STATEMENT OF WORK

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Assignment 4

CSE 6329-002 – Fall, 2019

**DMAIC: Data Analysis and Root Cause Analysis**

**Summary**

The purpose of this assignment is for you to apply several techniques covered in the class lectures and slides:

* ***the DMAIC method*** and, in particular, root cause analysis

and

* ***data analysis***, using several of the methods discussed in the first half of the course

You will use these techniques to find the underlying cause(s) of a company’s software quality and productivity problems and to recommend solutions. The problems are as follows: customers are complaining about two things:

* **software failures are occurring more often** than in the past for some (but not all) products
* software **problems are taking too long to fix**.

This is causing some customers to threaten to switch to a different software provider, so company management is very concerned about this problem.

## Supplementary Material

There are a number of supplementary handouts (SH1 – SH11) related to this assignment that describe various facts that have been gathered about the problems. Part of your job will be to examine this material and form an understanding of the defect levels occurring in the software products and the processes used to develop and maintain the software (in particular, the process to respond to customer problems).

## Overview of work to be performed

A DMAIC plan has been developed and is in the midst of being implemented (see separate template). Your job is to continue implementing that plan, completing key elements of the Define, Measure, Analyze and Improve steps and placing them into the template.

* From the information contained in the supplementary material you will
  1. define what’s most important to the customer in the form of two **CTQs (critical to quality measures)**, one for each of the two problems.
* To better understand the customer support process you will

1. describe the software customer support process in the form of a **swim lane diagram** and an **associated table describing all people and organizations (divisions, departments, etc.) involved** and **summarizing what they do**.

* To determine why the customer support process is so slow, you will

3.1, 3.2 do a **root cause analysis** (using two or more of the methods discussed in class – module 26), and

3.3 determine root causes of the slow response problem, summarizing in a table, and

3.4 develop a **causal model** (cause map) of what factors contribute to the problem.

3.5 identify all data that is important in understanding this problem and identify any additional that you believe should be collected in order to help understand the problem.

To better understand the high defect levels, you are provided with some data on products and their defect levels

* To determine what factors might be causing the high defect levels, you will

4.1 Phase 1 -- **analyze the product data** and **defect data** provided to you (using appropriate techniques of your own choosing from the *analysis techniques* discussed in modules 13-17), identifying one or more root causes based on the data analysis. This will focus on understanding *whether there is any relationship between defect levels and* the **manager**, the **development method** or the **programming language**.

and

4.2 Phase 2 – **analyze the product data** and **defect data** provided to you (using appropriate techniques of your own choosing from the *correlation analysis* techniques discussed in modules 13-17), identifying one or more root causes based on the correlation analysis. This will focus on understanding *whether there is any correlation between defect levels and* the **release date** or the **size** of the software.

and

4.3 Phase 3 -- produce a **causal model** (cause map) of the factors that appear to contribute to the problem, indicating which causes seems to be most significant.

* After considering all of the above, you will

5.1 identify the **most important root causes** and

5.2 make **recommendations** about how to improve the organization’s processes (eliminating waste, improving value added, reducing excess work in process, changing processes, and all the other concepts discussed in this course).

(Note that the root causes and related improvements may be from any department within the company. You are not limited to the customer support department.)

The class slides provide an introduction to root cause analysis techniques as well as information on the DMAIC process, causal models, value added, data analysis, and other such concepts. Further details about root cause analysis techniques can be found in Andersen.

A separate template file contains the current draft of the DMAIC plan that has been developed for this situation. Your job will be to complete the indicated sections of that plan. The plan has the following file name:

**A04 CSE6329 2019fa - DMAIC Template.docx**

**1.0 Work to be Performed for This Assignment**

* + **(DEFINE)** *Identify two* ***CTQs*** (critical to quality measures) that measure the factors most important to the customer. Include one CTQ for each of the two problems. *Explain exactly what you will measure for each – the base measures and compound measures required*.
    - Hint 1: these CTQs may be used in your final recommendation to assess the effectiveness of your suggestions for improvement.
    - Hint 2: the CTQs may be things that are already being measured, or they could be be new things you believe that the company should measure.
  + **(MEASURE)** Explain the process involved in responding to a customer problem. Do this by describing the ***process flow*** using a ***swim lane diagram***. You may also use other diagrams such as flow charts or control flow diagrams. The swim lane diagram should **show all the departments and people** involved in responding to and correcting a customer problem and the time required for each step, thus showing the overall time line. Here are the recommended steps for doing this:
    - **People and Organizations (Division they head or Department they work for).** Examine all of the handouts to identify the people involved, what department each of them works in (or what division they head), what role they each play in the process and what they actually do. *Produce a simple* ***table of people and organizations*** listing each person, their department, their job title or role and summarizing what each of them does.
    - **Process Flow.** Determine the order in which things happen in responding to customer problems. Also determine the dependencies between different people or organizations. Use the information gathered to *produce a* ***swim lane diagram***.
    - Examine the swim lane diagram and the IPC information provided to you in the supplementary handouts to *determine places in the process where there are delays (excess work in process), work tasks that do not add value or that constitute unnecessary rework, excessively complex processes, and other factors that affect quality, cost or cycle time.* You will use this information to help with the ANALYZE step.
  + **(ANALYZE - slow response problem)**
  + Use ***two or more of the root cause analysis techniques*** discussed in the class lecture on *root cause analysis* (module 26) (or you may use other techniques discussed in Andersen) to*analyze the various possible causes* and *reach a conclusion about what are the root causes of the customer’s slow response time problem*. Here are some of the techniques you might consider using**:**
    - * Five whys
      * Fishbone Diagrams (cause and effect charts)
      * Fault tree analysis
      * Pareto charts
  + *Produce a* ***Summary of Causes table*** showing all causes and indicating their relative importance. There should be at least three causes that you consider to be root causes, although you may find more than three and you will find many intermediate and proximate causes (useful when you produce the cause map). Some of these causes are likely to be more important than others.
    - In doing this analysis, you are not limited to the customer support process described in the swim lane diagram. For example, if you determine that the root cause is in another department of the company, that’s fine.
  + *Produce a* ***cause map (causal model)*** showing all factors that contribute to the customer’s problem (root causes, intermediate causes and proximate causes).
  + **(ANALYZE - high defect rate problem)**
  + *Analyze the IPC Defect Data File (SH11)* to determine causes of the high defect rate problem, using appropriate techniques of your choice. This should be done in three phases:
    - Phase 1 – *identify relationships* between defect level and factors that might influence defect levels, notably the software manager, the software development method and the programming language. Use one or more of the following techniques for this phase:
      * Basic analysis techniques such as looking at the data, sorting, it, or graphing it in a manner that shows some correlation or other relationship.
      * Basic statistical techniques such as central tendency measures, distributions, measures of dispersion
      * Robust statistics such as box plots, bar charts, control charts and scatter diagrams
    - Phase 2 – *identify correlations* between defect level and the release date and software size, using correlation ahalysis methods such as:
      * Pearson coefficient, Spearman coefficient or more advanced measures of association as described in the course slides, or ANOVA techniques such as regression.
    - You will be evaluated on choosing appropriate techniques and using them properly. Note in particular that your case will be stronger if you use multiple techniques that point to the same conclusions.
    - You do not need to use causal techniques such as Bayesian techniques, but you will need to produce a cause map.
  + *Phase 3 - Produce a* ***cause map (causal model)*** showing all factors that contribute to the failure rate problem. This will include all root causes and any intermediate and proximate causes leading to the problem.
  + **(IMPROVE)**
  + *Produce a* ***Table of Most Important Root Causes*** based on the information in the ANALYZE steps above. Identify the most important overall root causes the company must address and explaining why each is important.
  + *Explain your* ***Recommended Solutions***, based on your assessment of the problems and analysis of the root causes.

You may explain improvements in words and should also show how you would change the processes currently used for software development, customer support, or anything else you believe needs to be improved.

**2.0 Hints**

It is not necessary to use any statistical data analysis techniques for the slow response time portion this assignment, although you may do so if you wish. However, you should do some sort of data analysis for the high defect rate problem (see list of possible techniques, above). You may choose what type of analysis and it does not have to be very sophisticated, but it does have to be appropriate and used properly.

**3.0 Deliverables**

**3.1** You will turn in a single Word file containing your DMAIC plan/status report. The file name will be:

**A4 CSE6329 2019fa - DMAIC last first.docx**

In other words, replace the word “template” with your last and first names (if you are working with a team mate, show the last name and first initial of teach team member, in alphabetical order). Note that all diagrams, flowgraphs, etc. should appear in the DMAIC plan. However, if you must reduce the size in order to make it fit on one page, see the next deliverable.

**3.2** You may turn in a zip file containing all the diagrams included in the report in their full resolution, if you found it necessary to reduce their size to fit on one page in the DMAIC document. This will enable us to examine these diagrams more closely, if necessary. The file name will be:

**A4 CSE6329 2019fa - Diagrams last first.zip**

You may draw these other diagrams in Word, PowerPoint, or any other tool you find convenient.

***NOTE: This is the ONLY time in this course where you may turn in a zip file as part of an assignment, and this zip file is optional – use only if you have a large diagram to submit and that diagram is hard to see when it is placed within a Word file.***

***REMEMBER TO COMPLETE THE COVER SHEET [first page of the template]***