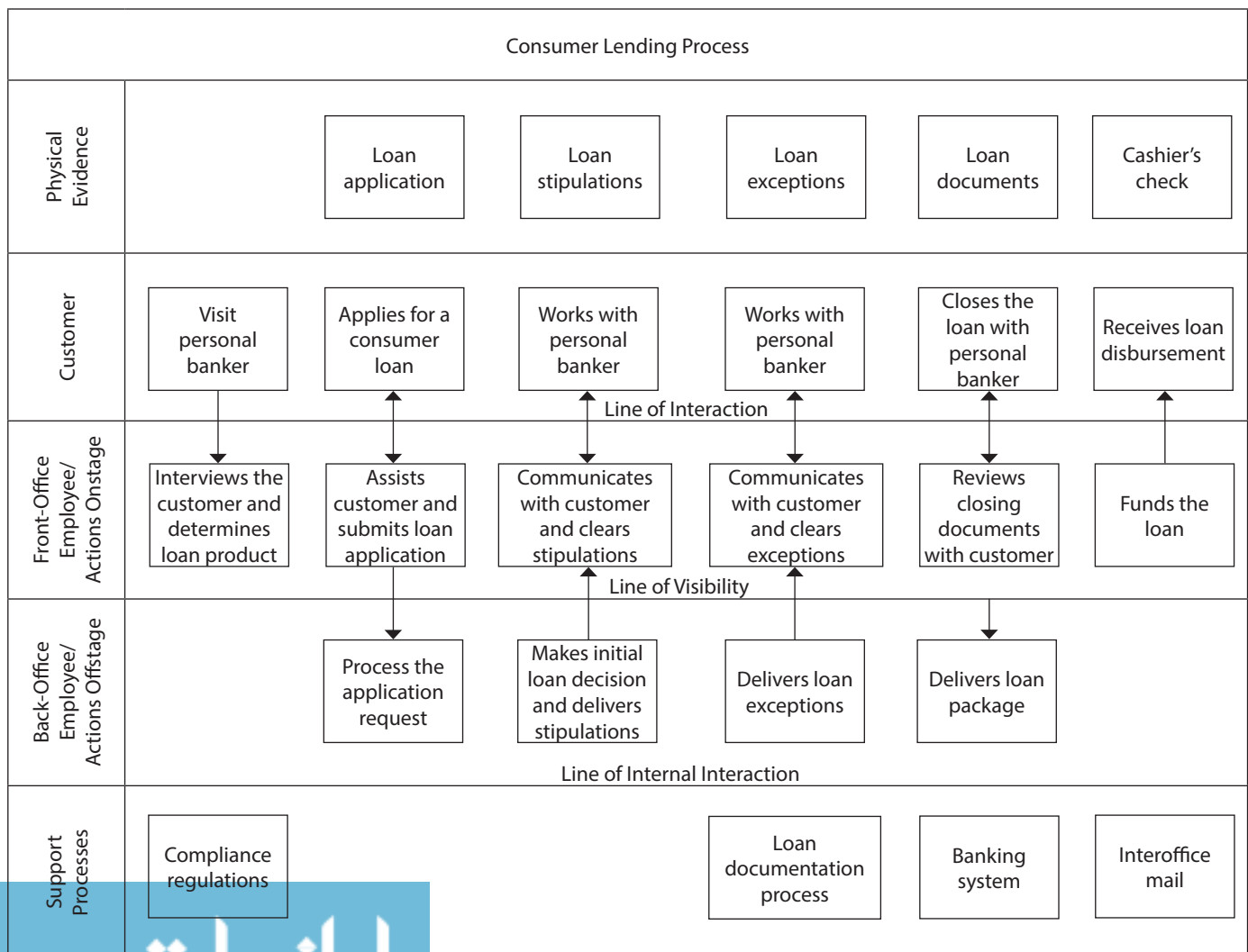
of the diagram define the high level actions that are involved in the consumer lending process. These actions rely on many internal groups and affect several external entities in the overall process, which are represented by the suppliers and customers. The consumer lending process begins when a customer visits a bank about a lending need that he or she may have. Through the course of interviewing the customer, the banker will determine a loan product that best serves the needs of the customer, and with the customer, the banker will submit the completed loan application to the direct consumer loan center. After reviewing the application, an underwriter will notify the banker of any outstanding loan stipulations. These are documents that the banker needs from the customer before the loan can be approved, such as proof of income. Once the loan application is clear of stipulations, the banker may also need to clear any outstanding loan conditions with the customer. These are documents that do not impact the loan decisions, but are needed to properly close the loan, such as an inspection of an automobile. Once all conditions are met, the banker and the customer may close the loan, which involves signing the loan documents specific to the loan closing package. Funds are then disbursed to the appropriate party.

The design team then proceeded to examine this process in more detail. To do this, they worked together to identify the step-by-step nature of the process and documented it in the form

of a service blueprint, which is a type of process flowchart that emphasizes the actions of the customer by documenting the interaction between the customer, the front-office personnel, and the back-office process elements (Bitner, Ostrom, and Morgan, 2008). However, because in this project the users of the policies and procedures manual are the bankers who work directly with the customers, the service blueprint, shown in Exhibit 2, focuses on the banker as opposed to the customer. This diagram specifically illustrates the actions taken by the bankers in the front-office as they interact with customers and back-office personnel throughout the consumer lending process.

The actions of the bankers are further defined in Exhibit 2 by the three lines shown on the service blueprint: the line of interaction, the line of visibility, and the line of internal interaction. The line of interaction represents major actions between the customer and a personal banker. These actions include such things as interviewing the customer about his or her loan needs, clearing outstanding loan stipulations, and funding the loan to the appropriate party. The line of visibility marks the boundary between those actions that the customer may see and those that are strictly performed in the back-office. For example, the loan approval is handled off-site by the direct consumer loan center. Any loan stipulations are communicated directly to the banker, not the customer. Finally, the line of internal interaction

**Exhibit 2.** The Consumer Lending Process for Bankers





represents the functions that support the consumer lending process, such as the bank's systems and the loan documentation process. By mapping the consumer lending process using a service blueprint, the design team increased their understanding of the lending process, which helped them to identify user needs in the Measure phase of the project.

### Measure

After documenting the consumer lending process, the next step in the development of the consumer lending policies and procedures manual was for the design team to identify the CTQs or needs of the users, i.e., the bankers who will use the manual. The user needs analysis process developed by Ulrich and Eppinger (2004) was used as the basis for gathering information from users and identifying the CTQs. To identify the CTQs, an open-ended survey that asked respondents to describe typical uses, advantages, disadvantages, and suggested improvements for the current lending process was sent to a representative sample of approximately 100 bankers selected at random. This sample included bankers with many years of experience, as well as those who were new to the role, including personal bankers who actively assist customers with consumer loan products, bankers who manage banking centers, and support personnel who provide bankers with solutions to their lending questions. The response rate for this survey was 62% (i.e., 62 respondents participated in the survey). For reference, Exhibit 3 shows one banker's responses to the survey questions. It is important to note that each response was further analyzed by the design team by translating it into an interpreted need statement, or CTQ. For example, this banker suggested that a quick reference guide was a nice attribute to have when working in the consumer lending process, which was interpreted as needing to make a policies and procedures manual that was easy for bankers to use and that

could help bankers find procedural references faster than the current lending process allowed.

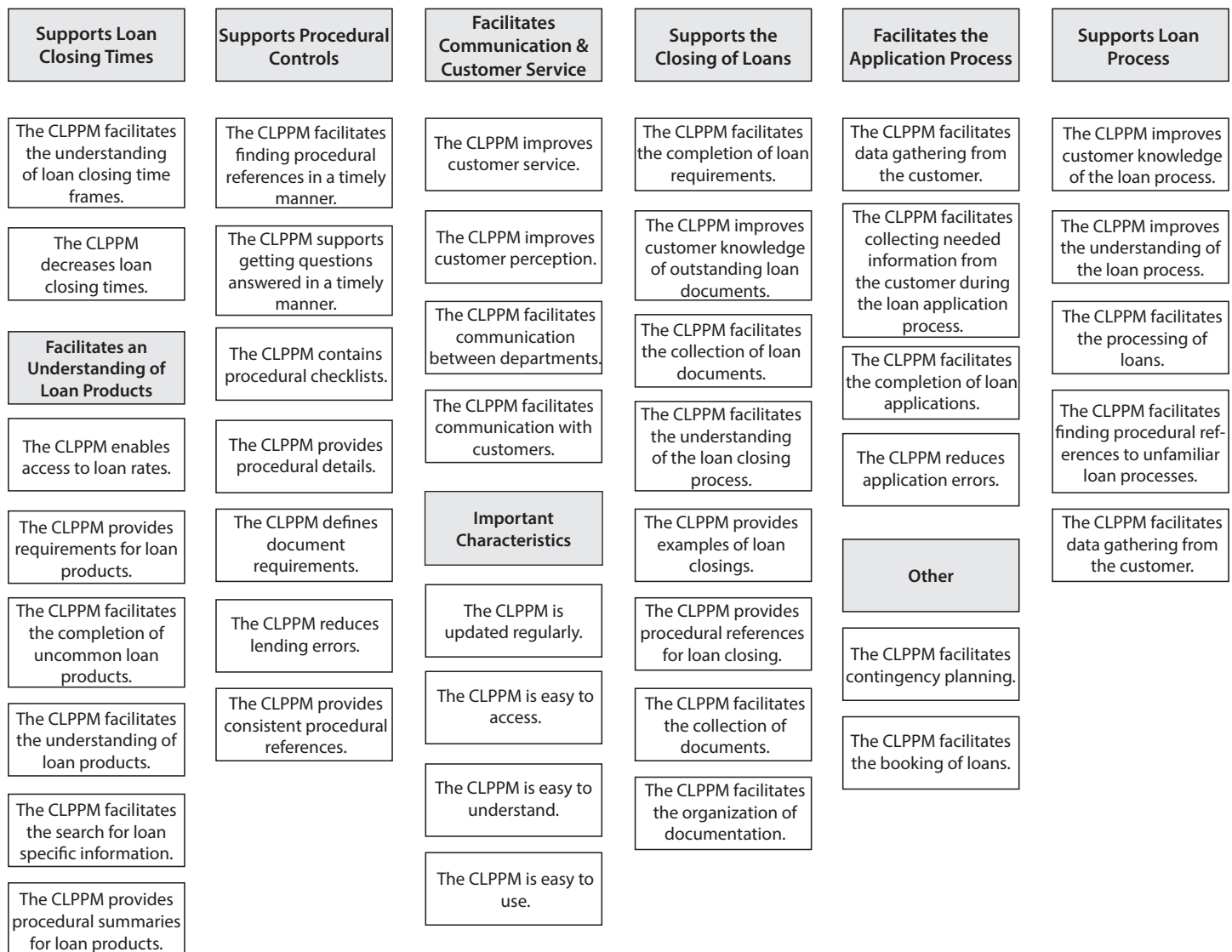
Next, the extensive list of more than 40 CTQs generated from the survey were organized into an affinity diagram, which is shown in Exhibit 4, by a group of six bankers familiar with the consumer lending process. This approach allowed the interpreted need statements to be grouped into categories, and it represents all the CTQs that were identified for the project (minus duplicates). However, trying to address all of these needs in the design of the new policies and procedures manual would have been impractical. To narrow the scope of the design project to only the most critical CTQs, the design team reflected on the needs listed in the affinity diagram and together identified 15 needs that they considered key to the design of the manual. This subset of needs from the affinity diagram was compiled by the design team into a prioritization survey, as shown in Exhibit 5. This second survey was sent to a representative sample of 150 bankers, 62 of which participated in the first user needs survey, asking them to rate these 15 CTQs on a five-point scale. Because the bankers are directly impacted by the development of a consumer lending policies and procedures manual, their feedback regarding which needs are important to the design project was critical information that the design team members felt they needed to know. CTQs receiving a score of "1" were considered undesirable as a feature; conversely CTQs receiving a score of "5" were considered critical as a feature.

The response rate for the needs prioritization survey was 69% (i.e., 103 respondents participated in this survey). After analyzing the survey responses, the design team identified six CTQs that approximately 50% of the respondents rated as "5" (i.e., critical). These top-rated users' needs are listed in Exhibit 6 and the importance of each was determined based on the median value of all survey responses. The design team used this list to guide the direction of the project moving forward.

**Exhibit 3.** Example Responses and Interpreted Needs from the User Needs Survey

Type of User:	Personal Banker	
Frequency of Use:	Frequently	
Question	Response	Interpreted need
Typical uses – i.e., what do you need a consumer lending policies and procedures manual (CLPPM) for?	It's always nice to have a quick reference guide.	The CLPPM is easy to use.
		The CLPPM facilitates finding procedural references in a timely manner.
What are the advantages of the collection of checklists currently used to document policies/procedures?	A checklist would speed up the process by making sure we get everything we need upfront.	The CLPPM decreases loan closing times.
		The CLPPM facilitates collecting needed information from the customer during the loan application process.
		The CLPPM contains procedural checklists.
What are the disadvantages of the collection of checklists currently used to document policies/procedures?	None	--
Suggested improvements?	A main number for general loan questions with loan experts would be nice.	The CLPPM supports getting questions answered in a timely manner.

**Exhibit 4.** Summary of User Needs Obtained through the Survey



**Analyze**

The next step in this project was to identify design elements or ideas that could be used to create the consumer lending policies and procedures manual. These preliminary design ideas were developed through brainstorming and benchmarking sessions held by the design team. These sessions involved members of the design team conducting interviews with individuals who have firsthand knowledge about the consumer lending process, such as personal bankers, or who are involved with policies and procedures development and maintenance, as well as business analysts who support retail banking operations. The design team selected both internal and external resources to participate in this process in order to obtain ideas from different viewpoints. Interviewees were questioned about the features needed in a policies and procedures manual to make it successful, including questions that addressed several of the top-rated users' needs such as:

- What would make a policies and procedures manual easy to use/understand?
- How could policies and procedures be made consistent?
- How could a policies and procedures manual provide understanding for loan requirements/products?

- What methods do you use (or would you use) to develop and communicate updates to policies and procedures?
- What are the advantages/disadvantages to the policies and procedures development process you currently use?

The ideas obtained from these interviews were organized into an affinity diagram by a group of five bankers familiar with the consumer lending process, as depicted in Exhibit 7. Categories within this diagram included those related to the development and maintenance of a policies and procedures manual (e.g., formatting, writing style, development process, updates, audit and review, and communications) as well as categories specific to the consumer lending process (e.g., internal content and external resources). Additionally, this group reflected on the list of ideas and together identified those elements they considered key to the design of the policies and procedures manual. These ideas are represented by the rounded boxes in Exhibit 7.

**Design**

With the selection of the key design elements completed, the design team moved on to establish a general framework for the

**Exhibit 5.** User Needs Prioritization Survey

Instructions: Please indicate how important the features of the consumer lending policies and procedures manual (CLPPM) listed below are to you, using the following scale:

1. Feature is undesirable. I would not consider a CLPPM with this feature.
2. Feature is not important, but I would not mind having it.
3. Feature would be nice to have, but is not necessary.
4. Feature is highly desirable, but I would consider a CLPPM without it.
5. Feature is critical. I would not consider a CLPPM without this feature.

Rating	Feature
	The CLPPM:
_____	1. Decreases loan closing times.
_____	2. Improves customer service.
_____	3. Contains procedural checklists.
_____	4. Provides procedural details.
_____	5. Provides consistent procedural references.
_____	6. Facilitates the completion of loan requirements.
_____	7. Provides procedural references for loan closings.
_____	8. Facilitates collecting needed information from the customer during the loan application process.
_____	9. Facilitates the completion of loan applications.
_____	10. Provides procedural references for the loan process.
_____	11. Improves the understanding of the loan process.
_____	12. Facilitates the collection of documents.
_____	13. Is easy to understand.
_____	14. Is easy to use.
_____	15. Facilitates the understanding of loan products.

**Exhibit 6.** Top-rated User Needs

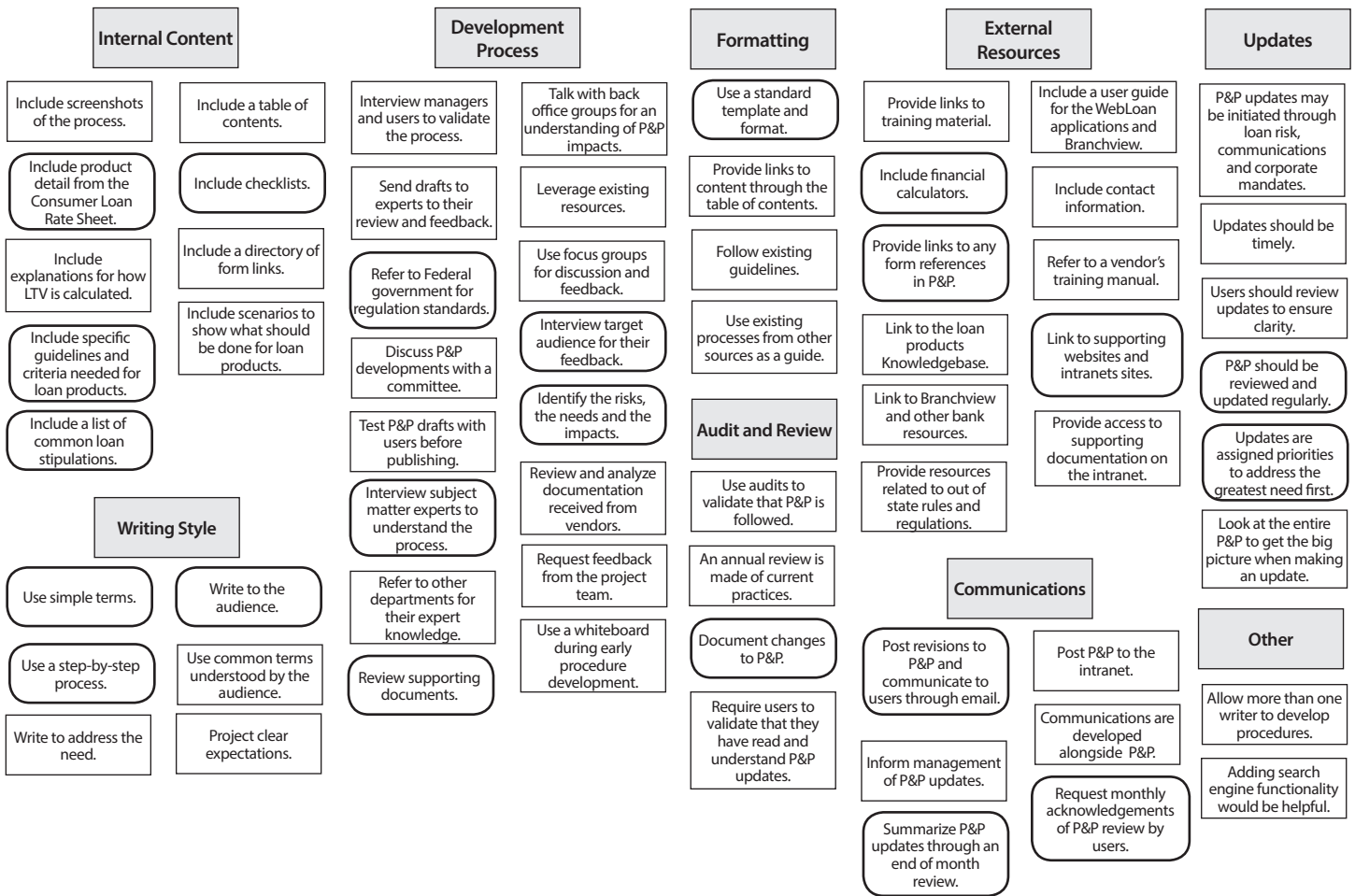
No.	Survey Item No.	User Needs (CTQs)	Importance (median survey response)
1	3	Contains procedural checklists	5
2	4	Provides procedural details	5
3	5	Provides consistent procedural references	5
4	6	Facilitates completion of loan requirements	4
5	13	Easy to understand	5
6	14	Easy to use	5

consumer lending policies and procedures manual that they envisioned creating. The structure they developed contained four elements: (1) content, (2) development, (3) communications, and (4) audits. The design team felt that content was the most important element of the manual, however, they acknowledged that content may only remain relevant and useful through the support offered by the development, communication, and audit of policies and procedures. Next, the design team developed a set of metrics, or CTPs, to ensure that each of the top-rated CTQs would be addressed by at least one element in the final design. The

five CTPs that the design team developed are shown in Exhibit 8 and included elements such as including resources to facilitate the process, system ease-of-use, and time to find information. This matrix, which is known as a needs-metrics matrix, indicates which metrics address/fulfill each need (shown by a dot in the grid).

Using the metrics defined for the project, baseline measurements of the current consumer lending process were obtained. Collecting this data was necessary to provide a value for the current state of the lending process that could be compared against the performance achieved later from using

**Exhibit 7. Design Elements for the Consumer Lending Policies and Procedures Manual**



**Exhibit 8. Metrics that Address the User Needs**

		Metrics (CTPs)				
		1	2	3	4	5
		Effectively includes resources that facilitate the loan process				
		Effectively documents the procedural process				
		System ease-of-use				
		System effectiveness				
		Time to find information				
User Needs (CTQs)						
1	The CLPPM contains procedural checklists.		•			
2	The CLPPM provides procedural details.		•	•		
3	The CLPPM provides consistent procedural references.			•		
4	The CLPPM facilitates the completion of loan requirements.			•	•	
5	The CLPPM is easy to understand.				•	
6	The CLPPM is easy to use.				•	•



the new consumer lending policies and procedures manual. The baseline measurements of the current process (i.e., where a formal policies and procedures manual is not currently available for use) are shown in Exhibit 9 (the verification measurements will be explained in the following section). The first four metrics were measured through a survey that was sent to approximately 75 bankers selected at random, which is shown in Exhibit 10. The survey asked them to rate how well the current consumer lending process met their expectations (using a five-point scale) relative to the metrics described by the items in the survey. The response rate for this survey was 40% (i.e., 30 respondents participated in the survey). The design team calculated the median value of responses for each survey item and used this as the baseline measurement for that metric/CTP. Assessing the “time to find information” CTP was completed by members of the design team observing a convenience sample of six bankers over the course of one month performing three different tasks: finding product specifications, naming the loan stipulations for a loan product, and finding document descriptions. On average, the first two tasks were completed in approximately 3 minutes and 12 minutes, respectively; however, bankers could not locate any information describing loan documents.

The bank’s internal standards dictated some aspects of the final design for the consumer lending policies and procedures manual, such as it must utilize a standard format and be accessible in .pdf format online. To select additional attributes for the final design, the design team reviewed the critical design elements depicted in the affinity diagram shown previously in Exhibit 7. They then selected those design concepts that closely aligned with the CTPs from the needs-metrics matrix depicted in

Exhibit 8. Finally, a concept selection matrix, as shown in Exhibit 11, was created to identify the attributes of the final design that best fulfilled the CTPs. In this matrix, the design team rated different attributes of the design against each of the metrics/CTPs (listed in the left-most column) using a three-point scale, where “1” represents not meeting the criteria, “2” represents fulfilling the criteria, and “3” represents exceeding the criteria. Because many of the attributes considered in this evaluation process could be used simultaneously to enhance the design of the new manual, the five highest rated design attributes were selected to be included in the final design of the manual. These attributes or features included using a table of contents, providing checklists of product requirements, elaborating on document details, listing step-by-step procedures, and providing links to other supporting content.

With the selection of the design elements completed, the design team concentrated on developing the new consumer lending policies and procedures manual over a three-week period. To develop the manual, the design team acquired a copy of the lending procedures used by an affiliate bank, and then had a team of experienced users review and then update the process steps according to the established internal best practices and the design attributes/features identified through this project. Concurrently with these actions, the design team also worked with back-office personnel to obtain explanations of loan documents and checklists that detail the requirements needed for loan products. After validating the content, building a table of contents, and receiving management approval, the design team posted the final consumer lending policies and procedures manual to the internal policies and procedures directory at the bank, and communicated

**Exhibit 9.** Baseline and Verification Measurements

Metric No.	Need Nos.	Metric (CTP)	Units	Baseline Measurement		Verification Measurement	
				Median Survey Response/ Average Task Time	Range	Median Survey Response/ Average Task Time	Range
1	1,2	Effectively includes resources that facilitate the loan process	5 pt. scale	2*	1-3*	4***	4-5***
2a	2,3,4	Effectively documents the consumer loan process in terms of providing detailed and consistent procedures	5 pt. scale	1*	1-3*	5***	4-5***
2b	2,3,4	Effectively documents the consumer loan process in terms of facilitating the completion of loan requirements	5 pt. scale	2*	1-3*	4***	3-5***
3	5,6	System ease-of-use	5 pt. scale	2*	1-3*	4***	4-5***
4	4,6	System effectiveness	5 pt. scale	3*	1-4*	4***	3-5***
5a	6	Time to find information: Finding product specifications	Minutes	3**	1.5-5**	2**	0.5-3**
5b	6	Time to find information: Naming the loan stipulations for a loan product	Minutes	12**	8-17**	3**	1.5-4**
5c	6	Time to find information: Finding document descriptions	Minutes	--	--	3**	2-4.5**

\* n = 30

\*\* n = 6

\*\*\* n = 28

**Exhibit 10.** Baseline Measurement Survey (Current Process)

Instructions: Please use the following scale to indicate how well the CURRENT methods used within the consumer lending process meet expectations relative to fulfilling the requirements listed below.

The CURRENT methods used within the consumer lending process:

1. Fall well short of expectations for this requirement.
2. Fall short of expectations for this requirement.
3. Meet expectations for this requirement.
4. Exceed expectations for this requirement.
5. Greatly exceed expectations for this requirement.

Rating

Requirement

\_\_\_\_\_

1. Effectively includes resources that facilitate the loan process (such as checklists)

\_\_\_\_\_

2. Effectively documents the consumer lending process (in terms of):

a. Providing detailed and consistent procedures

\_\_\_\_\_

b. Facilitating the completion of loan requirements

\_\_\_\_\_

3. System ease of use (in terms of how well the current methods are understood)

\_\_\_\_\_

4. System effectiveness (in terms of how well the current methods help with the completion of loan requirements)

**Exhibit 11.** Matrix for Selecting Design Attributes/Features to Use in the New Manual

Selection Criteria	Design Concept (Scale: 1 = Will not meet criteria; 2 = Will fulfill criteria; 3 = Will exceed expectations for criteria)							
	Table of Contents	Financial Tools	Screen-shots	Checklists	Document Details	Scenarios	Step-by-Step Process	Links to Supporting Content
1. Effectively facilitates the loan process	2	1	1	2	2	2	1	2
2. Effectively documents detailed and consistent procedures	1	1	2	3	2	1	3	1
3. Effectively facilitates the completion of loan requirements	2	2	1	3	3	1	3	2
4. System ease-of-use	3	1	2	2	3	2	3	2
5. System effectiveness	2	2	2	3	2	1	3	2
6. Time to find information	3	1	1	2	1	1	3	2
<b>Total</b>	<b>13</b>	<b>8</b>	<b>9</b>	<b>15</b>	<b>13</b>	<b>8</b>	<b>16</b>	<b>11</b>

the availability of the new manual to the bankers through the bank's daily announcements email. The design team included within the communication a certification form for the bankers to sign to attest that they had reviewed the new manual.

### *Verify*

After the consumer lending policies and procedures manual had been in use at the bank for approximately one month, data was collected to determine the effectiveness of the new manual. Measurements were obtained using the survey and task timing techniques discussed previously for setting the baseline measurements. The survey, however, was updated to ask respondents about the new manual (as opposed to the prior process before the manual was deployed at the bank). The survey was sent to the same 30 bankers who participated in the survey used to establish the baseline measurements. The response rate for the verification survey was 93% (i.e., 28 respondents participated in the survey). Again, the design team calculated the median value of responses for each survey item and used this as the verification measurement for that metric/CTP. The same six bankers who participated in the baseline measurement were also observed using the manual by members of the design team and were timed against the same situations that were evaluated for the baseline measurements. Exhibit 9 shown previously contains the results of all the verification measurements.

A comparison of the baseline measurements to the verification measurements indicates an improvement for each metric based on the median and/or average performance. The ranges calculated for the baseline and verification measurements for each metric, which are included in Exhibit 9, provides further information that suggests the largest degree of improvement was achieved for the metrics that involve resources (metric 1), detailed procedures (metric 2a), ease-of-use (metric 3), and finding loan stipulations (metric 5b). It is also important to note that finding document descriptions (metric 5c) was not possible prior to the implementation of the policies and procedures manual. However, using the manual developed through this project, this information can be obtained in 3 minutes, on average. This comparative analysis provides evidence that this manual successfully fulfilled the needs/metrics for which it was designed. In addition, the training department at the bank was provided with a copy of the manual so that the information it contains could be integrated into the existing training material for employees. As part of the new hire process, bankers will undergo training that focuses on the consumer lending policies and procedures manual. This will help the bankers to better address their customers' needs and to help them maintain a quality standard with the consumer loans they process.

### **Conclusions and Implications for Engineering Managers**

This research demonstrated the use of DFSS through an action research project in a banking operation. Following this approach for services (El-Haik and Roy, 2005; Yang, 2005), the design team was able to identify and prioritize the needs of personal bankers working in the consumer lending process relative to what a policies and procedures manual should do for them in order to support the work that they do. Given this information, the design team was able to relate needs to specific design metrics, which helped them to structure and include useful attributes/features in the manual that explicitly addressed the banker's needs, as opposed to developing something based on what the design team thought would be appropriate. The comparative analysis of

verification and baseline measurements for this project suggests that the project was successful because the new manual fulfilled the needs of the work environment for which it was designed. The successful adoption and use of the new manual at this regional bank specifically aids in closing the gap on compliance and financial risks that the bank was once exposed to. By providing bankers with instructions/guidelines to follow, the manual also facilitates improving customer satisfaction and building new customer relationships.

From an engineering management perspective, there are several implications that can be drawn from this work. First, managers involved in engineering design and/or process improvement functions within service related organizations can use this case study as evidence of the positive outcomes that can be achieved from using DFSS in service operations. As it is often difficult to translate methods that were originally developed for production environments for use in service operations (Antony et al., 2007), this case serves as an example of how to use DFSS to develop value-enabling elements within service processes. This case specifically demonstrated the importance of involving those who do the work in developing the design of a new product/process. The approach used in this research included the bankers and other stakeholders in the design process through multiple surveys and brainstorming sessions. While involving users in the design process and using these types of tools to do so are not revolutionary, the simplicity of the approach used is important to note. This case study identified the what's (i.e., what does the policies and procedures manual need to do?) and the how's (i.e., how should those needs be fulfilled?) that are typical for a design project without using complex design methods like quality function deployment (Akao, 1994) or the theory of inventive problem solving, which is also known as TRIZ (Hua, Yang, Coulibaly, and Zhang, 2006); yet, the design project resulted in the implementation of a manual that would be useful for its users, the bankers. This research, therefore, may help to facilitate a shift in thinking and encourage more managers in service industries to provide the support necessary within their organizations for these types of design projects, and it may support more planned attempts to continuously improve processes, which Huehn-Brown and Murray (2010) suggest is currently needed in industry.

This case study also helps address the challenge of developing engineering/design teams in financial services (Schell, 2008). The action research approach (Reason and Bradbury, 2008) used in this project paired researchers who knew the DFSS methodology well with employees at the bank who worked closely with the consumer lending process. This approach helped to overcome the fact that many employees at the bank are not formally trained in design methods, and it demonstrates that design tools can be used successfully by many given the right coaching and mentoring. This research specifically provides examples of how traditional design tools often need to be adapted to fit the context of service environments, as discussed in previous research (Antony et al., 2007). For instance, when investigating the process in detail, the design team selected to use a service blueprint instead of a basic flowchart or process map. In addition, the design ideas developed by the team related to the attributes/features of the new policies and procedures manual as opposed to developing various "design concepts" to choose from. As a result of using the action research approach to learn throughout the design process, the design team worked together to create a policies and procedures manual that will help support the bank's operations as they continue to grow their business.

While this research demonstrated positive impacts from the successful use of DFSS in a regional bank, further research may be needed to extend the use of this methodology to other larger or more diverse financial services. Furthermore, the underlying theory of design processes, like DFSS, should be investigated to develop a better understanding of what factors have a significant impact on the success of design projects, especially for service applications. This research provides some evidence that confirms the use of a structured design approach and the involvement of the users in the design process are important to the success of design projects in service environments. This case study also suggests that the ability to simplify and adapt traditional design approaches as needed to fit the needs of a service context are important factors to consider.

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