dA Quality-Engineered System Design for a Professional Certification Program

ESI4234 Semester Group Project

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Assignment ID:	u15p1
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Introduction

Management has instructed our team to construct and create a professional certification program that will appeal as a benefit to employers, help applicants to learn new information and hold credibility on a global level. We are using the DMAIC data driven cycle to design an efficient process that can remain in control and prove reliable.

Reliability is standard defined by a global market. Our credibility and customer satisfaction is built off of an understanding of what the customer wants, and adhering to NCCA guidlines to be in line with societal standards. The launch period for this program is 2018, giving the group ample time to run six sigma analytics on loop until maximum quality is prepared.

Predicting failures of our certification program was a key step in filling potential quality holes. 11 failure modes were created in order to keep possible mishap situations under control. The purpose of the FMEA is also to prioritize the potential failures by their severity. In doing this we can create an order for which we can address each hypothetical issue before our product is released.

In this project, unlike many, we are blessed with a blank check. Quality will not have to be compromised for the sake of cost. With this being true we can focus our efforts solely on aligning our certification process with exactly what the customer(s) wants. Regardless of this fact, it is not like unlimited money means unlimited quality. It will be on us to design the program using the quality analysis tools we are equipped with.

The work we provide in this project is a synthesis of others who have analyzed components of the field we are looking to master. literary reviews are provided as a preface. Our analysis consists of a define, measure, analyze, improv and control phase. Each of these is used to break down the six major steps. We will draw conclusions by finding patterns among all the aforementioned sections. It is our hope to reach a certification program that maximizes synchronicity with the customers needs that will be designed to improve itself with time. It is imperative that we adhere to guidelines agreed upon by all parties involved throughout our project.

Literature Review

Through creating a new and improved certification program you begin to wonder the "why" of certification itself. Why does it exist? Why do professionals seek it? What constitutes an effective program? To help us with these questions, we analyzed to professional articles in hope to find direction to these questions. The first one was written by John T. Phillips, CRM, CDIA, FAI, who is a senior consultant at information technology decisions. Over the past 25 years, he has worked as a management consultant, data systems project manager, computer research associate, librarian, and records manager. The article is called "Professional Certification: Does it Matter?" and its purpose is to examine professional certification in records management and explain why and how to pursue professional certification. The next article was written by Leonard L. Tripp, a Technical Fellow at the Boeing Co., where he is involved in software engineering processes, standards, and certification. Tripp, the 1999 IEEE Computer Society president, is the chair of the Society's Professional Practices Committee. The intent of his article, "Benefits of Certification", is to describe how certification positively impacts professionals, businesses, and society. He also predicts the increase demand of these programs in the near future. This review will also be touching the ISO 17024 standard updates as well as the certification cut score.

Certification Background

In its simplest essence, quality certification programs provide a benefit to all parties involved. A professional's gain could be a differentiator amongst his/her competitors, business become more accredited and could avoid budget cuts in bad economic times, but most importantly it improves the quality of life to all of society by continuously improving the standards to which we hold ourselves to. As our technology improves, so will our standards. "Software intensive systems are increasing the expectations of quality" (Tripp). As we increase the effectiveness of our technology, we should do the same with ourselves. In today's day and age what is taught in school will change throughout a professional's career much more frequently than ever before. Certification programs allow for us to keep up by raising the benchmark in the processes and products we are involved in. According to Tripp "Certification is a means for improving the discipline by promoting the practical implementation of standards, the awareness of a body of knowledge, the recognition of a code of ethics, and the need for professional development." This is becoming more and more prevalent in engineering and quality fields. Phillips points out that law and medicine have always required a graduate education mainly because a lack of knowledge in these fields could be catastrophic.

A quality engineering field that has always needed certification has been government positions. As this standards and certification programs are more recognized by the public, they will continue to be demanded. However, there are arguments of the need of certification on both sides. First, some managers believe that it adds value but is not absolutely necessary and others believe that without testing/certification it is difficult to establish professional expertise. The question then becomes, why do professionals seek it?

The competitive aspect we've created by perceiving a bachelor's degree as common causes for a new differentiator to be involved. Certification is a straightforward way to "illustrate

your level of skill, experience, and understanding in a way that sets you apart from hundreds of other candidates" (Phillips). Although it is a way to differentiate yourself, we as good industrial engineers always have to evaluate if an action is worth it. Benefits can include income raise as well as credibility, but is a particular certification program truly benefitting you? Phillips recommends some things to evaluate before pursuing a program and that include the overall role of the certification, what it professionally adds to the individual, and how it is perceived in the desired workplace. As stated previously, if the material has been changed from the time you were taught it while in school, then it will be necessary to go through that subject's certification process. Phillip's article challenges the individual by having them evaluate every aspect if a certification matters. Some things to consider as a professional could be what varieties of certification are available, can the certification evaluate various levels of skill, and looking if there is a major difference between professional certification, receiving a certificate, and credit-bearing academic courses.

While creating our certification program we must be wary of these factors and ensure to the professional that it will be a true benefit to themselves, their business, and society. What ultimately will drive the decision of a professional is if there is a quantifiable personal value of a certification that measures the immediate relationship between the certification and job responsibilities.

It may be self-explanatory that if the certification program is not effective, then all contents above are null. When creating our program, we should analyze market demands as well as project charter requirements, but we cannot forget the essence of this certification that is to make it credible. Due to the increase in technologies and online education, we will continue to see the customer demand (the business) of certification programs. Trip talks about how this thriving market will make it realistic for professionals to be certified and recertified as professional standards continue to change. Many certifications have been created but they vary largely on content. Bodies have been created to validate, such as the Certified Records Manager.

Team Strategy

Our certification program needs to meet the 21 standards in the NCCA (2007) accreditation model. Current globalization has called upon another standard, ISO 17024. According to ISO's website, which stands for International Organization for Standardization, this new conformity assessment "provides a global benchmark for personnel certification programs to ensure that they operate in a consistent, comparable and reliable manner worldwide, thereby allowing individuals to have skills that translate across national lines". The update will help businesses by certifying individuals in a vast amount of professions to protect the integrity and validity of certification programs. Our certification program will undoubtedly follow these standards as part of our goals in the project charter includes a global roll-out that includes full cultural and regulatory diversity. As far as the reliability of the actual test we will implement the cut score. A straight linear line is not appropriate. We want to a steep curve as shown in the process capability graphs in our readings. The steepness of the curve directly correlates with the difficulty of the question.

In designing the systems within our program we will also use the Six Sigma approach as well as the criteria for the Malcom Balridge National Quality Award (MBNCA) as a guideline

for how we should design the system to ensure long term quality. Using the criteria as a reference helped the team to make decisions and plan for prevention rather than waiting to act once a problem arises. This strategy can be be seen in the designs of the overall program as well as within the details and plans within the detailed PMAPS below. This strategy helped the team to make decisions throughout the planning of this process. In addition when the team went back and added or removed processes they were usually caused by rethinking once there was more research done about the award.

Methodology

Define Phase

The goal of the define phase is to first identify our problem we plan to solve, then work towards discovering a solution that will help to it. In this study our problem is the absence of a well-rounded certification program, to solve this we will create a high level program that aligns with the requirements of the project charter. It is important to first identify our customer, which will be the employers, and it is our goal to meet their needs as well as keeping the process up to not only their standards but the global standards to stay competitive.

Our first step in the define phase involved the individual work of each group member. Based on personal research, each member created a Suppliers, Inputs, Process, Outputs and Customer chart (SIPOC) along with a Process Map (PMAP). These charts helped the members to get an idea of the overall process and necessities for the certification. The SIPOC helps to discover all of the inputs that will be needed for each stage in the process, in addition to finding the requirements to meet the needs of the customer at the end of the process. The PMAP outlines the general process steps of how we plan to create the certification, this also tells us what each step requires as well as what each step adds to the process.

Once each member had created their own version of each chart we began to combine the work together. Each individual research helped to get nine different perspectives on the process, this helped to build a comprehensive PMAP and SIPOC that identify all of the requirements, as well as varying opinions on how exactly the program should run. Once we had agreed on what steps would be in the final charts we constructed a single version of the PMAP and SIPOC, which served as a high level charts. The PMAP we knew would encounter changes as we developed further research in addition to our next step in creating the detailed PMAP. Once we had created the final SIPOC and PMAP our group had a much better idea of how we planned to create our certification program.

Measure Phase

The measure phase focused on the each individual step in our process, here we immersed ourselves in each part of the process. This was necessary to be able to identify areas of potential failure which could be missed by the high level PMAP. Each member chose one step to research and create a new detailed process map, the detailed PMAP provided more in depth information

not shown by the high level. From this step our group members could return to the high level map and make adjustments that better suited for our customer. By this continued improvement we indirectly created a control layer, one that is compatible to change and continuous improvement.

In addition to the detailed MAP, each individual create an initial Sigma Score and a potential Failure Mode Effects Analysis (FMEA) sheet. The sigma score helped to identify requirements in more standard terms, it also helped to organize our data into a measurable form, and secondly we also began to establish our own goals for the product of the process. The FMEA analysis works to identify all possible failures in the design. It also explores the consequence of the failure, then prioritizes each failure by the severity of the consequence. Our goal at this stage was to first identify all the potential for failure and then correct it in the design phase so it does not still remain a problem by the time our program begins. Although we continue to use the FMEA into the process but rather as a control.

Analyze Phase

To analyze how well our certification met the customer needs we completed a Design of Experiment analysis by using a conjoint study that incorporated, what our team felt was, the three factors that were most important to the customer's needs. The conjoint study helped to give an idea of what relationship each factor has with its given levels. This ensures that each of the customer's most important needs will be met in our design. The three factors we chose to be most important to customer needs are:

Security

> For the certification to be well respected and effective all customers must have trust in the program. This trust is necessary as the all applicants will have to offer personal information, and all employers must be able to trust the validity of the exam results. Good security protocol will encourage new candidates to apply and hopefully become certified.

Recognition

> The main motivator for new candidates to apply to the certification program will be recognition within the industry. If employers within the industry hold certification from our program a major plus in their hiring process more possible candidates will seek to complete the program. This is as simple as supply and demand. Customers need there to be at least some recognition in the industry, which must be designed into the program through the BoK. If the BoK is comprehensive in regards to industry needs those people who become certified will be noticed in the workplace and recognition will continue to build with time.

Retention Rates

In order to maintain a relevant certification process that employers recognize there must be a steady stream of new applicants, but there also must be a good rate of certified individuals who renew their certification. This, in turn, will reinforce to possible new applicants the relevancy of our certification program. A high retention rate shows that the body of knowledge covered in our certification exam is comprehensive and relevant in work settings and is a valuable asset to have as an employee. We hypothesize that retention rates will be most affected by the content covered in the exam, as this is what will determine the certifications relevancy.

Our conjoint study and analysis of its results are posted below.

Conjoint Study:

	Value	Security	Recognition	Retention rate
Option 1	**1**	**High Security**	**High recognition**	**High retention**
Option 2	**-1(ab)**	**High Security**	**High recognition**	**Low retention**
Option 3	**-1(ac)**	**High Security**	**Low recognition**	**High retention**
Option 4	**1(a)**	**High Security**	**Low recognition**	**Low retention**
Option 5	**-1(bc)**	**Low Security**	**High recognition**	**High retention**
Option 6	**1(b)**	**Low Security**	**High recognition**	**Low retention**
Option 7	**1(c)**	**Low Security**	**Low recognition**	**High retention**
Option 8	**-1**	**Low security**	**Low recognition**	**Low retention**

Design Matrix

Option	Style	Difficulty	Coverage	Factors 1 & 2	Factors 2 & 3	Factors 1 & 3	All 3 Factors	Security	Recognition	Retention Rates
1	1	1	1	1	1	1	1	High Security	High Recognition	High Retention
2	1	1	-1	1	-1	-1	-1	High Security	High Recognition	Low Retention
3	1	-1	1	-1	1	-1	-1	High Security	Low Recognition	High Retention
4	1	-1	-1	-1	-1	1	1	High Security	Low Recognition	Low Retention
5	-1	1	1	-1	-1	1	-1	Low Security	High Recognition	High Retention
6	-1	1	-1	-1	1	-1	1	Low Security	High Recognition	Low Retention
7	-1	-1	1	1	-1	-1	1	Low Security	Low Recognition	High Retention
8	-1	-1	-1	1	1	1	-1	Low Security	Low Recognition	Low Retention

Security

High Security — High stress of ID verification of test takers. High prevention of test materials being released prior to exam.

Low Security — Low stress of ID verification of test takers. Low prevention of of test materials being released prior to exam.

Recognition

High Recognition — Companies acknowledge the certification as important. The process tends to provide an edge over the competition.

- Over half of companies require the certification

Low Recognition — The certification process is not recognized by industries and does not create any competitive advantage.

- Employees with certification average a higher salary

Retention Rates

High Retention — Certification is useful in the real world by creating a competitive edge for job applicants and well recognized by employers.

- Over 75% of certified employees update certification

Low Retention — Certification is not valued highly. Both applicants and employees put little value into the certification.

- Under 50% of certified employees do not update certification

Notable Outcomes:

After surveying hundreds of industry experts on these options, we found the results for what the most important outcomes from the relationship table above would be.

Best Outcomes:

Option 1: The best option we can possibly have is a high level for each of the three factors. Customers expect the program to be secure, recognized in industry, and a reason to apply for recertification. This is the optimal outcome.

Option 3: Our team decided that the third option was the next-best option. In this case, the process still has high security and retention rates but not recognition from the industry. This must mean that even though the industry is not recognizing the certification as much as we would like there is still an underlying reason for recertification.

Worst Outcomes:

Option 8: The absolute least favorable option is the last option which produces low security, low recognition and low retention rates. This is a failure of each of the three factors we decided to be most important to potential customers.

Option 6: The next-to-worst option from the table above is option six. In this case we again have low security and low retention rates; however, there is high recognition in the industry. This seems like a very unlikely option as retention rates would probably be high if there is recognition in the industry, but could be possible given unforeseen circumstances.

Improve Phase

For the Improve Phase, each team member was given a specific step to improve on, specifically in the FMEA and PMAPs. After each individual member made updates, it was discussed among the group to decide if the changes made by individual members were necessary. After all the improvements had been consolidated, the team chose ten of the most prominent failure modes between the different high-level processes and created a FMEA for them to highlight their importance. The detailed PMAPs for each process were also updated to reflect changes made.

In this phase, each member of the team took time to make edits along the whole document. Write-ups not present before were added as well as minor formatting of different sections to make a more fluid document.

Process Step	Detailed Process Step	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN	Actions Recommended
Define Program	Define Expert Criteria	Criteria too specific or too broad	Too many or too few experts are interested/qualified	10	Industry needs are extensive or narrow	3	Expert panel criteria	9	270	Alter criteria or hire established professionals
Define Program	Define program goals	Goals don't meet customer needs	Certification program not relevant to industry	9	Goals do not focus on content	3	Expert panel criteria	10	270	Expert Examination
Establish Infrastructure	Create a Certification Board	Lack of Interest	No applicants, No global Preference	7	Unorganizaed, failure to meet need	4	Establish Need	7	196	Continous Meetins with Industry
Hire and Maintain Faculty and Staff	Create Employee Application	Does not mention some employee requirements or too many requirements	Unqualified employee/Less applicants	10	Poor written application	4	Has to be approved by board writters	7	280	Restart application process
Hire and Maintain Faculty and Staff	Establish Roles	Unclear role explanation	Employee does not have experience	8	Poor written explanation	4	Have to be selected by the executive board to be an interviewer	7	224	Have a list of potential subject of questions as well as a clear rubric
Build Exam	Write Exam	Exam questions leaked. The exam questions are poorly written and are worded in ways that are diffiult to comprehend.	Loss of credibility, invalid exam, candidates achieve a lower score than expected	9	Lack of security, unqualified writers that were not chosen through the screening process	3	Approval through certification board	8	216	Exam questions are carefully reviewed and compared to a standard by secondary comprehensive panel
Build Exam	Standardize Test	Different forms of the exam. Exam questions are too specifc and bias	Unbiased scores, lack of credibility, exam not standardized/too complex for even the average candidate	7	Miscommunication by creators, bias from panel of eperts, disagreement in panel of experts	4	One group of exam writers	7	196	Create a pool of questions and the difficulty of questions always add to the same difficulty level
Administer Exam	Analyze Exams	Scoring Committee has bias/poor statistical analysis of exam scores	All exam scores in question/Unclear and inaccurate exam results	8	Poorly selected committee/Misuse of statistical	5	Exams are score by a group a group rather than 1 person	7	280	Exams scored by a blind group and hire statisticians
Maintain Re-certification	Contact certified applicants	Cannot reach certified applicants	Decrease of retention and business	6	Unresponsive candidate/incorrect contact info	6	None	7	252	Ensure candidate info is correct by asking for confirmation of info/as well as incentivizing through discount for recertification
Maintain Re-certification	Coduct Review	Unresponsive candidates/Survey bias	Loss of information/limited feedback	6	Time of day contacted/poorly written survey	6	None	6	216	Reach out to candidates and ask them what time is best to be contacted. Check for potenrial bias in survey

All other improvements made during the improvement phase have been reflected within the Results section. These changes include editing, formatting, addition and subtraction of text, and updates to any detailed PMAP and FMEAs.

Control Phase

The control phase is directly created to apply six sigma control tools and convert quantitative or nonquantitative data into data that can be tracked, managed, and improved. Each process step shows control charts for one detailed step. The control charts show before-and-after a recommended change has been implemented. The continuous improvement mindset was grasped from the steps' FMEAS and potential improvements. The continuous improvement sections under each process step also highlight analyzed data that emphasizes why we need to make certain improvements and how specifically to target the source of the failures. The higher the severity and RPN failure modes the detailed steps had, the more likely the team would create charts to evaluate the current production and improved production of the system. Ultimately, to have a well rounded certification program we need to ensure that the cyclical style of quality is implemented, and these control charts allow us to do just that.

In addition to specific changes in the control phase, many notable additions were made to the introduction and conclusion to increase the validity of important highlights that were added throughout our report, given the length of the document.

Results

The goal of the results section is to illustrate all of the inputs, outputs and requirements in each of our high- level process. In our process maps we break down the components into greater detail than what is shown in the SIPOC. Our SIPOC focuses on the higher level thinking with meeting the requirements of inputs and outputs for customer needs. Not each process will be pertinent to each need of the customer but we believe they are required to deliver the overall quality to our customer.

Shown below is our high level MAP, we have grouped it into six major processes. Below each box are inputs necessary to maintain the process step. The outputs are listed below and represent the products or steps resulting for the process. Each of the main six processes is broken down into a detailed PMAP which deals with in depth details not incorporated in the high level PMAP.

Sipoc and Pmap:

Supplier	Input	Requirements	Process	Output	Requirements	Customer
Employers	Feedback	Constructive	Certification Program	Updated Requirements	Relevant	Professional
		Progressive			Valid	
	Job Requirements	Cooperative		Certification	Pass Testing	
		Productive		Recertification	Pass Testing	
		Competitive			On-Time	
Candidates	Application	Professional		Exam Feedback	Constructive	Certification Board
		Valid		Employer Feedback	Impactful	
		Fulfills Requiremnts			Valid	
	Feedback	Helpful		Updated Knowledge	Validated	
	Admission	Affordable			Relevant	
	Recertification Application	Completed on Time		Certification Notifications	On-Time	
	Expertise	Relevant		Certification	Recognized	
		Credible		Certified Professionals	Qualified	
	Feedback	Comprehensive				
Volunteer Experts	Time	Dedication		Proctor	Qualified	Employers
	Update Process	Up to date			Discrete	
					Unbiased	
	Website Design	Informational		Website	Easy to Access	
		Professional			Appealing	
	Coding for Online Modules	User Friendly			Functional	
Certification Board	Rules	Applicable		Updated Information and Knowledge	Valid	Candidates
	Expectations	Employer Demands		Standard / Expectation	Meets demands	Certification Board
		Language and Cultural Accommodations			Maintained	
	Body of Knowledge	Research		Inferences on How to Improve process	Exam Result Statistics	

Fig. ____ : SIPOC

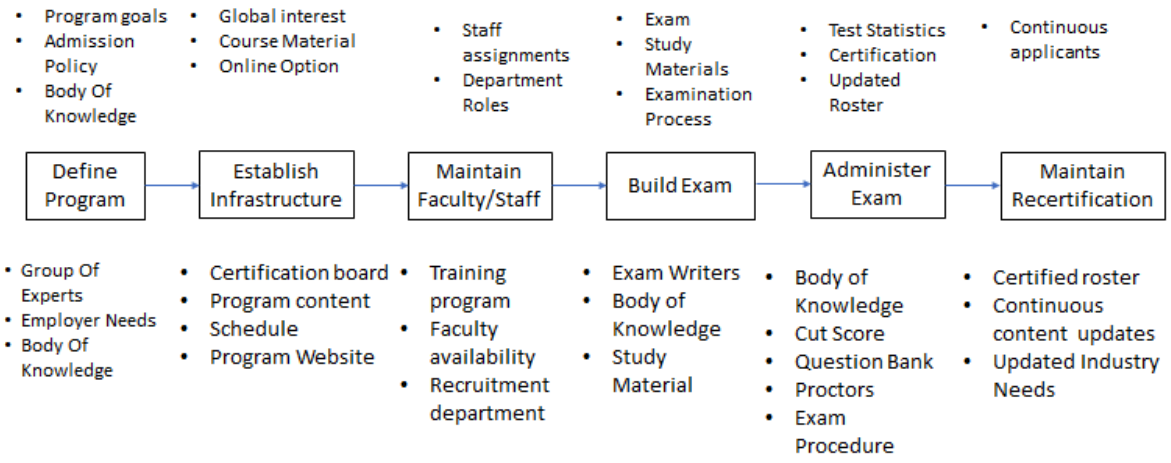


Fig. ____ : High Level PMAP

The above process map is an overview of the entire process and the six main processes we found necessary in designing the certification program. Each process on the high level process map above can be further dissected into the most fundamental steps possible. This breakdown is performed and analyzed in the sections below including both process maps for each step of the high level PMAP as well as analysis of all of the foreseeable defects/failures.

Process 1: Define Program

In order to build a high-quality certification program there must be a strong foundation from the start of the process. In order to begin compiling information and ideas on the certification program there must be a group, which can vary in size, that understand the subject matter thoroughly. From these individuals, come all of the program goals and standards, as well as the Body of knowledge (BoK), which is what truly defines the program. It is in this initial process step that we define the core of our certification and what it will be useful for in industry.

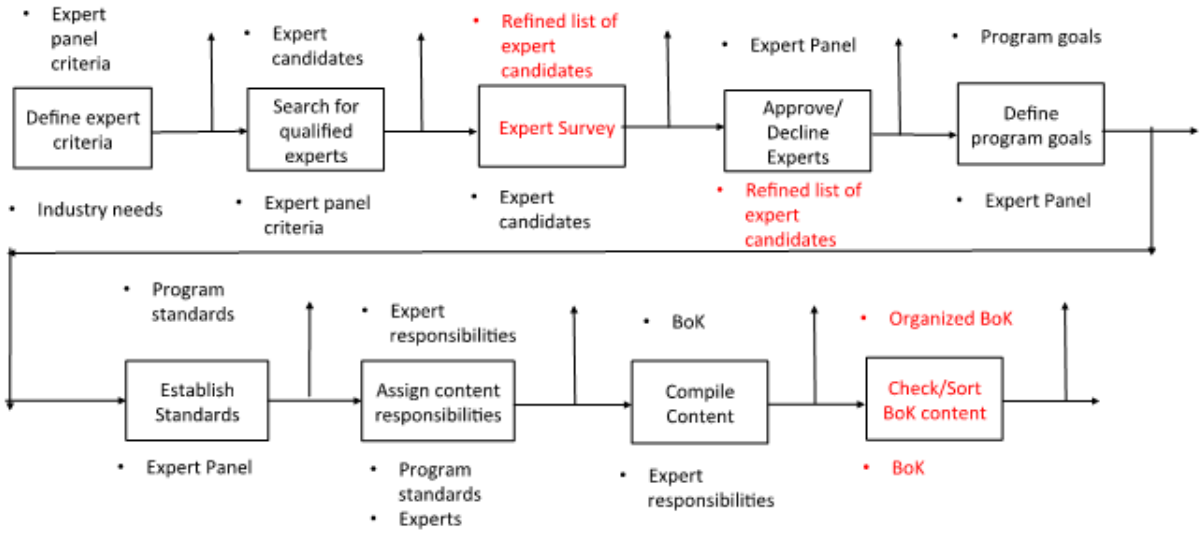


Fig. ____ : define program detailed pmap

Step 1: Define expert criteria

This process step will develop the criteria any would-be expert panel member must meet. This is how we will determine whether to approve or decline expert candidates.

Inputs:

1. Industry needs – A certain need in the industry is fundamental to creating a good certification program. This is the motivation for the customers (applicants) to participate in our program.

Outputs:

1. Expert panel criteria – the panel must be educated. It is pertinent to the process that the experts are well versed on the subject matter.
    a. Req: Educated, available

Step 2: Search for qualified experts

After determining an exact criteria for the experts there must be an active pursuit of experts via advertising, job boards, etc.

Inputs:

1. Expert panel criteria – The expert criteria will be clearly posted and understood so that we reach out solely to qualified individuals.

Outputs:

1. Expert candidates – the desired output of this process is a pool of qualified expert candidates. This pool will consist of those individuals who meet the three criteria listed above.
    a. Req: qualified

Step 3: Expert Survey

This step's purpose is to narrow the list of potential experts by preemptively declining prospects. The survey will consist of questions pertaining to the certification subject matter and based off the answers candidates will be deemed good or bad.

Inputs:

1. Expert candidates – all of the expert candidates from the previous step will be asked to complete the survey before approving or declining them.
    a. Req: qualified

Outputs:

1. Refined list of Expert Candidates - after the survey, many expert candidates will not be considered. this will cut down on the time and energy associated with approving or declining candidates.

Step 4: Approve/Decline experts

Given that we have a group of qualified expert candidates, this process step will allow the certification administrator to approve or decline the candidates. This step can vary in its execution depending on the volume and expertise of the expert candidates

Inputs:

1. Refined list of expert candidates – all of the qualified candidates' skills and experience will be evaluated.

Outputs:

1. Expert panel – Depending on the scope of the certification, the expert panel will consist of anywhere from 10-50+ experts.
    a. Req: experienced

Step 5: Define program goals

The expert panel will congregate to discuss and establish the overall goals of the program including its scope, expected number of certifications, schedule etc. These goals will be recorded and will be made according to both customer and supplier needs.

Inputs:

1. Expert panel – The group of experts must be present to establish important goals for the results of the program.

Outputs:

1. Program Goals – fundamental goals of the program will include content (exactly what industry needs are we aiming to guarantee), scheduling (exact dates for key processes to be accomplished) volume (an expected number of applicants, passing candidates, re-certifications).
    a. Req: Content, Scheduling, Volume

Step 6: Establish standards

The expert panel will work together to determine the standards that encompass the certification program. Eventually, the BoK will be organized and developed by these standards.

Inputs:

1. Expert panel – The group's collective knowledge should encompass all of the knowledge necessary to become certified. From this collective body of knowledge the experts will discuss and eventually decide on the key standards that shape the certification.

Outputs:

1. Program standards – A skeleton of the BoK will come from this process step. All of the standards developed by the expert panel must be satisfied by the BoK and will make up each examination.

a. Req: comprehensive, up-to-date

Step 7: Assign content responsibilities

Each program standard and/or substandard will be assigned to an individual or group of experts to further collect information and knowledge about in order to create a comprehensive BoK.

Inputs:

1. Program standards – a compilation of the program standards must be established at this point, as it will be broken down in this step.
    a. Req: comprehensive
2. Expert Panel – The same group of experts who developed the standards will now work to expand the BoK.

Outputs:

1. Expert responsibilities – The experts will assign individual tasks to split up the overall workload of collecting relevant content.
    a. Req: all subjects covered

Step 8: Compile content

The experts will be held accountable (as they were evaluated in process step 3: approve/decline experts) to thoroughly gather information corresponding to their assigned standards. In this step, all of this information will be compiled into one BoK which encompasses all program standards.

Inputs:

2. Expert responsibilities – at this point each expert has been assigned a given task and is expected to produce content that is relevant and comprehensive. Relevant information gathered by experts must be up to the standards the board member was assigned. The information gathered must also include all important concepts for each standard ranging from basic to complicated.
    a. Req: Relevant, Comprehensive

Outputs:

1. Body of Knowledge – If the expert responsibilities are met the resultant BoK will include information necessary to meet industry needs, Content on each of the program standards, range of concept difficulties, and all information that could be included on an examination.

Step 9: Check/Sort BoK Content

After compiling all of the information gathered by the experts, a select group of experts will also double check all of the information and sort the information into distinct categories making exam preparation much easier.

Inputs:

1. BoK - the previously developed draft of the body of knowledge will be sorted/maintained in this step.

Outputs:

1. Organized BoK - since the BoK is such a vital part of the program, it is necessary to maintain it. from this step we will have a much more organized collection of the subject matter.

Define Program FMEA/Sigma Score:

Process Step	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN	Actions Recommended
Define expert criteria	Criteria too specific or broad	too many or too few experts are interested/qualified	4	Industry needs are extensive or narrow	3	Expert panel criteria	3		Alter criteria or hire established professionals
Approve/decline experts	Type 1: qualified experts declined Type 2: unqualified experts are accepted	Standards not comprehensive of industry needs BoK incorrect or missing information	6	Approval guidelines are unclear	1	Expert panel criteria	2		Expert examination
Define program goals	Goals don't meet customer needs	Certification program not relevant to industry	9	Goals do not focus on content	3	Fundamental goal criteria	3		
Assign content responsibilities	Not all standards are accounted for	BoK is not comprehensive	8	Responsibility assignment miscue	2	Program standards	2		Make assignments public
Compile content	Content lost or misplaced	Examinations are not balanced between standards	5	Program standard ambiguity	6	Program standards	5		BoK revision/Checklist

In the FMEA chart shown above there are several possible failure modes of the define program process. The failure modes can be split into two categories:

Pre-Expert Selection:

The first two failure modes listed above come from a mistake during the expert search. This can either happen due to the expert panel criteria being either too specific or too broad. If the criteria is too broad there would be a large amount of possible experts but could cause the BoK to be too vague or possibly incorrect. On the other hand, if the criteria is too specific it could be hard to find a sufficient number of experts to develop the BoK.

Furthermore, whether the criteria is inappropriate or not, another possible failure mode could come from the approve/decline experts process step. In this situation there are two types of errors which could possibly be made:

Type 1 - qualified experts declined

Type 2 - Unqualified experts approved

The type 2 error is more detrimental to the program because it could lead to more failure modes in later stages of the program (BoK development). A type 1 error is only a true defect if at the end of the approved/declined expert process an insufficient number of experts are approved. This will create a problem either with developing the BoK or in the scheduling of the program.

Post-Expert Selection:

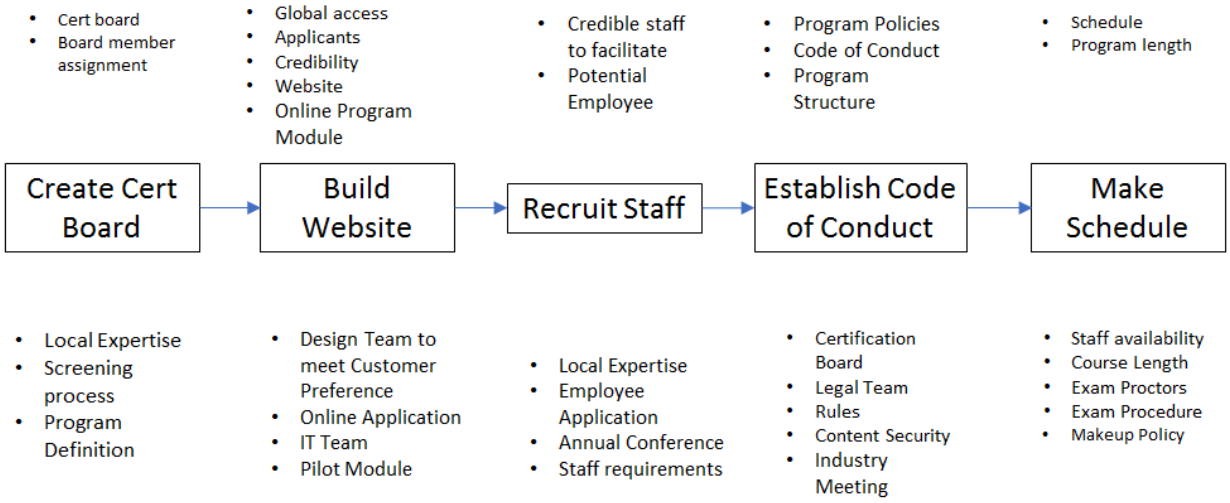
Assuming the expert selection process is done correctly, more possible failure modes can still occur. These failure modes can be attributed to human mistake while developing the program goals, standards or BoK. If, for any reason, industry needs are not met during this development we consider this a failure mode.

Below is a visual representation of the sigma score calculation.

SigmaScore Calculation Worksheet			
Process:	Define Program		
Timescale:	Month		
Period:	N/A		
	Customer Defectives	Count	Total
A.	Standards	50	50
B.	Program Goals	5	250
C.	BoK topics	100	25,000
	Defect A-B-C opportunities/unit:	3	
	Total A-B-C opportunities:	75,000	
	Defect A-B-C actuals:		
	Standard not met	750	3%
	Topic incorrect	1,250	5%
	industry need not met	2,000	8%
		0	0%
		0	0%
	Total A-B-C defects:	4,000	
	Total Opportunities	75,000	
	Total Defects	4,000	
	DPU:	0.16	
	DPMO:	53,333	
	Customer Defectives Sigma Score:	**3.11**	

Process 2: Establish Infrastructure

In this step in our process we are looking into the infrastructure, however not on the physical aspect but more towards the organization of steps and programs needed to be implemented for our program. Our first step is establishing our program, this first stems from deriving a need for our program in order to make application possible.This step addresses and uses the criteria from the MBNQA, specifically here leadership The creation of the certification board will help to place capable individuals that will begin to build the rules and regulations for our program. The board will serve also a voting group on any changes or updates needed as time goes on. As we build the program we have to establish a curriculum, how long classes are going to be, how many hours of work are needed and what material will be covered. From these plans we can move into our next step of maintaining staff and will be able to determine the number of faculty members that will be needed to administer the curriculum.



Step 1: Create Certification Board

Inputs

1. Local experts – Need to be unbiased and have strong knowledge of area of certification
    a. Req: Knowledgeable, Qualified

2. Screening Process – Create competitive environment to promote quality instructors, which would include the staff members presenting work they may have in the field, as well as cross referencing with former employers
    a. Req: Comprehensive
3. Program Definition – This is an input that needs to be a driving force for the creation of certification board.As mentioned in the Baldrige requirements the leaders of the program will be responsible for instilling these ideas for the foundation of the certification. The board needs to be clear and understanding of what this goal is before we select them for work.
    a. Req: Clear, Meet Customer Needs

Outputs

1. Board Member assignments- This will allow us to give a description and schedule for each of the positions, we will be able to ensure our faculty will be ready and available.In addition the team will be able to collect information from those assigned to each process.
    a. Req: Understandable, Achievable
2. Certification Board- Needed board to execute policies and facilitation of the program, this needs to be established by a group with similar goals, that can be understood
    a. Req: Qualified, Helpful, Dedicated

Step 2: Build Website

Inputs

1. Design Team- By this input we refer to a web design team we want a formatting team that would ensure a website that meets needs but appeals and can be simply operated by the user
    a. Req: Qualified, Creative
2. Online Application- This will be large part of the website, as we need candidates for the program, it will not only be on the website, but in online links for employers, the requirements for the program may change as time goes on
    a. Req: Easy to use, Updated
3. IT Team- This requirement would be focused on online module, the IT team would have to be a full time team that aids in problems, malware and continuous updates
    a. Req: Qualified, Available
4. Pilot Module- The pilot module will be sent out to a group to use and run the software that will be implemented for study material and communication. The point here is to solve major problems with the software before it is delivered to candidates. Software updates will have to be made but the goal of this process will be solving any major issues that would prevent communication or content availability.
    a. Req: Useable, Functional

Outputs

1. Global Access – Building a website that is easily visited makes the program available to anyone with access to the internet, granted they are able to travel for the examination day
    a. Req: Updated, Functional, Appealing

2. Applicant – A large portion of applications will be received through the website, once this is created the program will be able to begin taking applications and accepting candidates
    a. Req: Qualified, Reachable
3. Credibility – This step adds credibility as we will be able to upload information on the program, become recognized by employers and begin applications
    a. Req: Consistent
4. Website – This is going to serve as a main function of the program and be an area that candidates will visit frequently, it needs to be updated and monitored by an IT team
    a. Req: Updated, Functional
5. Online Program Module- The module will serve as a means of study and area where information for the exam can be obtained, the program team will have to content for candidates to use as means of preparation. It will be an output once the website is built correctly and testing. It can also be referenced as our "dashboard" for relevant information.
    a. Req: Ease of use, Comprehensive

Step 3: Recruit Staff

Inputs

1. Human Resources Department: After the completion of the certification board, this department will allow the program to receive the best available candidates, by having a group dedicated to searching for potential candidates
    a. Req: Efficient, Available
2. Local Expertise- Local Experts will help to have knowledge of other local talent, in addition to determining if potential candidates are qualified
    a. Req:Available, Qualified
3. Occupation Role- Here we establish the role of each member of the staff, that way we are able to recruit for a position with detail and applicants have an understanding of the job they apply for
    a. Req: Understandable, Possible
4. Annual Conference- This input would be difficult to begin with due to because of the lack of customer relations before the certification is established, but the goal is to draw in industry leaders each year to meet the needs of the customer and remain consistent with changes. This process is carried out annually to ensure long term quality.
    a. Req: Interest, Local experts

Outputs

1. Credible Staff- This process creates our staff, with the inputs we have put in the goal is to have a qualified staff with the same understanding of the program goals
    a. Req-Qualified, Unbiased, Experienced
2. Credibility- When recruiting other local experts from the field, our program gains credibility by having experience on our staff, and gives our customer reassurance that their needs will be met

    a. Req: Consistent, Clear
3. Potential Staff- As a result of the annual conference we hope to be drawing in future leaders in the industry that could be a valuable input to the program over time, whether it be speakers at future conferences or replacements when current staff leaves
    a. Req: Qualified, Passionate

Step 4: Establish Code of Conduct

Inputs

1. Certification Team- This will be the task of the Board, they need to establish a multitude of policies at the start of the program, that way when problems occur the policies serve as a guideline for how to handle it
    a. Req:Clear, Comprehensive
2. Legal Team- The legal team will be responsible for the literature of the policies once the certification board has agreed on a plan
    a. Req: Qualified,
3. Rules- From the policies we also establish a set of rules for which candidates understand, violation of these rules would result in termination of the certification
    a. Req: Available, Clear
4. Industry Meeting- Meeting with industry on this topic involves taking the output of what is expected in the work field and construct this into the program so the candidates have this instilled once becoming certified
    a. Updated, Accurate

Outputs

1. Program Policies- From this we will have policies established and in place for applicants to review prior to the start of their program
    a. Req: Understandable, Available
2. Code of Conduct- By code of conduct we are referring to the goal and creed to the process, this involves the ethics to our program and outlines them clearly
    a. Req: Clear, Concise
3. Program Structure- This process gives the program and board a guide for how they will operate in cases with applicants. They will build a process for handling cheating, and reviews for recertification in place at this point. As the program progresses
4. Decisions Plan- The code of conduct will serve as a guide once the certification in making decisions down the road. It will help when there are disagreements in what direction the board should take. Also it is a guide for how the staff and candidates will conduct themselves
    a. Req: Fair, Consistent

Step 5: Make Schedule

Inputs

1. Staff Availability- Here we refer to each member of the staff notifying of any time off, or amount of hours they are able to work, this input is required to ensure a schedule that can

run smoothly, although it will be difficult to account for sickness or other unknown means
    a. Req: Amount of hours, Availability
2. Exam Day- One of the most important days in our program lies here, this needs to be a key focus of the schedule, staff needs to determine if there will be multiple days to take the exam, the location and planning of the day
    a. Req: Announced, Fair,
3. Proctors- They will be needed for day of the exam to distribute and overview the exam to ensure the validity of each exam taker
    a. Req: Available, Qualified
4. Program Length- Certification board needs to determine how long candidates will have for the final once they have begun the program
    a. Req: Established, Consistent
5. Makeup Policy- The team will design policies for things such reasons for absences or reschedule for the final exam. A point of failure in the administer step refers to no-show candidates, however there may be reasons that can not be controlled by the person. Options include reschedule of exam or alternate exam to ensure the validity.
    a. Req: Established, Fair

Outputs

1. Program Length- Candidates will get an understanding of how much work will go into the certification, as well as plan to be available on important dates
    a. Req: Clear, Established
2. Schedule- Once this process has been completed our board will have a final schedule to present and post, making it clear to applicants, as well as instilling in a recertification length
    a. Req: Available, Fair

Establish Infrastructure FMEA and Sigma score

In our Sigma Score evaluation, we focused on defects again from the webiste. In this portion of our process the website failures will present the largest number of defects to the process. Our goal is to have all of our candidates using the process but it could become difficult if not everyone either has access to the information or if the software is not able to function correctly for the candidates to review.s Secondly we took a look into the actual policies of the program, here we are looking more into instances of cheating, failure to show up to an exam or other activities that require the team to look back at the written policies of the program. If they are unclear a candidate who may be considered cheating may not even be aware that the action they are undertaking is a form of cheating. For this reason the language of the policies needs to be extremely clear and any problems that can arise need to be addressed. Scheduling is a lesser portion of defects this will result from. The only way to limit this is to send out all of the important dates in advance, ensure that first the candidates are all able to meet this schedule then secondly ensure staff will be able to be present whether it be proctoring the exam or customer service with our online portion.

	Customer Defectives	Count	Total		Process Defects	Count
A.	Program Policies	10	10	W.	Policy Not Clear	200
B.	Website	7	70	X.	Poor Website design	10
C.	Schedule	5	350	Y.	Staff Unavailable	10
	Defect A-B-C opportunities/unit:	10			Defect W-X-Y opportunities/unit:	10
	Total A-B-C opportunities:	3,500			Total W-X-Y opportunities:	200,000
	Defect A-B-C actuals:				Defect W-X-Y actuals:	
	Unfair Policy	5	0%		Poor Grammar	200
	Crashed Website	10	0%		Software Unable to handle traffic	500
	Absent Facult	7	0%		Failed Scheduling	100
	Total A-B-C defects:	22			*Total W-X-Y defects:*	3,600
	Total Opportunities	21,800			Total Opportunities	2,222,000
	Total Defects	22			Total Defects	44,040
	DPU:	0.01			DPU:	0.22
	DPMO:	1,009			DPMO:	19,820
	Customer Defectives Sigma Sc	**4.59**			**Process Defects Sigma Score:**	**3.56**

Process Step	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN	Actions Recommended	Resp.	Actions Taken	SEV	OCC	DET	RPN
Create Cert Board	Lack of Interest	No credibility	8	Unorganized, failure to meet need	4	Establish Need	7	224	Continious Meetings with Industry			8	4	7	224
Build Website	Website Crash, Unapplealing	No applicants, No global precence	10	Web and IT team	4	Continious website montitoring,	7	**280**	Run simulation with more traffic than exposed			10	4	7	**280**
Recruit Staff	Lack of Availablity	Unable to facilitate program	4	Uncompetitive salry, HR department	4	Continious recruitment,	7	112	Adverstise at conference, Hold Personal Conference			4	4	7	112
Establish Code of Conduct	Unable to agree	No code of conduct, no soloution to violations	7	Lack of communication, discprepicancy with board	4	Set goals before process, Constant communication	7	196	Meet with Industry on code			7	4	7	196
Make Schedule	Lack of Availablity	Difficulty getting staff, applicants with no resources	7	Lack of creditbility, unknown program	4	Posted Schedule for applicants	7	196	Attempt to keep schedule consistent, Have plan for changs, Electronic Reminder System			7	4	7	196

Create Certification Board: As in the MBNQA, the first criteria is leadership, for many of the same reasons we began with this step in our design of this process. Those in command are responsible for instilling the ideals and goals of the program continually in their work. The process for selecting the board will have to have the aid of local experts who are able to serve as guides for the selection process. In addition the need of the customer should be in line with how leaders will run the program. We plan to locate individuals with similar goals and passions by hosting an annual conference. It will be a chance for the program to showcase why employers should adopt the certification while serving as a chance to receive more input not only from our own customers This will ensure that the voice of the customer is always being integrated into how the program runs

Build Website: This is serious input to our system, we placed a more in depth look at it. The simulations will be a great additon to reduce failures, as it will not run a cost to the customer. The website will have discussions areas, contain content and serve as medium for updates or changes of the program. For this reason it has received the highest score, because it will be the greatest impact if not facilitated correctly. We also plan to run a simulation with much more traffic than what the software would be exposed to, that way we are confident it will be able to handle once the program begins.

Recruit Staff: Staff will be difficult in the beginning stages but planning and recruiting before the establishing the program. We have also incorporated plans to involve local experts in the industry to aid in the beginning stages, part time positions would be the best route and then finding experts to continue to run in the long run. In addition the annual conference will serve as another hub for recruiting potential staff employees.

Establish Code of Conduct: This will be the guide to decision making and future improvements for the program. Failures will arise we believe if the policies are unclear or not updated. Adding the input of the industry into this process would be quite helpful, this way the customer's voice will be instilled in the entire program. In addition this will be a time where the customer can voice any concern. It also serves to let the customer feel a part of the planning process while getting the best interpretation of what exactly they seek from certification.

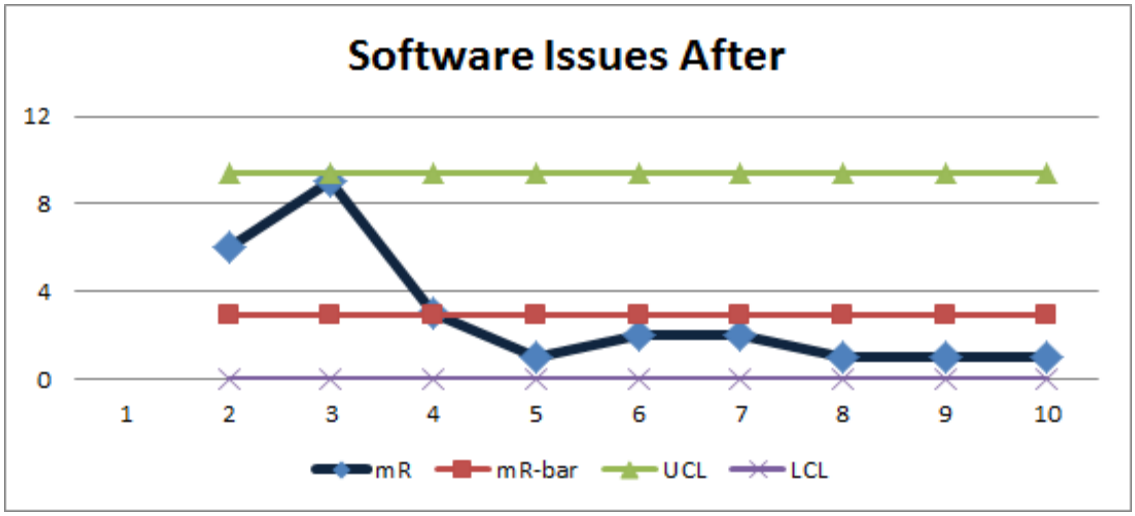
Make Schedule: One of the main failures to address in this process will result from a lack of availability. An action to prevent this in the design stage is finding part time staff, once again these will be local experts. Once the program gains credibility the team can go into finding full time employees and creating a consistent schedule from year to year. In addition we would like to use an electronic reminder system, this could be via mass text message, this can notify candidates of last minute changes as well as remind them in advance for the test so they are aware. Secondly this will remind candidates if they will be able to make the exam, if they are unable to attend they will have time to request an alternative exam.

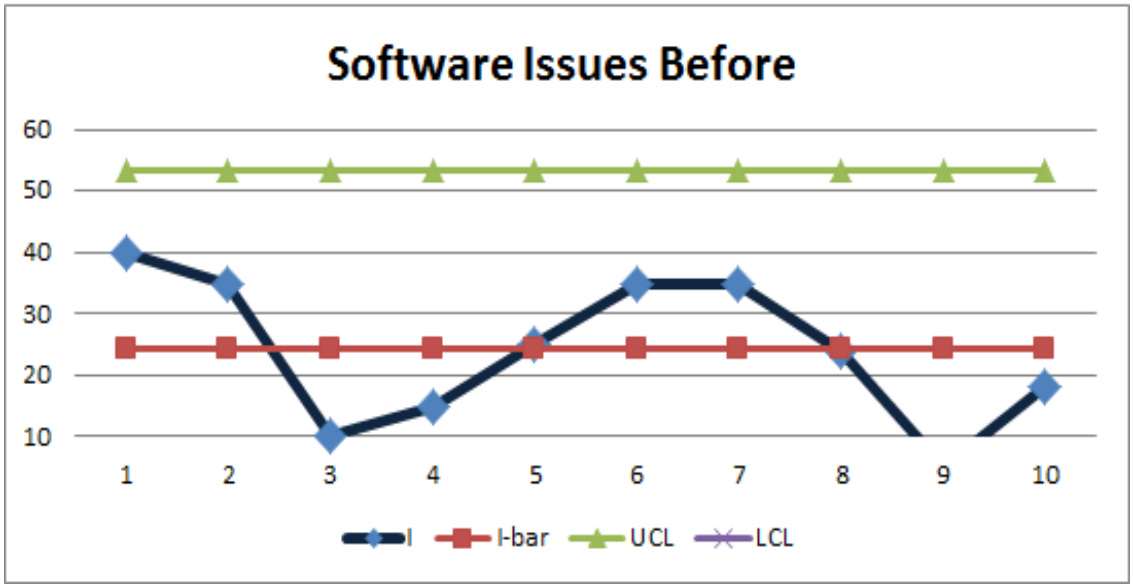
Continuous Improvement

The website will continue to be a valuable input to our process, the first control chart shows the results of not having a control system around our initial software launch, each point here in the data set will represent 10 candidates that have issues using the software. The issues focused on our website crashes, unable to navigate the menu or any general issues. The goal is to have to software be an aid to the candidates rather than impeding their efficiency. In the first chart we can see that there a high number of people undergoing problems with software.

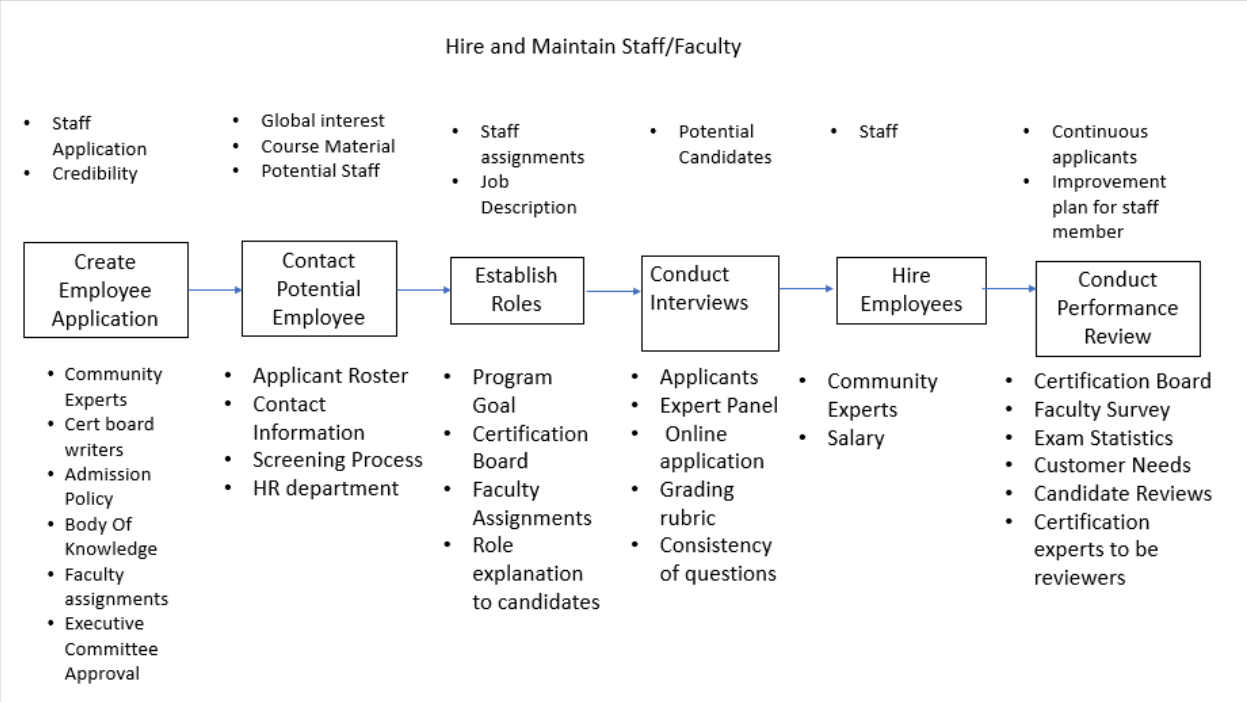
One the important aspects that the team went back and corrected was adding the control for the website. Hiring a full time IT team to work with first the employees to get all of the content needed, then secondly with the customer. In this case a 24 team on call for any issues that a user of the website would need. This control along with design a pilot module for testing shows the improvement in our second control chart. Even the scale of the chart is reduced, solving the minor issues before installation will be a huge benefactor.

Lastly the goal is to implement updates annually this will involve keeping current with the type of software available as well as remaining compatible with new technology platforms. In each year the team will create a pilot platform run simulations, as well as being ran through a pilot group. This will continuously improve the website, by help in the prevention of new problems that may arise.





Process 3: Hire Maintain Faculty and Staff



Step 1: Create Employee Application

Inputs

1. Community Experts – We first need an understanding on what the experts on the certification believe the community is looking for.
    a. Req: Professionals with experience in taking a certification test as well as creating one
2. Certification Board Input – The internal board should now know what they are looking for in an well rounded employee.
    a. Req: No more than 10 people.
3. Faculty Assignments – Each current faculty member should be responsible in looking what type of employee will best fit the certification project.
    a. Req: Above average tenure at the company.

Outputs

1. Staff Application – The application should be easily accessible, sent out to qualified potentials, and thorough.
    a. Req: Open for 1 month
2. Credibility – Minimum requirements to be part of the project such as having quality engineering or certification program experience for at least 5 years.

    a. Req: Respected in the industry.

Step 2: Contact Potential Employee

Inputs

1. Applicant Roster – This step is more so regarding logistics of the process. Like stated in the previous step we want the application to be accessible to as many candidates as possible to have a bigger pool.
    a. Req: Good balance between different ages, experiences, and gender.
2. Contact Information – In order to reach back out to the applicants we need this information. This may sound obvious, but all steps of the plan need to be listed.
    a. Req: email, phone, and address
3. Screening Process – We need to ensure that no one lied in their application as well as if any intense criminal charges are on their personal record.
    a. Req: Honesty and clean record.
4. HR Department – HR's main role is to ensure that the hiring process is as fair and as smooth as possible.
    a. Req: Fairness and consistency of process.

Outputs

1. Potential Staff – We need to figure shrink down the pool of applicants in order to more deeply interview who we saw as the most qualified group
    a. Req: Double the amount of people we want to take in.
2. Course Material – After a group is hired they immediately need to start to work on the certification course material.
    a. Req: Consistent and credible information
3. Global Interest – We need to ensure that we keep the goal of global accessibility and the potential staff would play a great role in it.
    a. Req: Online and multilingual course accessibility.

Step 3: Establish Roles

Inputs

1. Program Goal – Once the staff is fully in place, the team needs to come up with a vision and goal for the project so they work as a cohesive unit.
    a. Req: Compromise
2. Faculty Assignments – Work will now to start delegated amongst the team so deadlines can be met.
    a. Req: Realistic expectations.
3. Certification Board – The certification board is the duty of some members of the team that will oversee the overall process and make adjustments to the program when needed.
    a. Req: Oversight.
4. Customer Service Rep – This is a crucial role in taking in concerns and answering questions to keep the customer satisfied.
    a. Req: Great people skills.

Outputs

1. Job description – The job descriptions will all now be detailed.
    a. Req: Specific responsibilities
2. Needed staff – The hiring process may not be perfect so there is the possibility of a new applicant taking an unexpected role.
    a. Req: A candidate with versatility.

Step 4: Conduct Interviews

Inputs

1. Applicants – The applicants will now go into their final rounds of interviews.
    a. Req: Passing the first 2 phases of the process.
2. Panel of experts – This panel is the ultimate decision makers of who is selected.
    a. Req: High up leaders in the organization.
3. Review Team – This team will ensure that nothing has been missed in the final application round.
    a. Req: Members need to have not been involved in any other part of the process.

Outputs

1. Potential candidates – These are the candidates that will be planned on being hired.
    a. Req: Consistency throughout their hiring process.

Step 5: Hire Employees

Inputs

1. Community experts – The experts are now hired and will continue to evaluate the role of the certification project.
    a. Req: Understanding of customer and company.
2. Salary – Salary will be competitive with benefits.
    a. Req: Above competitor average.

Outputs

1. Staff – The official staff is ready to work.
    a. Req: Goals are still aligned with the project charter and company's values.

Step 6: Conduct Performance Review

Inputs

1. Certification board – The board will always be pushing for relentless improvement throughout the process.
    a. Req: Eyes on every staff member
2. Faculty Survey – This will be used to improve the performance of the team. If specific employees continue to get bad reviews, the more repercussions could occur.
    a. Req: Easy to fill out for the customer.
3. Exam Statistics – Evaluate to see if the scores are in control. If the data points land in the improvement zone we need to understand that we need to find the assignable cause and fix it.
    a. Req: six-sigma

4. Customer Needs – Always seek for input and to keep the customers happy. Never, however, give special treatment to some customers over others. This needs to be a constant part to the process. Our team plans to do so in surveys as well as industry conferences
    a. Req: Survey
5. Candidate reviews – Check to see if person taking the exam is doing it ethically.
    a. Req: Proctoring

Outputs

1. Improvement – The certification program will never be fixed. On the contrary, it will be dynamic and always working to be better than the rest.
    a. Req: Control charts and effective analysis.
2. New faculty – If needed by demand or lack of performance through surveys submitted. New faculty will have to be hired.
    a. Req: Application standards are raised.
3. Suggestions – No suggestion is a bad suggestion and will all be looked into by the certification team.
    a. Req: Open mind.

Process Step	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN	Actions Recommended
Create Employee Application	Does not mention some employee requirements or too many	Unqualified employee/Less applicants	10	Poor written application	4	Has to be approved by board writters	7	280	Restart application process
Contact Potential Employee	Incorrect Contact Information	Loss potential employee	7	Input error	5	Multiple information contacts	7	245	Have a confirmation email
Establish Roles	Unclear role explanation	Employee does not have experience	8	Poor written explanation	4	Explain the roles prior to completing the selection process	7	224	Ask employees what they think the purpose of their role is
Conduct Interviews	Unexperienced interviewers	Asking the wrong questions/inconsistency	8	Hirirng incorrect candidates	4	Have to be selected by the executive board to be an interviewer	7	224	Have a list of potential subject of questions as well as a clear rubric
Hire Employees	Unqualified employee	Delays process	7	Have to fire and rehire	1	Exectutive board votes who gets hired	7	49	Multiple screenings
Conduct Performance Review	Conduct Performance Review	Poor reviewer	7	Lack of understanding of the certification process	4	Unannounced reviews	7	196	Multiple performance reviews

FMEA Potential Failures:

1. Create Employee Application: Unqualified employees comes as the most severe potential failure. This is due to the fact that if our employees are unqualified that will ultimately make our certification unreliable. The potential of a poor written application can be monitored by the approval of the executive committee. If these control is not effective, and it is noticed that unqualified candidates are applying, then it is worth restarting this step of the process.
2. Contact Potential Employee: Losing potential employees is a problem we do not want to face. If their contact information is lost are incorrectly placed, then we have lost an applicant that would have boosted the credibility of this certification. TO ensure this does

not happen we will ask for multiple contact information. Further action could include having a confirmation email being sent out. The applicant will then know if this email is not received their must have been an input discrepancy.

3. Establish Roles: If the roles are poorly described to the applicants, a real possibility exists of the misunderstanding of the certification goal. The description should be actionable. Through day-to-day roles, week-to-week roles, month-to-month roles, and ultimate role in relation to the certification program. If the failure occurs, we should first consider sitting down with the employee and redefining their role. If they are not qualified to execute it, then hiring a new employee will be needed.
4. Conduct Interviews: When interviews occur, there could be the possibility of inconsistent questions. When there are inconsistent questions, the hiring process becomes unfair and unreliable. If a less qualified applicant is hired due to this, it would have a high negative impact on the process. The actions that should occur are well-written questions that are approved by HR and a rubric that aligns with potential answers to the questions.
5. Hire Employees: A real detriment to creating a well-rounded certification would be hiring the incorrect employee. There could be a number of ways this failure comes into fruition. In order to avoid this problem the executive committee will do a final check and vote of each employee that is being hired. Luckily, this potential failure is not as severe due to its likeliness of occurrence. However, if it does arise, a necessary action would be to rehire
6. Conduct Performance Review: A performance review is essential to this process because we need the ability to monitor how well our employees are doing way after they have been screened and hired for the position. A survey will be created for each customer that deals with each faculty and staff. If the survey created is incorrect, then the evaluation of each employee will be skewed. We want to multiple reviews of each role for the employee. For example, their ability to teach, understanding of material, and communication level would all be included in a performance review. If the performance review is done incorrectly, then we could potential fire a great employee.

	Customer Defectives	Count	Total		**Process Defects**	Count	Total
A.	**Applying**	1	1	W.	**Hiring**	40	40
B.	**Experience**	1	1	X.	**Interviewing**	150	6,000
C.	**Contact Info**	5	5				
	Defect A-B-C opportunities/unit:	10			Defect W opportunities/unit:	9	
	Total A-B-C opportunities:	10			Total W opportunities:	360	
	Defect A actuals:				Defect W actuals:		
	Change contact info	5	1%		Unexperiences employees	8	20%
	inexperience	5	2%		miss interviews	3	8%
	Incorrect info inputs	5	2%		few interviews	8	20%
	Apply to unwanted position	5	2%				
	Total A-B-C-D defects:	25			*Total W-X-Y-Z defects:*	96	
	Total Opportunities	320			Total Opportunities	60,360	
	Total Defects	45			Total Defects	1,320	
	DPU:	1.80			DPU:	0.22	
	DPMO:	140,625			DPMO:	21,869	
	Customer Defectives Sigma Score:	**2.58**			**Process Defects Sigma Score:**	**3.52**	

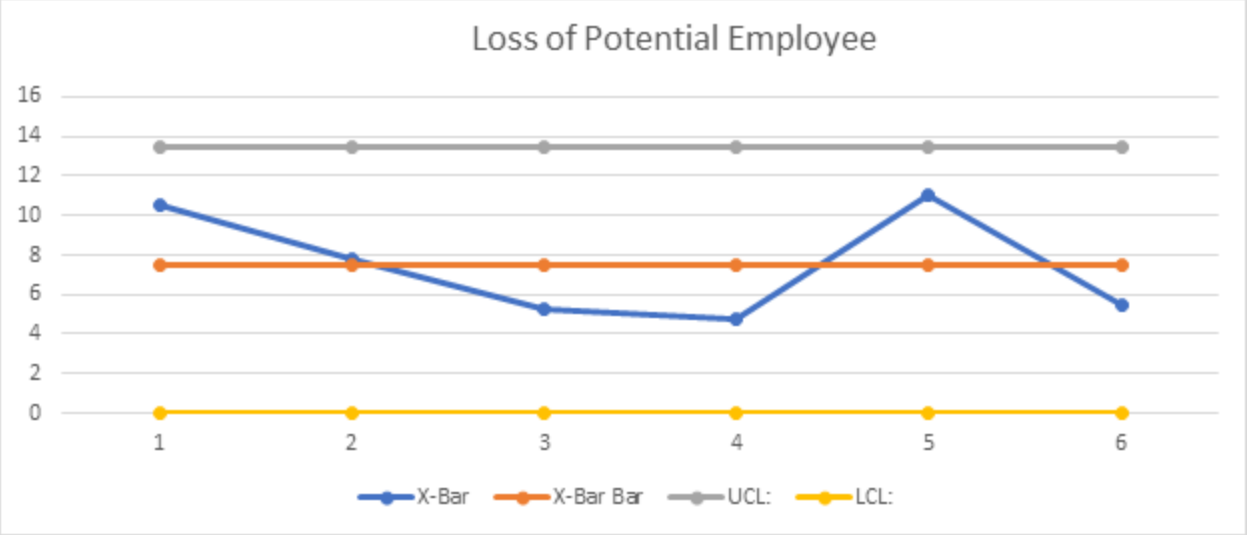
The most detrimental defectives for the customers will be the application process, their experience, and their personal information. 1) When customers apply it should be easy to understand what is being asked from them. If they fill out an application incorrectly or do not put in all the information required in, we now have a defective application. 2) If a potential's experience lacks, then there is a defective in the process. A lack of qualifications could result in unqualified staff that are not fit to teach professionals that are going through the certification. 3) If the contact info is not correct by the customer then we cannot put them through a full interview and training phase.

For the process the defectives that would have the greatest impacts are the hiring and interviewing. 1) If the hiring process is not vetted correctly through HR, we will hire unqualified applicants. 2) The interviewing needs to be the same. Questions must be exactly the same for all applicants. Also a clean and defined rubric for potential answers must exist. If neither of these exist, then that is when we will end up with a defective.

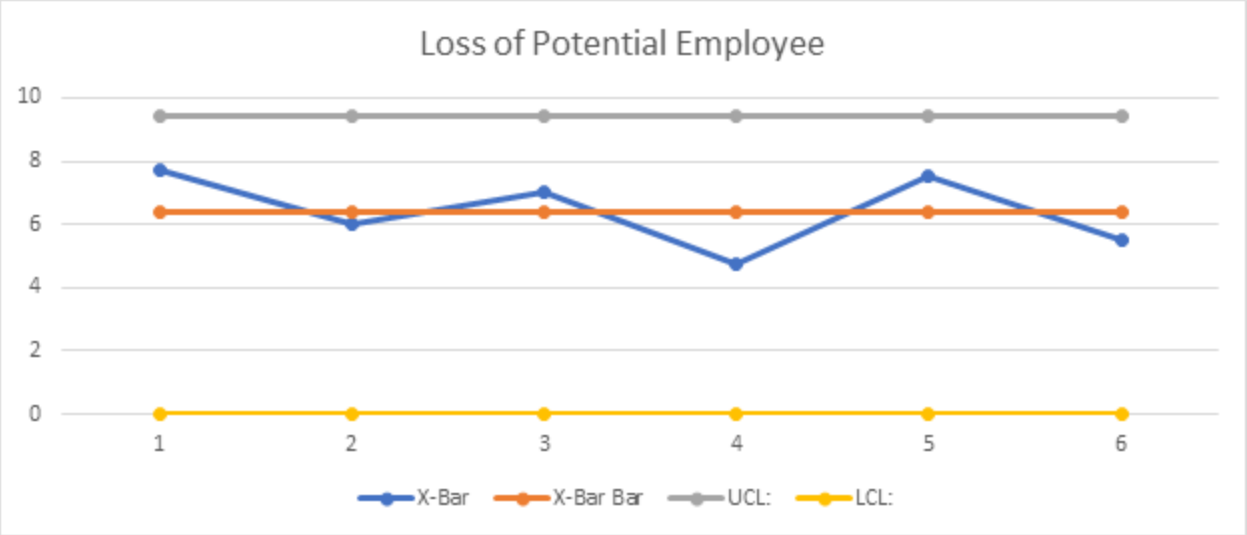
Continuous Improvement:

Control charts will be used not only to keep the process in control, but also to see how the recommended actions in our FMEA's helped the charts. For step 3, hire & maintain faculty and staff, we will be considering the detailed step "loss of potential employee". Our current potential causes are user input errors and our current controls are providing multiple contact information. Our recommended actions will be to provide a confirmation email for the applicants. The charts below will evaluate an x-bar chart before and after the recommended actions take place. The y-axis will be how many applicants we have lost due to information and the x-axis will be over the application time which lasts 6 months. While both charts are in control, the recommendation shows a massive improvement of tolerance. The biggest change that is seen that the UCL is significantly dropped from 12 to 9.

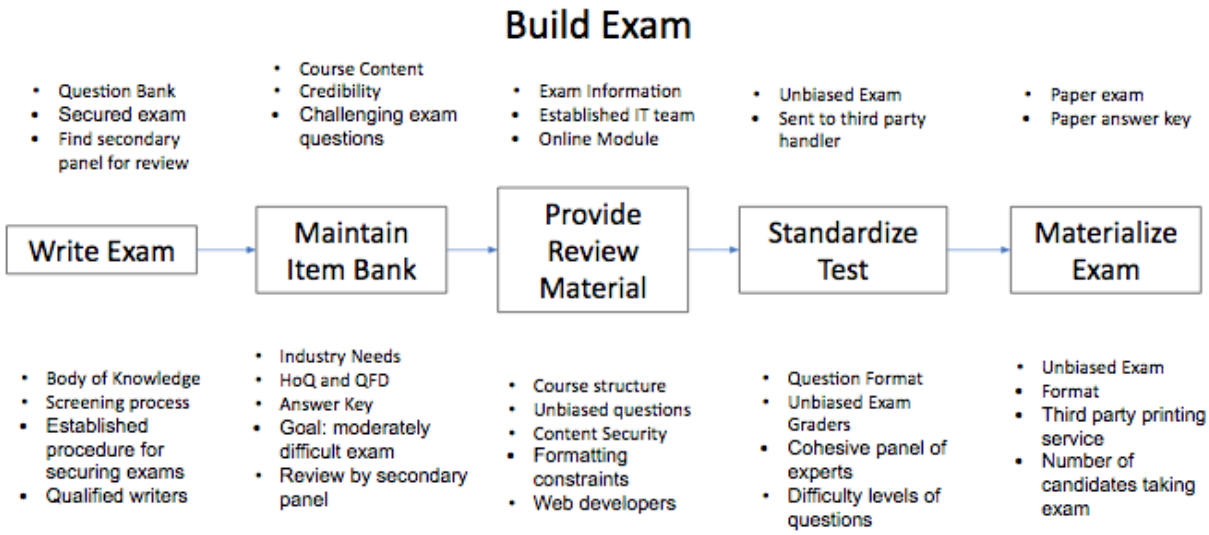
Before Recommendation:



After Recommendation:



Process 4: Build Exam



Step 1: Write Exam

This process step develops the basis of the exam. Expert writers will draft up questions they think is relevant to the body of knowledge surrounding the certification, and out of it will come a certification exam.

Inputs

1. Body of Knowledge – This is one of the most vital inputs to our system, it is a continuous process of updating information and content for the program. It needs to be able to be easily updated, and constantly referring to industry standards in order to meet customer needs.
    a. Req: Current, Updated
2. Screening process - We included a screening process within this step because we felt the certification exam questions needed to be relevant to the BoK, as well as what the question was evaluating.
    a. Req: Thorough
3. Established procedure for securing exams
    a. Req: Detailed, clear, concise
4. Qualified writers – A team of writers will be needed to create several questions that evaluate the knowledge necessary to obtain certification.
    a. Req: Unbiased, appropriate, and relevant questions

Outputs

1. Question Bank – This will be a large group of questions, that way each exam will be randomly selected questions from the bank, through this we attain validity
    a. Req: Fair, Updated
2. Secured exam - All generated exam questions will be secured in a safe location, and will make up the certification exam.
    a. Req: Prevention of being disseminated prior to exam date
3. Find secondary panel for review
    a. Req: Strict; acts as last filter for relevancy and appropriateness in exam questions

Step 2: Maintain Item Bank

Inputs

1. Industry Needs – Industry has to be constantly contacted, whether by survey or in person meetings, the item bank needs to continuously updated to remain credible
    a. Req: Updated, Helpful
2. HoQ & QFD – The customer should also be expressing their needs here, from this we can help to build a more valid item bank and remove old items that may not have relevance that they did before
    a. Req: Available, Continuous
3. Exam day announcement - Supplies candidates with time, date, location, and what materials will be given/not given during exam day, as well as the exam protocol

    a. Req: Detailed, informational, clear
4. Answer Key – Shows correct answers to all generated questions within the first process step. This is the guideline that will help our unbiased graders evaluate each exam
    a. Req: Accurate, objective
5. Goal: moderately difficult exam - We included this goal as an input to this step because we feel as though we need to create an exam that is worth taking; effectively looking for a passing rate target of approximately 60-70%
    a. Req: Realistic
6. Review by secondary panel - This was deemed necessary in order to preserve the relevance of the exam questions. This will ensure that each exam question evaluates some part of the BoK, as well as being an acceptable form of exam question
    a. Req: Extensive, consistent

Outputs

1. Course Content – Candidates will be able to have to knowledge of what will be presented in the final exam, this will instill fairness so that each candidate has the same access to material given from the program
    a. Req: Comprehensive, Available
2. Credibility – We get credibility from this step because we take step to ensure relevant, appropriate, and quality questions are created for our exam
    a. Req: Warranted
3. Challenging exam questions – By building the item bank we have access to a plethora of questions that can be on the final exam, from this we can also create practice items for candidates to use in preparation
    a. Req: Unbiased, Clear, Comprehensive, challenging

Step 3: Provide Review Material

Inputs

1. Course Structure – The course structure needs to be established, whether we are going to present teachers for the material or place the review materials online, in this case our website will serve as the main area for review and continuous information will be uploaded to it
    a. Req: Decisive
2. Unbiased questions – It is imperative that our study materials cover all of our exam material so that our candidates can properly prepare for the exam. Therefore, we must have unbiased questions so that our review material is objective and accurate.
    a. Req: Relevant to BoK
3. Content security – The panel of experts will serve as to determine how much of the review material will be given, we still want to maintain an element of competitiveness in the program while at the same time giving candidates a fair chance. We also need to maintain the online module on which we provide our review material
    a. Req: Reliable
4. Formatting constraints – The online module will be an area for candidates to log in and interact with the material, whether it be through readings, quizzes or mock exams

    a. Req: Consistent
5. Web Developers - We require web developers to create, operate, and maintain our online module through which we distribute our review materials to our candidates
    a. Req: Qualified, effective

Outputs

1. Exam Information – When the review material is released we will have a set time for when to candidates need to take the exam, that way we can continue forward and remain competitive
    a. Req: Clear, accurate
2. Online Module - This is the platform we will release our review material. This is crucial to our certification process as it will prep our candidates for the exam
    a. Req: Informational, comprehensive
3. Established IT team – The IT team is to ensure that the online module will be up and running at all times
    a. Req: Reliable

Step 4: Standardize Test

Inputs

1. Question format – The question format needs to be a large part of this process, if the exam is vague or ambiguous in the wording of questions it begins to lose validity, creating challenging and fair questions will be an arduous process, but necessary
    a. Req: Unbiased, Standardized
2. Cohesive panel of experts - The panel of experts will be used to help make the test standardized. The panel will be responsible for creating the percentage makeup of the exam by question type
    a. Req: Qualified, Cohesive
3. Difficulty level of questions - In order for our test to be standardized, our questions should vary in difficulty
    a. Req: 3 levels: easy, medium, hard

Outputs

1. Unbiased Exam – Now that we have completed standardization we have an exam that remains competitive and valid for employers to put their trust in
    a. Req: Unbiased
2. Sent to third party handler - In this step of the process, our exam has been created and our review materials have been distributed. Exam day is approaching, and to prepare all the necessary testing materials, we decided to outsource the task of printing all the exam materials
    a. Req: Trustworthy, credible

Step 5: Materialize Exam

Inputs

1. Unbiased Exam – In this step we refer to the actual process of printing and compiling the exam, exam questions should be randomized in order and should not be the same
    a. Req: Final
2. Format – By now the format will be established, and it will be decided how many questions will be on the exam, the amount of essay questions
    a. Req: Consistent
3. Third party printing service - In order to prevent issues that could potentially arise on exam day (i.e. not enough exams printed, incorrectly printed exams) we will hire a third party to take care of that task
    a. Req: Professional, reliable
4. Number of candidates taking exam - This is an important piece of information for us as we would like to have enough exam materials as well as conserve materials
    a. Req: Accurate

Output

1. Paper Exam – The exam will now be properly prepared, randomized and securely transported to the exam location
    a. Req: Consistent, Secure
2. Paper Answer Key – Along with the exam an answer key and scoring system will be made available for the grading panel
    a. Req: Accurate, Unbiased

Process Step	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN	Actions Recommended
Write Exam	Exam questions leaked, the exam questions are poorly written and are worded in ways that are hard to comprehend the full extent of the question.	Loss of credibility, invalid exam, candidates achieve a lower score than expected on exam	8	Lack of security, unqualified writers that were not chosen through screening process	4	Writers remain unknown, separate location,	7	224	Contracts for writers, exam questions are carefully reviewed by secondary comprehenisve panel
Maintain Item Bank	Insufficient information, as far as the exam not encompassing the entirety of the knowledge needed for the certification.	Industry standard not met, invalid certification that is not recognized by any standard and cannot be used in most jobs that require certification	8	Inexperienced panel of experts, not taking input from industry	4	Continuous industry survey, updated experts	7	224	Surveys, workshops, Use QFD and HOQ to obtain voice of the customer
Provide Review Material	Not provided in time, provide material is not parallel with the examination itself, if web-based material then it could be glitchey and not user friendly.	Unprepared candidates, invalid scores, negative feedback on the certification program as a whole.	7	Lack of communication, exam not prepared to provided parallel study material, inexperienced web-designers/ programmers	4	Communication with writers and review team, updated programmers that have more experience in user-friendliness	7	196	Implement selection process screening for computer specialists, IT team constantly monitoring online material
Standardize Test	Different forms of the exam, exam questions are to specific, exam questions are biased.	Unbalanced scores, lack of credibility, exam not standardized/too complex for even above average candidate.	7	Miscommunication by creators, bias from panel of experts, disagreements in panel of experts	4	One group of exam writers,	7	196	Create a pool of questions of different difficulty and content. Ensure that the randomized test is always at the same standard difficulty level.
Materialize Exam	Exam not formatted properly, unable to print, printer or printing station does not work properly by the exam date, paper exams are mishandled by the carrier.	No paper exam, unable to test candidates, not enough paper exams to go around for every candidate, exam date is pushed back to later date.	7	Exam not prepared, printer or printing station does not work properly by the exam date, paper exams are mishandled by the carrier.	4	Making exam deadline, team to print exam	7	196	Print in same location, arrange all exams materials via third party, ensure printer passes inspection

FMEA Potential Failures:

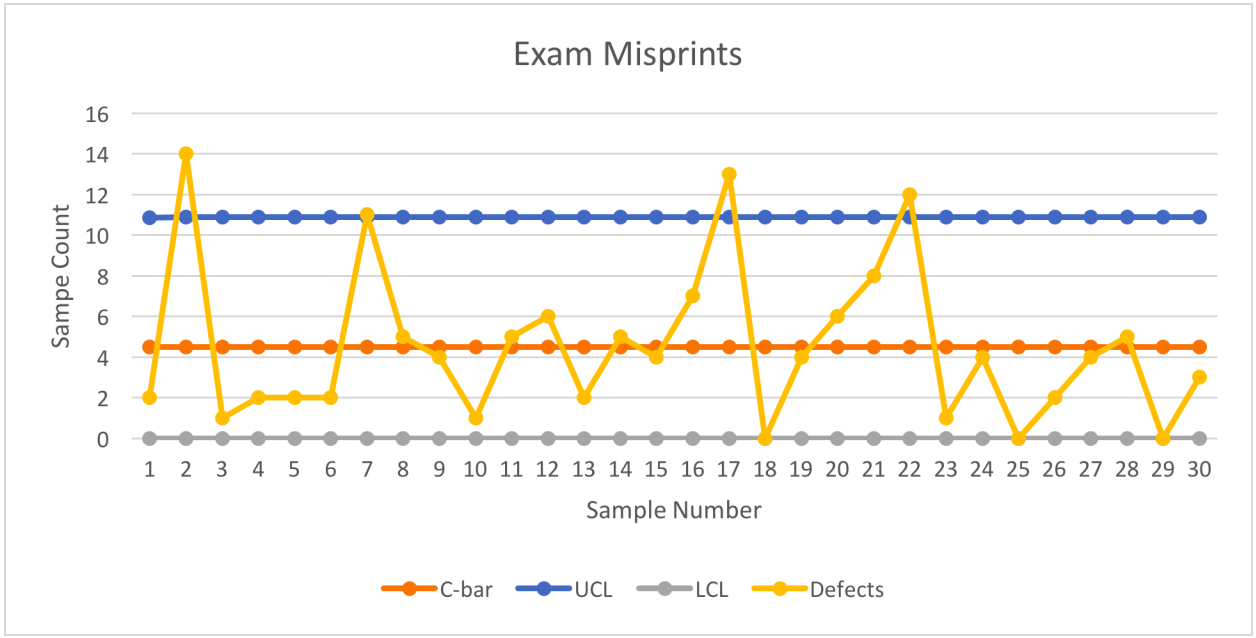
1. Write Exam: For the first step in the FMEA, the exam questions could be leaked due to a lack of security when submitting potential questions. Security could be reinforced by enforcing a zero-tolerance policy and having writers sign a contract. The exam questions could also be poorly written, meaning that they are written in ways that would be overly challenging for the majority of the candidates to comprehend. This could be caused by obtaining unqualified writers and a way to fix this would be to use a rigorous selection process for choosing the writers and/ or have the questions reviewed by a secondary panel of experts for comprehensiveness.
2. Maintain Item Bank: The exam may not end up encompassing the entire scope of the information needed to obtain a certification that meets industry standards or customer needs. This could be caused by using an inexperienced panel of experts and could be corrected by continuously taking surveys from industry, creating workshops or using the House of Quality and Quality Function Deployment to obtain the voice of the customer.
3. Provide Review Material: The review material has the potential to not completely match up with the examination and the study modules may become glitchy and therefore will impact user-friendliness. This potential failure could be the cause of unprepared candidates and invalid scores, which will develop a negative perspective on the certification program as a whole. A way to address this issue could be assigning an IT team that constantly monitors the website and modules.
4. Standardize Test: Exam questions could potentially be biased or too specific and could make it very subjective and/or to complex for the average candidate to comprehend. A solution to this could be creating a question bank that has questions with varying difficulties. When selecting the questions from the question bank, we would have to ensure that the all the question's difficulties sum up to the same standard difficulty for each exam version.
5. Materialize Exam: The formating of the online text of the exam could be incompatible with the print format, which would delay the materialization of the exam. Also, the printer that is being used for the exam may need to be serviced or may be out of order. In order to prevent this failure mode, we could arrange all exams via third party and make sure the printers pass inspection. This would ensure that there will be enough paper exams for every candidate and that the exam date will not be pushed back.

	Customer Defectives	Count	Total		Process Defects	Count	Total
A.	Compromised Exam	100	100	W.	Lack of Security	200	200
B.	Item Bank	10	1,000	X.	Irrelevant Information	10	2,000
C.	Exam Format	50	50,000	Y.	Different Forms of Exam	10	20,000
	Defect A-B-C opportunities/unit:	10			Defect W-X-Y opportunities/unit:	10	
	Total A-B-C opportunities:	500,000			Total W-X-Y opportunities:	200,000	
	Defect A-B-C actuals:				Defect W-X-Y actuals:		
	Questions Leaked	200	0%		Mishandled Exam	200	2%
	Incomplete Information	130	0%		Unknown Questions	500	2%
	Biased Format	175	0%		Area Specific Questions	100	2%
	Total A-B-C defects:	505			*Total W-X-Y defects:*	3,600	
	Total Opportunities	3,011,000			Total Opportunities	2,222,000	
	Total Defects	505			Total Defects	44,040	
	DPU:	0.00			DPU:	0.22	
	DPMO:	168			DPMO:	19,820	
	Customer Defectives Sigma Sc	**5.09**			**Process Defects Sigma Score:**	**3.56**	

Continuous Improvement

In order to analyze the process of building the exam (and questions), data was gathered over the course of the development of the exam and then modeled by the control charts below. These are C-charts, attribute charts which measure the control of a process as its data is being received. This creates a method to measure process control over time during the exams development.

These charts show how the process, measured by the number of nonconformities per item or group of items, changes over time. Nonconformities are defects or occurrences found in the sampled subgroup; defects in our chart represent misprinted exams. In our case, we have labeled the nonconformities to be exam misprints which occur during the "materialize exam" step. Looking at both of these charts, we can see in the first year, our process of materializing the exams produced three instances of nonconformities per sample outside of our calculated control limits. To adjust, we outsourced to a specialized third party vendor. These adjustments can be seen in the revised chart within the second year. This consistency means that the process of materializing the exam is running at a very efficient level and any changes should be only to promote even better quality.


Exam Misprints
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16
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8
6
4
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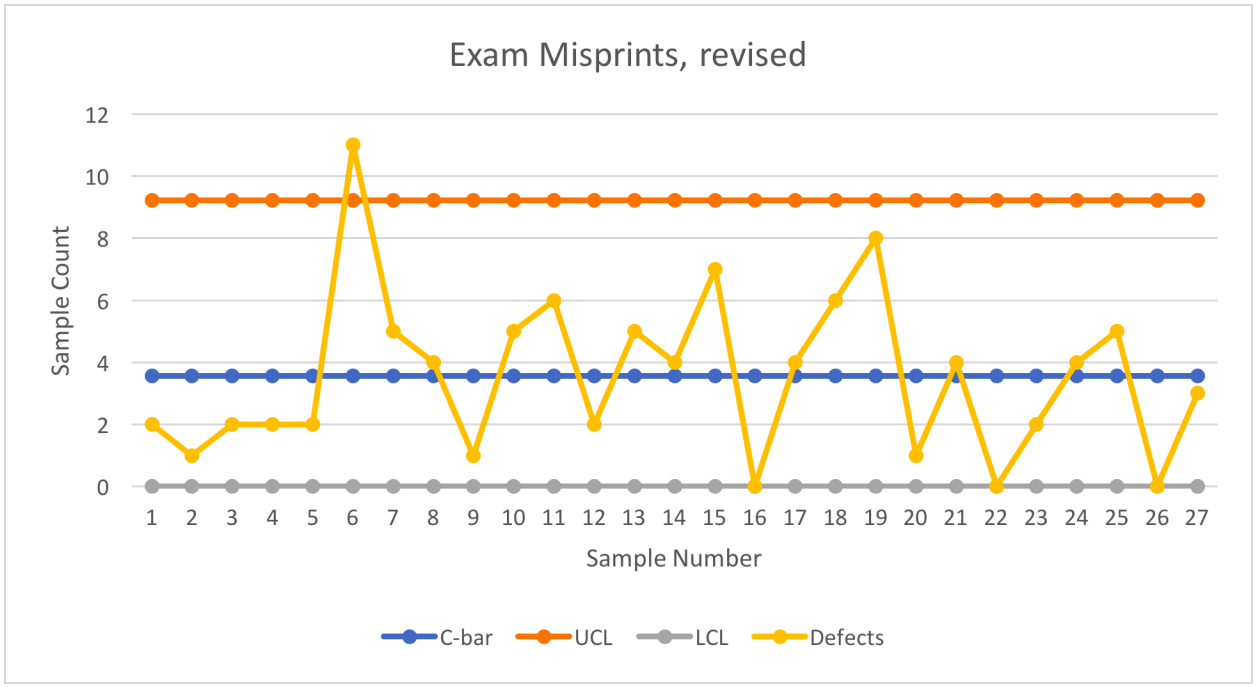
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Sample Number
C-bar
UCL
LCL
Defects


Exam Misprints, revised
Sample Count
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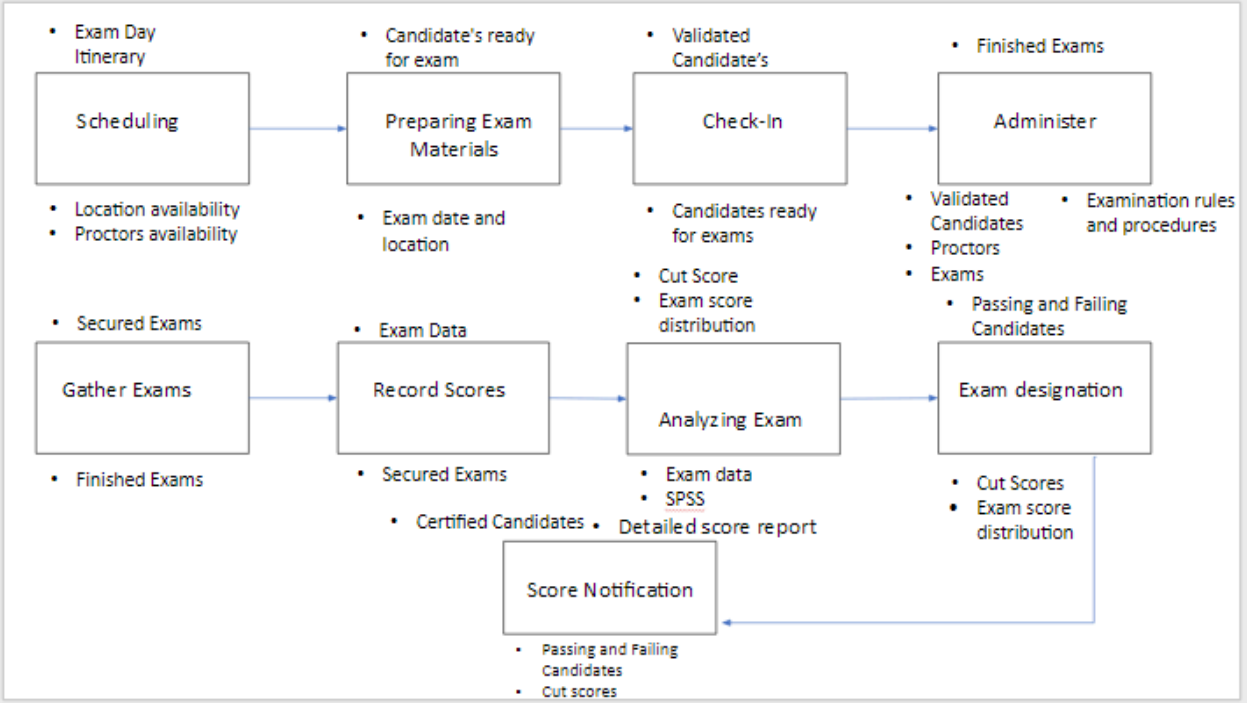
10
8
6
4
2
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Sample Number
C-bar
UCL
LCL
Defects

Process 5: Administer Exam



Step 1: Scheduling

This process step will assemble all the necessary requirements prior to administering the certification exam. The items being addressed in this step include the location of the exam, the proctors administering the exam, and all the procedures that follow with it.

Inputs

1. Proctors availability- proctors will have to submit their availability to ensure proctors will be available for exam date. Proctors will also need to be up to date with all testing rules and procedures. Testing environments must remain neutral to ensure fairness and consistency
    a. Req: Available, Qualified, Unbiased
2. Location availability - Obtain possible exam locations availability and pick location that will best fit proctors availability. A location will need to be found where candidate can take their exam that is large enough for all the candidates. In addition the environment of the exam needs to be suitable so candidates are not hindered by poor conditions. This would mean ensuring the correct level of light, tolerable temperature and directions to get arrive.

a. Req: Established, Clear

Outputs

3. Exam Day itinerary - A itinerary for the exam day will be available for candidates, including rules and procedures for taking the exam, how and where to access results of the exam, and any other additional information that may be useful to candidates seeking certification.
    a. Req: Through, Clear, Understandable

Step 2: Preparing Exam Materials

This process step will prepare all testing materials for the administering of the exam. Candidates and proctors will receive testing date, time, and location. Additionally, proctors will receive the exams in advance so that they may be able to set up all testing locations on the exam day.

Inputs

1. Exam date and location- exam date and location will be selected weeks in advance of examination date, and all exam material will be delivered to proctors in advance.

Outputs

1. Candidates ready for exam - will be ready to take their exams, proctors will be prepared to administer the exam.

Step 3: Check-In

This process step is the last check before the administration of the exam. Proctors will ensure that all candidates seeking certification are registered with the certification program, all candidates have all the necessary items needed to take the exam (i.e. pen, pencil, exam booklet, scratch paper), and that all the preparation work in the two previous steps have been put into place correctly.

Inputs

1. Candidates ready for exam - candidates will have to check in with a valid form of ID, proctors will verify candidates Identities to ensure no one will take the exam for someone else.

Outputs

1. Validated Candidates - only those authorized to take exam will; keeping certification credibility secure.

Step 4: Administer

This process step is one of the most crucial to the overall certification process. This step must be precise, accurate, and controlled. Proctors will administer the exams to those candidates who have checked in at

the testing location and the candidates will attempt to prove they have a strong knowledge base in the certification they are seeking.

Inputs

1. Validated Candidates - Once candidates are validated, prepped, and seated, the proctors will begin the administering the exam in accordance to the rules and procedures given to them
    a. Qualified, On time
2. Proctors- Proctors will help administer exams before exam
    a. Helpful, Unbiased
3. Exams- exams will passed out once everyone is seated and quiet
    a. Req: Unbiased, Standardized
4. Examination rules and procedures- before the exam starts, proctors will explain rules and procedure and answer any questions, once addressed candidates can start
    a. Req: Established, Clear, Understandable

Outputs

1. Finished exams- After the allotted time for the exam has passed, the proctors will stop the examination. All candidates will stop working and wait for proctors to collect the finished exams
    a. Req: Secure,

Step 5: Gather Exams

This process step will be responsible for collecting all testing materials in a secure manner. Proctors will make sure all candidates stop working after time has been called, and will proceed to gather each exam booklet and all scratch paper.

Inputs

1. FInished exams - All exams are collected in accordance with the rules and procedures given to proctors to ensure the security of the exams. All instances that occur in violation of said rules and procedures will result in an invalidated exam.

Outputs

1. Secured exams- All exams materials will be collected and ready for scoring. Any and all invalidated exams will be also noted and sent to scoring committee.

Step 6: Record Score

This process step will extract all the raw exam data from the testing materials. Exam booklets will be scanned for analysis, all invalidated exams will be identified.

Inputs

1. Secured Exams- Testing materials from examination will be secure and untampered. It is imperative that all exam materials are left within the testing location to ensure privacy of candidates and validity of exam.

Outputs

1. Exam Data- Exam booklet data from each candidate will be ready to be submitted to scoring committee.

Step 7: Analysis Exam

This process step includes analyzing all exam booklets from the examination. All raw scores and responses will be recorded and submitted to scoring committee, which will then determine the merit of each answer/response of each candidate.

Inputs

1. Exam Data - The database with exam answers and responses will have identifying information, including testing date, time, location, and name of candidate.
2. SPSS - Using this commonly used statistical software to help analysis exam scores

Outputs

1. Exam score distribution- Using SPSS, a statistical software, the scoring committee with conduct a statistical analysis of the scores from the examination. The distribution of scores will be distributed.
2. Cut scores- cut scores will be created, to help better understand exam questions and determine pass or fail

Step 8: Passing and Failing

This process step will determine which candidates passed the examination. The determined cut score will be used to filter candidates into two pools: passing and failing. A third pool of candidates will be created for all those who received an invalidated score.

Inputs

1. Exam Score Distribution and Cut Scores - Using the statistical analysis and cut score a pass/fail/invalidated designation can be created.

Outputs

1. Passing and Failing Candidates- Each exam will earn either a pass, fail, or invalidated designation.

Step 9: Scoring Notifications

This final process step notifies the candidates of their performance on the exam. Notifications will be sent confidentially with information on how to view feedback from scoring committee.

Inputs

1. Passing and Failing Candidates - Using candidates' emails, emails will be sent out with an encrypted link to view the results of the exam. All exams will have a raw score as well as feedback from scoring committee for the free response section of the exam.

Outputs

1. Certified Candidates- Passing students will receive certification, failing and invalidated candidates will not. Each candidate will receive a formalized report of their score, analyzing which areas they performed best and poorly in.
2. Detailed score report- A report will show the rubric and how points were awarded and which questions were dismissed.

Process Step	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN	Actions Recommended	Actions Taken	SEV	OCC	DET	RPN
Scheduling	No testing location availble No proctors available	Causes students exam to be invalidated.	3	Poor scheduling and/or organization	9	None None	4	108	Extensive planning Extensive interviews of potential proctors	Predetermine where exam will be taken before program begins	3	9	4	108
Preparing Exam Materials	Exams are misplaced Exam materials are tampered with	Allows the students to converse items on the test.	5	Inproper proctoring Misconduct by proctor/candidate	2	None Proctors must collect all exams	4	40	Strictly enforce testing rules and procedures	Chain of custody maintained	5	2	4	40
Check-in	Candidates do not bring necessary ID	someone isnt able to take the exam	7	Candidates not properly informed	5	Require candidates to show ID to take exam	8	280	Canidates have to submit photo cpoies of ID's;	When candidates apply to program, the must upload copies of their ID's	7	5	8	280
Administer	Not enough exam materials Improperly proctored Candidates/Proctors violate testing	Some candidates cannot take exam Loss of validity to certification	7	Poor coordination Poor proctor	4	None Testing rules and	7	196	Have a surplus of exams Replace poor proctors	Have extra materials in case some are damaged, or miscounted	7	4	7	196
Gather Exams	Not all exam materials are collected Collected exams are not secured	Exam details leaked, candidate not scored Exams lost or tampered with	7	Poor proctoring	4	None None	7	196	collected before candidates leave exam location Hire third party to ensure	Exams wil be counted before candidates are released	7	4	7	196
Record Scores	Error in score recording Illegible responses	Questions validity of exam processing Unable to score exam accurately	7	Malfunction in exam scanner Poor legibility	4	Automated scanning None	7	196	Recalibrate exam scanner	Re grade exams twice	7	4	7	196
Score Notification	Scores not kept confidential	Destroys credibility of certification program	7	Incorrect contact info for candidate	4	Login required to access score report	7	196	Invalidate entire examination	Candidates must confirm date of birth to see scores	7	4	7	196

FMEA Write up:

1. Scheduling - One of the most important factors for the certification process is to have a location picked out before the program beginnings, if the program can't find a location to proctor the exam early on, the exam could be in jeopardy of not being taken by all candidates on the same date because of candidate's availability to make it. We want to have all our candidates take the exam on the same data to avoid exam questions being leaked to people who haven't taken it at the same time as everyone else.
2. Preparing Exam Material- Whenever exam material are made, a chain of custody will be maintain so everyone who manages the test materials can be held liable if material were to be lost or stolen
3. Check in - Candidates are required to check in with a valid government issued ID, to avoid the hassle of someone possibly forgetting their ID, candidates will also be required to upload 3 forms of photo ID just in case they were to forget their ID's on exam day.
4. Administer- We will send confirmation email will be sent out days prior to exam date to have candidates confirm that they will be taking the final exam. Proctors will be give a specific amount of test of the total number of candidates with a surplus of 10 just in case exams are destroyed or misprinted.
5. Gather Exams- After candidates are finished with their exams, they will wait for proctors to comes around and collect all exams, once they are all collected and counted, then candidates will be released.
6. Record Scores - So scores can be scored correctly, exams will be scored twice by different individuals to insure nothing was missed or scored incorrectly
7. Score Notification - After exams have been scored, emails will be spent out with a link to a secured browser, once they are redirected to the secure browser, candidates will have to confirm their date of birth so that it will ensure they are looking at the correct score.

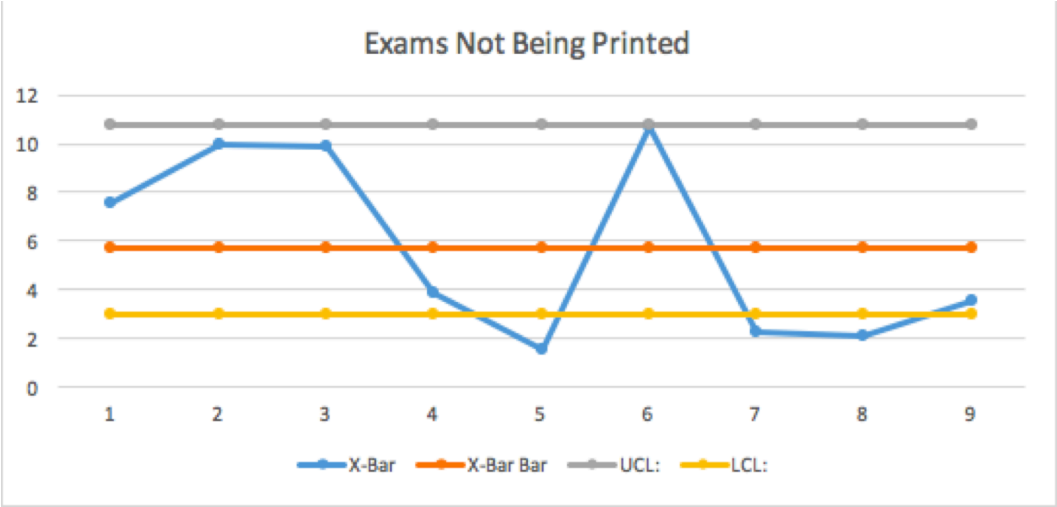
	Customer Defectives	Count	Total		Process Defects	Count	Total
A.	Exams	1	1	W.	Exams	200	200
B.	Questions	150	150	X.	Answers	150	30,000
C.	Poorly Written Questions	5	750				
	Defect A-B-C opportunities/unit:	10			Defect W opportunities/unit:	9	
	Total A-B-C opportunities:	10			Total W opportunities:	1,800	
	Defect A actuals:				Defect W actuals:		
	No correct answer	5	1%		incorrect answer	40	20%
	Exam paper issue	5	2%		no answer	16	8%
	Incorrect wording	5	2%		more than one answer	40	20%
	Typos	5	2%				
	Total A-B-C-D defects:	25			*Total W-X-Y-Z defects:*	96	
	Total Opportunities	46,510			Total Opportunities	301,800	
	Total Defects	45			Total Defects	6,216	
	DPU:	0.01			DPU:	0.21	
	DPMO:	968			DPMO:	20,596	
	Customer Defectives Sigma Score:	**4.60**			**Process Defects Sigma Score:**	**3.54**	

In the sigma score calculation above, we focused on the formatting and questions on the final examination. We used 150 for the count to serve as a model for the amount of questions that the exam will contain. These defects are more focused because they will have a large impact on the outcome of the exam. If we have an immense number of defects the exam will lose validity, making no purpose for the certification.

We know that there will be discrepancies in questions, we get a better idea by recording and analyzing statistics after the exam has been administered. If questions are not relevant, poorly worded or region specific they will either be removed or the cut score will be adjusted accordingly. Input should be taken from the employer in the analysis of the exam to help decide if irrelevant questions need to be removed as well as highlight skills that are important to achieve by becoming certified.

Continuous Improvement

The control charts show that when we were administering exams we had a problem, where there would be days we would not have exams for the candidates. When we were calculating our Six Sigma score we had about 2% of exam paper issues, we were averaging 5 misprinted exams for every 200. A way that we decided to fix these problems is to print an excess amount of exams on the day of administering the exam, this allows us to never have a shortage of exams for the candidates. The control charts show the before and after effects of the decision we made for the program. The controls that were added to the process changed the outcome for the charts, the controls changed the process from falling out of control into the process to fall in control. When looking at the charts after the controls were added, it can be seen that the correct decision was made in the projected outcomes.


Exams Not Being Printed
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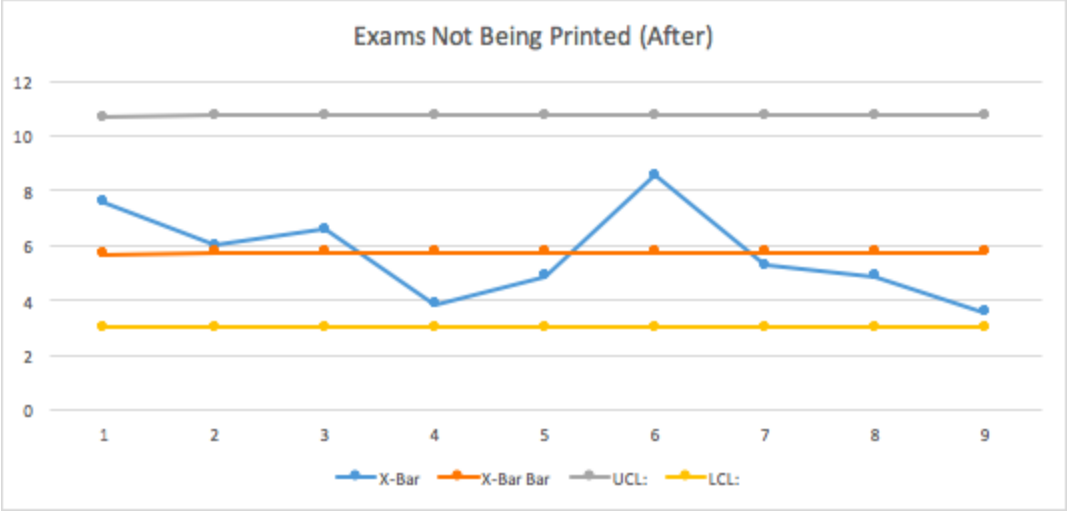
Exams Not Being Printed (After)
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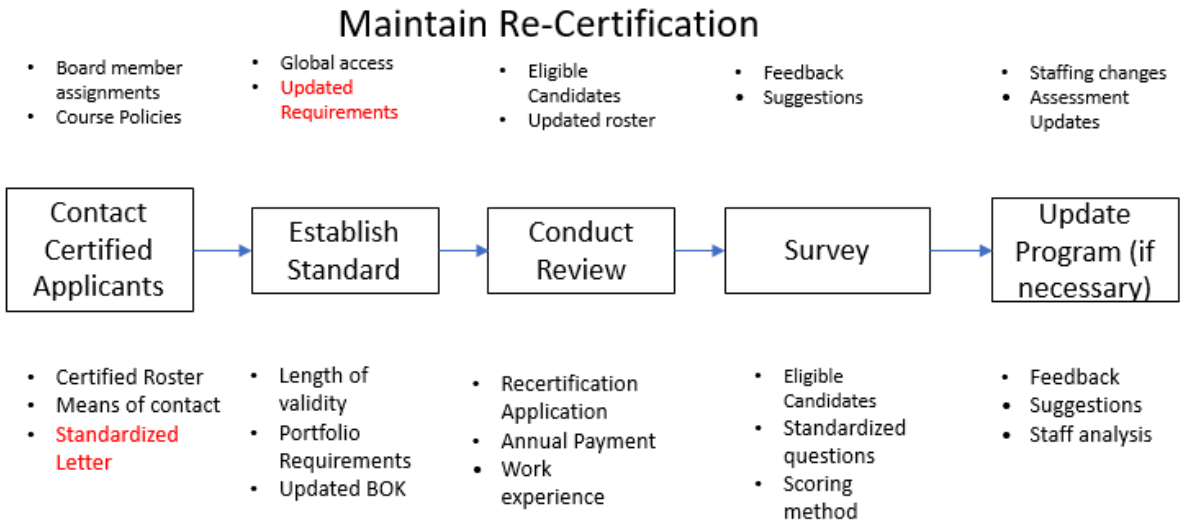
Process 6: Maintain Re-certification



The Maintain Re-Certification step analyzes the importance of bringing customers back into the program. The Re-Certification of a program is what keeps the program relevant and updated. To maintain re-certification, many steps must be taken to assure that the program keeps progressing.

Step 1: Contact Certified Applicants

The first step to maintaining re-certification is to have a process which contacts the individuals which are already certified and letting them know it is time to re-certify.

Inputs

1. Certified Roster – Collect a roster of individuals which have received the certification in the past.
    a. Req: Accurate, current
2. Means of Contact – Staff gathers the necessary information needed to contact the individuals in the certified roster.
    a. Req: Valid, Up to Date
3. Standardized Letter - A letter is to be drafted which can be sent to every certified applicant, it should be standardized to efficiently reach out to more constituents.
    a. Req: Concise, Welcoming

Outputs

1. Board Member Assignments – After the board is gathered, it is important to delegate assignments to each board member.
    a. Req: Measurable
2. Course Policies – The course policies are reviewed by the board and determined to still be valid or not.
    a. Req: Defined, Clear

Step 2: Establish Standard

The next step the program must assess is to review the current standards of the program and determine which parts need to be updated due to research.

Inputs

1. Length of Validity – The length of which a certification is valid must be standard to every person who gains the certification, but also must be evaluated to see how often the field undergoes major changes.
    a. Req: Reasonable
2. Portfolio Requirements ¬– Each individual applying for re-certification must turn in a portfolio which shows their work relevant to the program which would allow them to be re-certified.
    a. Req: Exclusive, Specific
3. Updated BoK – The body of knowledge must be assessed in order to determine its validity. The BoK must be updated to provide an accurate representation of the program's subject matter.
    a. Req: Accurate

Outputs

1. Global Access – The new standards of the program must be available to anyone interested in applying.
    a. Req: Available, Easily Accessible
2. Updated Requirements – After updates, the requirements for a re-certification will need new requirements to keep the integrity of the program.
    a. Req: Restrictive

Step 3: Conduct Review

After establishing a new standard, the program must withhold a review to decide if people who have earned the certificate already are up to the new standards.

Inputs

1. Re-certification Application¬ – Individuals which already have the certification are required to re-apply in order to gain re-certification.
    a. Req: On-time, Up to Standard
2. Annual Payment – To keep the program going, and keep staff members' salaries, an annual payment is taken from those which have received the certification.
    a. Req: Affordable, On-time
3. Work Experience – Certified members are to submit work experience which proves they have stayed up to date within the subject matter of the certification.
    a. Req: Relevant, Important

Outputs

1. Eligible Candidates – After the review is done, a new list of those who have received the certification in the past is created with those who still meet the newest standards of the program.
    a. Req: Exclusive, Fair
2. Updated roster – an updated roster of newly eligible candidates can be used by the program to assess if the new standards changed membership.

a. Req: Accurate, Extensive

Step 4: Survey

In this step, a survey is sent out to those members did and did not recertify. This survey is to assess what could improve within the program.

Inputs

1. Eligible Candidates – Those candidates which are eligible for re-certification will be asked to fill out a survey to see where they think the program can improve.
    a. Req: Concise
2. Standardized Questions – Each survey should be the same in order to focus on certain aspects of the program. Each survey would also have a section for free response to get honest feedback.
    a. Req: Relative
3. Scoring Method – A scoring method must be standardized in order to accurately determine which parts of the program must be assessed first.
    a. Req: Standard

Outputs

1. Feedback – the surveys will give feedback which the program will use to make changes within the program.
    a. Req: Thorough, Constructive
2. Suggestions – Customers will offer suggestions in the free response area so the program can focus on certain areas.
    a. Req: Constructive

Step 5: Update Program

The severity of this step is determined by the answers given in the surveys. The program up to this point has already been changed and updated, in order to keep our customers happy, it is important to get their feedback and act on anything outstanding.

Inputs

1. Feedback – The feedback that is received from the previous step is used to make upgrades.
    a. Req: Thorough, Constructive
2. Suggestions – The free response answers given by customers will be used as customer service.
    a. Req: Constructive
3. Staff Analysis – After feedback and suggestions are reviewed, it is important to review staff to tackle any necessary changes.
    a. Req: Thorough, Fair

Outputs

1. Staffing Changes – This step is an “if necessary”, from feedback and suggestions from customers it is important for the program to look inwards and make any changes necessary.
    a. Req: Accurate

2. Assessment Updates – The feedback and suggestions might have updates which will help update the effectiveness of our certification program.
    a. Req: Thorough

Maintain Re-Certification FMEA and Six Sigma Score

The possibility to fail is always present in any process. It is important to have plans in place to make sure these failures do not occur. The FMEA is a tool that can be used to predict these possible failures and take preemptive measures. The first step, Contact Certified Applicants, can fail if certified applicants are not reached. If the applicants are not reached, the certification program will lose business and would suffer major losses. Reasons which would cause this failure would be an unresponsive candidate as well as incorrect and outdated contact info. Although you cannot make an applicant respond, incorrect contact info would be the fault of the program, as they should verify the information. Verification of the information could prevent this failure.

The second step is to Establish Standard. This step potential failure would come if there is no agreement reached by the Certification board or if the program does not meet the international guidelines. This failure could potentially cause the certification program to become outdated and irrelevant. The cause of this would be if the certification board became complacent and performed poorly.

The third step is to Conduct Review of the current applicants. This review could fail if the program had incomplete data or if candidates were overlooked. This failure would also lead to loss of business as well as an incomplete review. This failure can also be attributed to a complacent, poor-performing certification board.

The next step in the process is to Conduct a Survey. The survey is made to keep the program up to the standards of its constituents. The survey could fail if candidates did not fill it out or if the survey presented a bias. The process would then suffer due to a lack of information and feedback. Reasons for the survey failing could be the time of the day that candidates were reached or if the survey itself was written poorly.

The last step of the process is to improve the program. From the surveys, the program could then look in and improve itself. The ways this step could fail would be if feedback was inconsistent or irrelevant, or if no improvements were needed. The effects of this step failing would cause customers to be upset due to no progression and failure to meet the customer's needs.

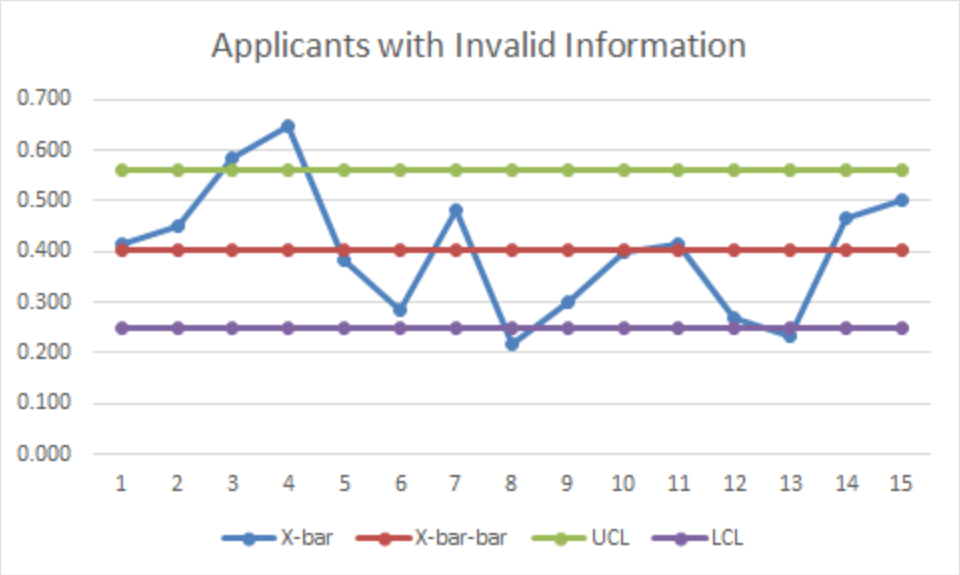
Process Step	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN	Actions Recommended	SEV	OCC	DET	RPN
Contact Certified Applicants	Contact Info is Outdated/incorrect	Certified members cannot be reached	8	Unclear registration	3	Examples/Employee training	7	168	Verification of Information	8	3	7	168
Establish Standard	Agreement cannot be reached among board International guidelines not met	Standard is not updated	4	Disagreement Guidelines not met	5	Mediation Strict updating code	7	140	Have someone there to help mediate board members	4	5	7	140
Conduct Review	Applicants overlooked Annual payment from members is not collected	Applicants not contacted Cannot pay employees	9	Failed payment method	5	Multiple methods of payment	7	315	Accept any form of payment	9	5	7	315
Conduct Survey	Certified members do not take survey (or do not take it honestly)	Program does not receive any feedback	4	Not correctly administered	4	Necessary step in process	7	112	Survey is part of assessment	4	4	7	112
Improve Program	Program failed and needs complete overhaul	Program starts from ground 0	10	Program was not up to standard in first place	2	Quality checks throughout entire program	7	140	Be thorough in quality checks	10	2	7	140

	Customer Defectives	Count	Total
A.	Poor Survey	100	100
B.	Does not meet Standards	20	2,000
C.	Does not pay fee	15	30,000
	Defect A-B-C opportunities/unit:	3	
	Total A-B-C opportunities:	90,000	
	Defect A-B-C actuals:		
	Survey filled out incorrectly	900	3%
	Standards not met	1,500	5%
	Fee not payed	2,400	8%
		0	0%
		0	0%
	Total A-B-C defects:	4,800	
	Total Opportunities	90,000	
	Total Defects	4,800	
	DPU:	0.16	
	DPMO:	53,333	
	Customer Defectives Sigma Score:	**3.11**	

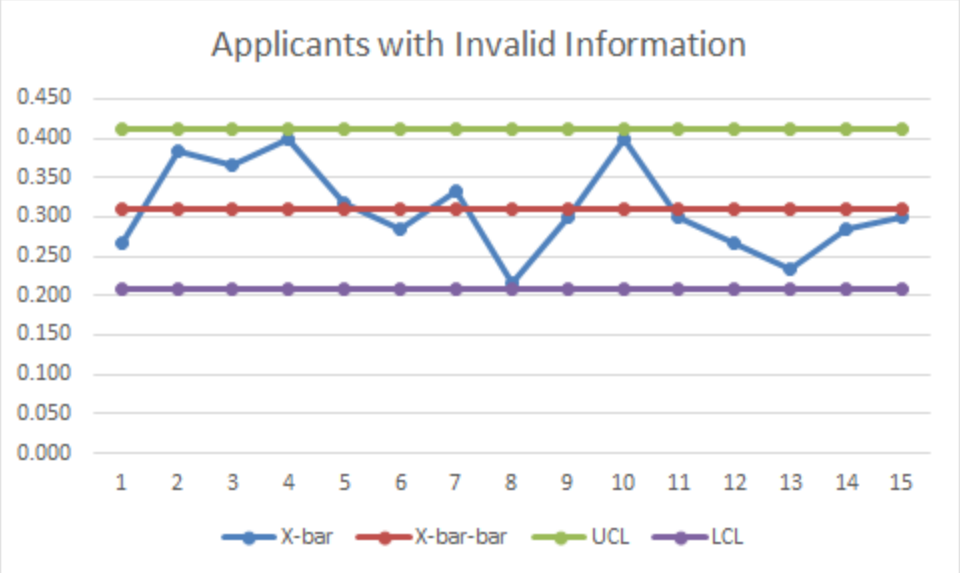
Continuous Improvement

While working to get certified members to re-apply and gain certification again, we found some members were not responding to our efforts to contact them. Upon further investigation, we found certified members either incorrectly input information, or the information was outdated. This was a major failure in our FMEA with the action we recommend to include a section within the application process which asks the user to verify their contact information. In this step, the computer can then determine if the information input at the beginning is the same as the information input at the end, the user would then be notified if a difference was found. Fifteen trials were taken to determine the number of applicants with invalid contact information. Before the verification step was added, we found that, on average, about 4 out of every 10 members had incorrect information. After the verification step was added, that number decreased to about 3, and so the recommended action proved to make a difference in the process.

Before Recommendation:



After Recommendation:



Conclusion

Our team was asked to design a new certification program that will be launched over the next two years. In the above report we defined the basics of the program and continued to work out all of the details in the measure and improve phase of the report. While designing the program we kept in mind the main

goals of the program such as high retention/pass rates, workplace recognition, and others such as security. These goals were central to our thinking in the analyze phase above. To design a formidable program, we worked as a group to make sure the design was comprehensive and all aspects were explained explicitly.

In the beginning planning stages the design implemented a strategy for marketing the program in an attempt to increase the amount of applicants. As the team began to research more we believed the best decision was to have a third party implement their own marketing strategy, leaving the team to focus on the engineering of the actual process.

The budget for this project was not addressed during the report but the team did continue to have this in mind but ultimately designed with the idea that the budget would meet the design because of the impact it would create within the program. However the team does believe that the design above will not have to require a significant amount of money based on the changes proposed.

Our design is intended to be simple yet sufficient for launching and maintaining a brand new program. To ensure that the program is maintained properly, we have included regular analysis and built in responsibility for up-keeping the BoK. In our opinion, the BoK is the most important component of the program.

This is a certification program template, which is applicable to many different certifiable subjects. Some steps and procedures may change depending on the scope of the actual certification program.

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Appendices

Acronyms

BoK	Body of Knowledge
PMAP	Process Map