6σ
The Master Book for
Lean Six Sigma Green Belt Certification

Nilakantasrinivasan J

Part One

CSSGB

Comprehensive Study Guide for Certification Exams & Job Interviews

Canopus Business Management Group

The Master Book for
Lean Six Sigma Green Belt Certification

CSSGB Comprehensive Study Guide
for Certification Exams and Job Interviews

Nilakantasrinivasan J
Canopus Business Management Group

Published by Canopus Business Management Group

For details contact:
Canopus Business Management Group www.collaborat.com
No.1, Anna Street, Ponniamman Nagar +91 9176615766
Ayanambakkam littlebook@collaborat.com
Chennai - 600095
India

Foreword

Are you looking for a compendium of references on Lean Six Sigma that is a comprehensive guide with answers for the questions that arise – this book is for you. *The Master Book for Lean Six Sigma Green Belt Certification* is a good companion to help assimilate your learning. Structured in a simple Question and Answer format, it is easy on the reader in getting answers from a practical stand point, for day to day application of concepts, certification or preparing for job interviews.

Lean Six Sigma Certification boosts career progression, from my own personal experience. However, preparation for Certification can be quiet daunting. While too many aids are available, this book covers all the topics of ASQ and IASSC Green Belt Body of Knowledge. As a certified in Lean Six Sigma Green Belt holder – you are expected to know the concepts and also be able to answer in job interviews. This Q&A format, with relevant examples and infographics, comes handy in preparing for such job interviews.

I have known Neil both professionally as well as on a personal front for more than fifteen years. He has contributed significantly to the process management community through various training programs that lead to certification, custom projects or advisory initiatives. I am sure you will enjoy referring to this book in your Lean Six Sigma journey.

Hussain Thameezdeen
Head of Operations
Qatar First Bank

Purpose of the Book

In my experience of coaching over 3000 candidates for Lean Six Sigma Certifications and having interviewed over 300 candidates for Lean Six Sigma roles, one thing I can say with conviction is that ***Six Sigma is overwhelming and a difficult subject when it comes to answers questions in exams or in interviews.*** While many practitioners understand the concepts of Lean Six Sigma, they fail to give 'right' answers in these instances. They fail to create the right impression in the interview. Instead, they leave an impression of mere familiarity, which doesn't make the cut either in Interviews or Exams.

Why this book?

While preparing for CSSGB exams of ASQ & IASSC, a learner like you encounters a lot of doubt. If you have to clear exams, you should have crystal clear understanding of all the concepts and you should know to paraphrase it in the right way. Whether you are taking objective or subjective type exams, these are critical aspects.

- As a result, this book is structured in the form of Q & A.
- All necessary concepts are explained with examples across industries. In interviews, interviewers test application knowledge; I have seen candidates drawing a blank when you ask them for an example.
- It is comprehensive and covers all the necessary topics that a CSSGB needs to know. It is drawn based on universal curriculum that maps to both ASQ & IASSC Body of Knowledge.

How to use this book?

- While preparing for CSSGB exams, reading the book sequentially will help
- Before an interview, you can brush up the topics of your choice

Structure of this Book?

As this is an in-depth study material, it is voluminous. Thus the content is split into 3 parts. While Part 1 covers, Six Sigma Overview & Define Phase, Part 2 covers Measure, Part 3 Analyze, Improve & Control phases.

Further reading?

If you wish to learn about various application aspects, tips and practical nitty-gritties, you will find out online learning courses invaluable.

For more details visit: www.SixSigmaCertificationCourse.com or www.Collaborat.com

All the best!

Nilakantasrinivasan (Neil)

Part One
Six Sigma Overview & Define Phase

Contents

Part One
Six Sigma Overview & Define Phase

Some Pages Missing

4 Six Sigma Project Charter

Identifying a Six Sigma project involves charting the key elements that will measure the success of a Six Sigma project. A project charter can provide a clear roadmap for the successful completion of a project. In this topic, you will draft a project charter. A project charter provides a clear framework for the project-specific and business goals of a Six Sigma project. In order to execute the Six Sigma project successfully, you need to apply the fundamentals of drafting a project charter.

Six Sigma Project

A *project* is a temporary work endeavor that creates a unique product, service, or result. It has a clearly defined beginning and an end. The end of a project is reached when its objectives are met, the need for the project no longer exists, or it is determined that the objectives cannot be met. Projects can vary widely in terms of budget, team size, duration, expected outcomes, and industries.

Example: The FPY Improvement Project.
Rudison Inc., a leading tape drive manufacturer, has been facing a decline in its annual sales for the past two years. With stiff competition in the industry, the company was under considerable pressure to maintain its position as a market leader. As a consequence, the company wanted to implement the Six Sigma methodology to improve processes. Based on the initial analysis, the Six Sigma team defined the first pass yield (FPY) improvement process as the Six Sigma project. The project's goal was to improve FPY from 56 percent to 94 percent within the next four months.

Characteristics of a Project

Every project has certain characteristics that differentiate it from other projects. A few characteristics are listed below.

- Projects are undertaken to create a lasting outcome.
- Projects have clearly defined beginning and end points.
- Projects have a finite time frame to produce the expected outcome.
- Projects have resources allocated according to need. The team is disbanded when the project ends with unique products, services, or results.
- Project deliveries produce products or artifacts that become the end item or a component item.
- Deliver services to business functions supports production or distribution.
- Projects produce results as outcomes or documents.

Define Project Charter

A *project charter* is a contract between a Six Sigma project team and a sponsor. It provides a clear, concise description of the business needs that the project is intended to address. Any changes to the critical elements of a project charter need prior approval from the sponsor and consensus from the team members.

What are elements of a Project Charter?

A Six Sigma project charter includes different elements such as the business case, problem statement, scope of the project, goal statement, potential benefits, tollgates, and team members.

- **Business case:** A description that provides a background of the process and product or service. The objective of the business case is to highlight the current situation and provide a justification to change the current state. The business case further highlights the urgency to change the current state.
- **Problem statement:** A description of the problem or opportunity that the project must address. It underlines the reasons for implementing the project in your organization.
- **Project scope:** A description of the scope of work that the project must include. It can also specify what the project will and will not include.
- **Goal statement:** A description of the objectives of the project. The goals of a project should be SMART: Specific, Measurable, Achievable, Realistic, and Time-bound.
- **Potential benefits:** The key benefits that would be obtained by implementing the project. They help garner the support of management to allocate necessary resources to implement the project.
- **Tollgates:** Milestones for tasks that need to be completed at each phase of the DMAIC methodology. They help in planning a project properly and completing it on time.
- **Team members:** All the people who will be part of the project team. The roles of Six Sigma team members include an approver, a resource, a member, and an interested party.

How to Draft a Project Charter?

An effective project charter clearly communicates a Six Sigma project's importance to the organization and formally authorizes the project. To create an effective project charter, follow these guidelines:

- Use a corporate template, if one exists at your company.
- Build a business case that shows the importance of the project in relation to the goals of your organization.
- Define the problem statement. Include a brief description of the opportunity or problem area that the project is intended to address.
- Include a goal statement that describes the expected results of the project.
- Include a project scope that clearly states the boundaries of the project.
- Explain what the project will and will not include.
- Include summary descriptions of the potential benefits that the project would bring to the product or service.
- Provide a list of project tollgates.
- List milestones for each phase of the DMAIC methodology.
- Include the team members who will be a part of the Six Sigma project and their roles.
- List the team members under the roles of approver, resource, member, and interested party.
- Include the amount of time that each team member would spend on the project.
- Ensure that the person who has the required knowledge and authority signs the project charter.
- Distribute the signed charter to appropriate project stakeholders, including: Project team members, Customers and, if relevant, sellers (vendors), Relevant functional managers, Finance department, accounting department, or both.

Example: Creating a Six Sigma Project Charter.

Having identified problems in the packaging process, the management of a food processing company decided to implement a Six Sigma project to rectify the problems. Management asked the Six Sigma team to create a charter that will formally authorize the project and establish its priority. The name of the project in the charter and the charter's date serves as the authorization date. The charter describes the need for implementing the Six Sigma project. It includes the problem statement, objectives, scope, and benefits of the project. The team members and their roles are also included in

the charter. Once the charter is signed, it is distributed to all the stakeholders and project managers involved in the project.

Project Name	Six Sigma Project for Reducing the Percentage of Damaged Packets		
Project Number	586930		
Process Name	Reducing the Percentage of Damaged Packets in East Coast	**Yellow Belt**	Jim
Sub-Process Name	Packaging and Logistics	**Sponsor**	David

Business Case

The average number of damaged packets has consistently increased by 30% from the past year resulting in additional staffing and facility costs of $3 million. The increasing trend of damaged packets is a bigger cause of concern because the percentage of damaged packets of our total units sold has now touched 5%. It has also resulted in an 11% dip in Customer Satisfaction Scores. If ignored, this can seriously impact top line growth.

It has been observed that increase in damaged packets in the East Coast is higher, in general. (7% in East Coast alone.)

By reducing damaged packets, the company will be able to restore customer confidence in products and use it as a competitive advantage too.

Problem/Opportunity Statement

30% increase in damaged packets is a serious business problem to be addressed immediately. The reason for the increase in damaged packets is not clear. This project aims to reduce the percentage of damaged packets to no more than 1% of the total units sold.

Goal Statement

Reduce the percentage of damaged packets from an average 7% per month to 1% per month in East Coast by November this year.

Project CTQ Details

CTQs	Unit of Measure	Target
Damaged parts	%	< 1% per month

Project Milestones

	Start Date	End Date	
Phases	**Target Date**	**Actual Date**	**Tollgate Review Date**
Define	5/1/2011	5/3/2011	5/5/2011
Measure	5/20/2011	5/20/2011	5/22/2011
Analyze	5/27/2011	5/27/2011	5/27/2011
Improve	6/30/2011	7/5/2011	7/5/2011
Control	7/18/2011	7/25/2011	7/28/2011

Roles and Responsibilities

Name	Approver	Resource	Member	Interested Party	Time Commitment
Colin	X				1 hr/wk
Jim	X	X			5 hr/wk
David			X		1 hr/wk
Amy			X		1 hr/wk
Paul			X		1 hr/wk
Walter			X		1 hr/wk
Sandy				X	0.5 hr/wk
Robert			X		1 hr/wk

Project Comments

NA

Project Charter Sign Off (with date)

Sponsor	Jim
Yellow Belt	David
Coach	This project does not have a coach.

▪ ▪ ▪ ▪ ▪ ▪

Project Scope

In the previous topic, you drafted a project charter. At this stage, you will determine the project scope at a preliminary level; it helps prevent the Six Sigma project from veering off its baseline and improvement goals. In this topic, you will develop the project scope.

The project scope determines major deliverables, assumptions, objectives, and project constraints that form the basis of decisions regarding the execution of the Six Sigma project. By developing the scope of a project, you can easily determine the timeline and cost of the Six Sigma project and reduce misunderstandings regarding the goals of the project.

The project scope is a set of agreed-upon project characteristics and boundaries that define the project and what it does and does not need to accomplish. The best way to scope a project is by

having an open-minded conversation with all stakeholders and involved parties of the project. Scoping ensures that the project team is concentrating on the best opportunity for process improvement. It is normally done by Black Belts or Green Belts with assistance from a Master Black Belt or Sponsor. In Six Sigma, Pareto charts and the In Frame/Out Frame diagram are the most common tools used to scope a project.

Example: The Scope of a Six Sigma Project in Manufacturing.
Ristell Corp., a leading garment manufacturer in the U.S., has been manufacturing printed T-shirts since 1970. In the recent past, the company faced a decline in profits and management was forced to take a second look at the existing process to improve revenue. In order to improve the process, management implemented a Six Sigma project. During implementation, the Six Sigma project team evaluated the VOC and drafted a project charter. The VOC stated that on-time shipping and image centering were the major CTQs (Critical To Quality) of the project. Based on the CTQs, the team defined the project scope, which included reducing customer complaints and providing on-time shipping.

What the characteristics of project scope statements?

A project scope statement is a statement that describes a project and what it does and does not need to accomplish. The project scope statement is created at an early stage of the project to reflect the stakeholders' common understanding of major activities to be performed in the project, and to provide a basis for future project decisions about what should and should not be included in the project. Depending upon the size and scope of the project, a project scope statement should typically include:

- Project objectives, deliverables, and requirements.
- Project constraints and assumptions.
- And, product acceptance criteria.

Example: The Project Scope Statement of a Six Sigma Project.
As part of Six Sigma implementation at Ristell Corp., the project team drafted the project scope statement as follows:

- Reduce customer complaints based on the price and period.
- Reduce on-time shipping time.

This clearly conveys the boundaries and limitations of this project. The project team excluded fabric quality from the scope statement because customers select the fabric quality in the market.

Describe In Frame/Out Frame Diagram

The *In Frame/Out Frame diagram* is a project management tool that is used to define the scope of a Six Sigma project. The tool considers three aspects: in the frame, on the frame, and out of the frame.

In the frame aspects are variables in a process that are included as part of the scope of the project. On the frame aspects are undecided variables in the process that can be treated as a parking lot for future debates during brainstorming sessions. Out of the frame aspects are variables in the process that can be excluded from the scope of the project.

How to Develop the Project Scope using In Frame/Out Frame diagram?

1. Draw a large square picture frame on a flip chart.
2. List activities pertaining to the process on sticky notes with one sticky for each activity.
3. Sort out the sticky notes based on whether they fall within the scope or outside the scope.
4. Some aspects about the scope may not be clear up front. Place these aspects on the frame for the time being.

Some Pages Missing

5 Interrelationship Digraph

You have gained knowledge about the fundamentals of project management. An interrelationship digraph is one of the tools used in a Six Sigma project for identifying relationships among different factors in a given group of data. In this topic, you will create an interrelationship digraph to determine how different factors in a given group of data are related to each other.

Once you categorize data relevant to different processes in your organization using an affinity diagram, you need to identify relationships among the different aspects in a category. By creating an interrelationship digraph that depicts the cause-and-effect relationship, you will be able to identify how different factors are connected to each other in a particular group of data when complex issues arise.

Understanding Interrelationship Digraphs

An *interrelationship digraph,* also called a *relations diagram* or *network diagram*, is a tool that depicts relationships among different elements, areas, or processes through a network of boxes and arrows. It is usually used by Six Sigma teams to understand cause-and-effect relationships among different factors of a problem.

Different factors associated with a problem are entered in boxes or written on sticky notes. Factors related to one another are placed close to each other. If any factor causes or influences any other factors, then an arrow is drawn from that factor to those affected factors. At the end of the exercise, the arrows are counted. Generally, boxes with the most arrows leading to them are the major issues. However, this is not a hard-

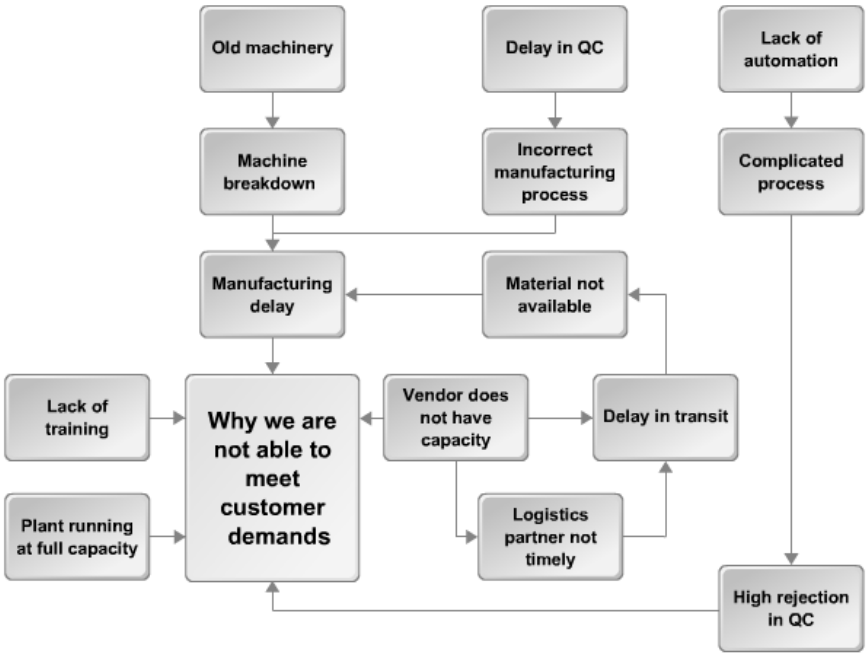

Fig : An interrelationship digraph that analyzes why a company is not able to meet customer demands

and-fast rule. Sometimes, even key issues may have only a few arrows. Therefore, no issue should be ignored. Issues that have more outgoing arrows are regarded as major causes, whereas issues that have more incoming arrows are regarded as major effects.

Share the uses of Interrelationship Digraphs?

Interrelationship digraphs are used by organizations in different situations for varying purposes.

They are generally used for:

- Analyzing any kind of relationship, besides cause-and-effect relationships.
- Analyzing complex issues involving several interrelated issues.
- Determining areas of improvement that will have the greatest impact on the organization.
- Analyzing logical relationships.
- Analyzing problems where causes cannot be organized as hierarchies or matrices.
- Analyzing a problem that is believed to be caused by another problem.
- And, developing a better understanding of the relations identified using tools such as affinity diagrams.

How to Create an Interrelationship Digraph?

To create an interrelationship digraph for identifying relationships among different factors:

1. Write the statement defining the problem or issue to be explored through the interrelationship digraph on a card or sticky note.
2. Generate all possible factors of relationships pertaining to the basic problem using:
    a. Brainstorming or;
    b. Affinity diagrams or;
    c. Fishbone diagrams.
3. Write all the identified factors on cards or sticky notes.
4. Place these cards or sticky notes on the work surface one by one after the team discusses the relationship between a card to be placed and all the other cards already placed.
5. After arranging all the cards, draw a relationship arrow from a cause item to an effect item.
6. Repeat this activity for all the cards.
7. If necessary, make several revisions to discuss and discover the cause-and-effect relationships that exist between all the factors.
8. Shortlist the factors to which most arrows point as possible factors for improvement.
9. Discuss and determine the factor that causes most of the problems.

▪▪▪▪▪▪

Some Pages Missing

Matrix Diagram

In the previous topic, you created a prioritization matrix. A matrix diagram is another important tool used in a project to identify how different categories of data are related to each other. In this topic, you will describe a matrix diagram.

One of the reasons for organizing data is that it helps you analyze data. The matrix diagram that depicts the relationship between different categories of data helps you better interpret the data.

What are Matrix Diagrams?

A *matrix diagram,* also called a *matrix chart,* is a management and planning tool used for identifying relationships between two to four groups of elements or among elements in a single group. The elements in different groups are placed in rows and columns and relationships among them are analyzed by the team. Symbols indicating the strength of the relationships are then entered in the cell where the row and column of the two elements intersect. If there is no relationship, then it is left blank. Because matrix diagrams help you analyze data, they are also extensively used in the Measure and Analyze phases of the DMAIC methodology.

What are the different types of Matrix Diagrams?

Symbol	Description
⊖	❑ Indicates that there is a primary or strong relationship. ❑ Has a high impact and carries a value of 9.
○	❑ Indicates that there is a secondary or moderate relationship. ❑ Has a medium impact and carries a value of 3.
▲	❑ Indicates that there is a minor or weak relationship. ❑ Has a low impact and carries a value of 1.
+	❑ Indicates that there is a positive relationship.
−	❑ Indicates that there is a negative relationship.
↑	❑ Indicates that the item on the left has an effect on the item at the top.
←	❑ Indicates that the item at the top has an effect on the item on the left. ❑ The arrows are usually drawn next to another symbol to show the strength of the relationship.

Matrix diagrams can be sorted into several types depending on the number of data sets being compared.

- **L-shaped** Relates two sets of elements to one another or a single set of elements to itself.
- **T-shaped** Relates three sets of elements where there is no relation between the two sets that are related to a common set.
- **Y-shaped** Relates three sets of elements where one set is related to the other two sets in a circular manner.
- **C-shaped** relates three sets of elements simultaneously.
- **X-shaped** relates four sets of elements.
- **Roof-shaped** relates one set of elements to itself.

What is a L-Shaped Matrix Diagram?

The *L-shaped matrix* is a matrix diagram that directly relates two sets of elements (say A and B) to each other or a single set of elements to itself (say A and A). Because the diagram resembles an inverted “L” with a main row and a main column, it is called an L-shaped matrix. It is the most basic kind of matrix diagram and commonly used.

	Americas	EMEA	Asia	Pacific
Misfeed rate	<40 PPM	<40 PPM	<100 PPM	<100 PPM
Multi-feed rate	<50 PPM	<50 PPM	<50 PPM	<50 PPM
Jam rate	<100 PPM	<100 PPM	<500 PPM	<100 PPM
Copy rate	100 copies per min	100 copies per min	60 copies per min	100 copies per min
Jam clearance rate	<20 sec	<30 sec	<1 min	<20 sec
Paper damage rate	<20 PPM	<20 PPM	<20 PPM	<20 PPM
Unit cost	<$5,000	<$6,000	<$3,000	<$4,000

Fig: An L-shaped matrix that summarizes the requirement for a photocopier from customers

What is a T-Shaped Matrix Diagram?

The *T-shaped matrix* is a matrix diagram that relates three sets of elements where there is no relation between the two sets that are related to a common set. Here, the sets B and C are related to a common third set, A. However, B and C are not related to one another. This matrix is called a T-shaped matrix because the main column or row is separated along the center by a single row or

2011	**L**	**H**	**M**	**L**
2012	**L**	**H**	**M**	**M**
2013	**M**	**H**	**M**	**H**
2014	**H**	**H**	**H**	**H**
Estimated Market Potential High (H) Medium (M) Low (L)	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Americas	**L**	**M**	**H**	**M**
EMEA	**L**	**M**	**H**	**H**
Asia	**H**	**H**	**M**	**L**
Pacific	**L**	**L**	**M**	**L**

column, resembling the letter “T.” The elements of the common set A are entered on the main row of the matrix. The elements in set B are on the top half of the main column above the main row and the elements in set C are on the bottom half of the main column. By analyzing the matrix in different ways, you can gather different information. The T-shaped matrix is also widely used like the L-shaped matrix.

Fig: A T-shaped matrix that summarizes the requirements for different models of photocopiers

What is Y-Shaped Matrix Diagram?

The *Y-shaped matrix* is a matrix diagram that relates three sets of elements where one set is related to the other two sets in a circular manner. . It can be formed by bending the columns of sets A and B in the T-matrix in such a way that there is an interrelation between the elements of these two sets.

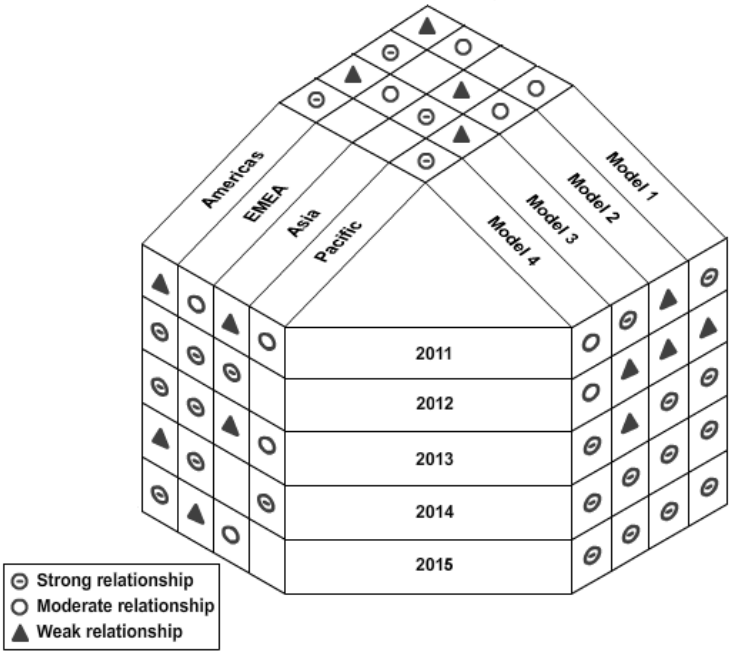

Fig: A Y-shaped matrix that summarizes the requirements for different models of photocopiers

What is a C-Shaped Matrix Diagram?

The *C-shaped matrix* is a three-dimensional matrix diagram that relates three sets of elements simultaneously. The “C” in its name stands for “cube.” Because drawing a C-shaped matrix is difficult, organizations rarely use this matrix and opt for three-dimensional models of computer software that

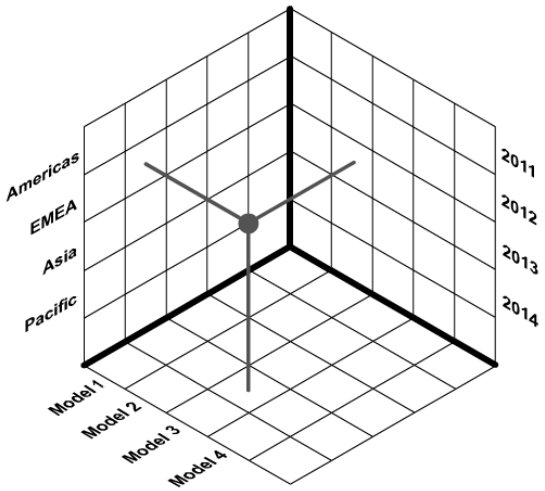

Fig: A C-shaped matrix that summarizes the requirements for different models of photocopiers

delivers a clear visual depiction if they want to compare three sets at the same time.

What is a X-Shaped Matrix Diagram?

Fig: An X-shaped matrix that summarizes the requirements for a photocopier model

The *X-shaped matrix* is a matrix diagram that relates four sets of elements. Each set is related to two other sets in a circular manner. However, each axis of the matrix is related only to the two adjacent axes and not to those across them. (but not or). The X-shaped matrix is nothing but two T-shaped matrices placed back-to-back and can be formed by extending the T-shaped matrix. Just like the C-shaped matrix, the X-shaped
matrix is also rarely used in organizations.

L	H	M	2011	L	H	M	L
L	H	M	2012	L	H	M	M
M	H	M	2013	M	H	M	H
H	H	H	2014	H	H	H	H
Manufacturing Plants				Estimated Market Potential			
Plant 1	**Plant 2**	**Plant 3**	High (H) Medium (M) Low (L)	**Model 1**	**Model 2**	**Model 3**	**Model 4**
L	M	H	Americas	L	M	H	M
L	M	H	EMEA	L	M	H	H
H	H	M	Asia	H	H	M	L
L	L	M	Pacific	L	L	M	L

What is a Roof-Shaped Matrix Diagram?

The *roof-shaped matrix* is a matrix diagram that relates one set of elements to itself. It is generally used with an L- or a T-shaped matrix. In the roof-shaped matrix, and also in an L- or a T-shaped matrix. It is also used with a House of Quality (HOQ), with the matrix forming the roof of the house.

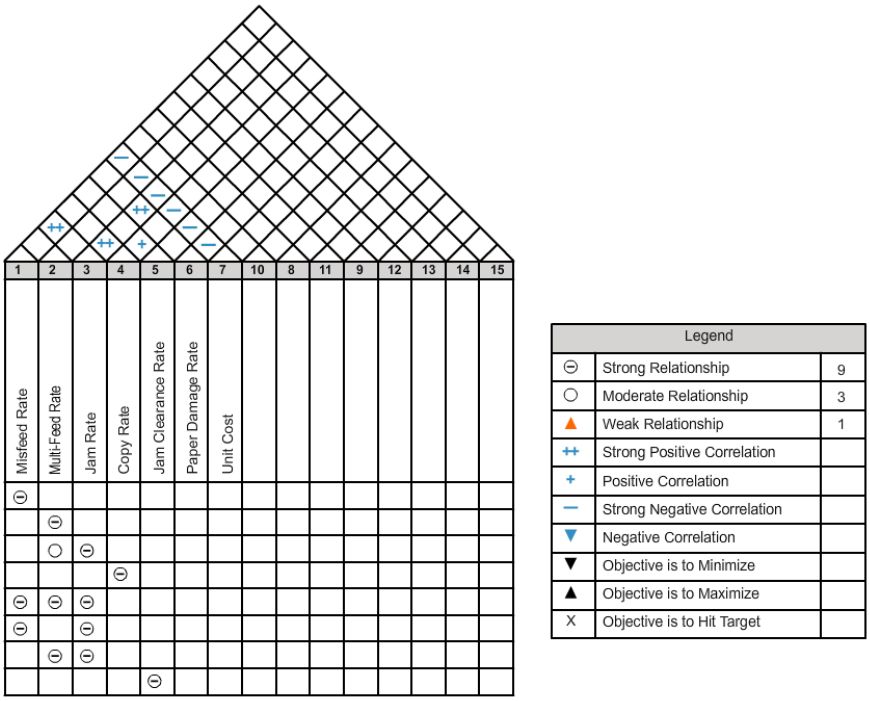

Fig: A roof-shaped matrix that summarizes the relationship of technical specifications

Describe the uses of Matrix Diagrams.

Matrix diagrams are generally used for identifying:

- Relationships among different sets of items by comparing them, especially many-to-many relationships among them instead of one-to-one relationships.
- The strength of the relationship between different sets of items qualitatively.
- And, the success of a process that generates one set of items from another set of items.

▪▪▪▪▪▪

Process Decision Program Chart (PDPC)

In the previous topic, you created a matrix diagram. After categorizing and prioritizing different issues related to a Six Sigma project, the potential risks associated with the project also need to be identified. A Process Decision Program Chart (PDPC) is an important tool used during the Define phase for identifying risks that may affect the project later. In this topic, you will draft a PDPC.

Before implementing a Six Sigma project, you must identify potential risks that may arise later in the project. Using a PDPC, you can identify risks associated with bottom-level tasks and devise contingency plans and countermeasures to prevent these problems.

Explain PDPC

The *Process Decision Program Chart (PDPC)* is a management and planning tool used to identify potential problems that may arise in a project as well as solutions or countermeasures to address those problems. It is a structured tree diagram with multiple levels for different purposes. It is usually developed from a tree diagram that has up to three levels of activities involved in accomplishing a

task. The first, and highest, level shows the objective, and the second level shows the main activities. In the third level, the activities at the second level are divided further to show broadly defined tasks to be performed for accomplishing the main activities.

In many cases, the second and third levels may also coexist as a single level.

The Six Sigma project team brainstorms to anticipate problems that may happen for each task at the third level. These problems are entered as the fourth level. Solutions or countermeasures for each potential problem are then identified through brainstorming and are entered as the fifth level.

What are the uses of a PDPC?

- Before implementing a large and complex plan.
- For identifying potential risks to complete a project successfully.
- For identifying and choosing preventive steps to eliminate potential risks.
- And, when the project is crucial and the consequences of failure are disastrous.

Some Pages Missing

6 Key Metrics in Six Sigma Projects

In this lesson, you will identify key metrics of Six Sigma. Whenever you implement new steps or changes in a process, you need to closely monitor how the changes affect performance. You begin by tracking the performance of a process using different parameters. In this topic, you will track process performance. Any process implementation aligns to a set of redefined organizational goals and characteristics that impact customers and businesses.

Track Process Performance

Your role as a Six Sigma Green Belt is to identify opportunities for improvement in a process. Tracking process performance using different parameters will help you determine the quality of a product or service.

DPU (Defects Per Unit)

Defects Per Unit (DPU) is the average number of defects detected on a specified number of units of a product or service. The formula for calculating DPU is:
Total number of defects / Total number of product units.

Defects

A defect is defined as unacceptable variation from specified standards or customer requirements. It can also be due to the variation of a quality attribute from company-specified standards. Defects in a product or service lead to customer discontent. They may also render the product or service unfit for use.

Defective Units

A defective unit of a product or process contains one or more defects.

Opportunities

Opportunities are defined as a measure of all possible occurrences of defects in a process. They must be independent of each other and measurable. Opportunities are essentially the number of aspects of a product or service that are required to meet customer expectations in which defects can occur. The complexity of a product or service can be determined by the total number of opportunities existing in that product or service.

DPMO

Defects Per Million Opportunities (DPMO), a measure of process performance, is the average number of defects across a million opportunities that a current process will produce. The formula for calculating DPMO is

(No. of defects x1,000,000)/(No. of units x No. of opportunities per unit)

where the number of defects is the total number of defects found in a process, the number of units is the total number of units produced, and the number of opportunities per unit is the number of ways to generate defects.

Sigma Levels

A *Sigma level* is a metric that helps determine the quality level of a process output. The six different Sigma levels are One Sigma, Two Sigma, Three Sigma, Four Sigma, Five Sigma, and Six Sigma. A Sigma level is also called Sigma Capability and is expressed as a number, usually restricted to the first decimal. The higher the Sigma level, the lower the defect level of the process output. Sigma levels are determined based on the defect rate in a process.

DPMO and Sigma Levels

You can convert DPMO to Sigma values using the Yield to Sigma Conversion table. The following table includes details about DPMO pertaining to different Sigma levels.

DPMO	Sigma Level
691,462	1.0
308,538	2.0
66,807	3.0
6,210	4.0
233	5.0
3.4	6.0

As the Sigma level increases, the DPMO of the process drastically decreases. Organizations operating at higher Sigma levels produce substantially fewer defects and will have very high customer satisfaction levels.

Impact of Sigma Levels

Sigma levels determine the maturity level of a process. Process improvements are easy with a new process because there are more opportunities to find flaws, and flaws are often obvious. But, at later stages, it is increasingly challenging to identify opportunities for improvement because a mature process has already undergone many fixes.

Therefore, Sigma levels below Four Sigma involve gathering general data that is less discrete in nature. On the other hand, Four Sigma and Five Sigma levels involve process characterization and optimization and deal with continuous data.

For Sigma levels Five Sigma and Six Sigma, improvement opportunities are very difficult to identify. Therefore, the Design for Six Sigma (DFSS) methodology is used to deal with continuous data related to the process.

RTY

Rolled Throughput Yield (RTY) is the probability that any unit can go through a number of processes without revealing any defects during quality inspection. RTY is the overall process quality that summarizes DPMO data for the entire process. It is an important metric used for processes that require excessive rework, and it serves as a baseline score in the Measure phase and a final score in the Control phase of Six Sigma projects.

Some Pages Missing

Horizontal: The horizontal or sideways flow of communication involves the exchange of information, ideas, and feedback among Six Sigma project team members
at the same level in an organization or a project. Horizontal communications are effective in flat organizations and provide quick results. In hierarchic organizations, this type of communication may cause problems because it is independent of managerial intervention.

Explain communication strategy

Communication strategy is a management technique to determine the most effective method for articulating, explaining, and promoting an organization's vision and goals. Communication strategy links diverse activities in a process improvement effort and broadcasts a consistent message that appeals to all stakeholders.

An effective communication strategy ensures the distribution of accurate and timely information critical to the success of the project and promotes and gains support for project improvement.

Example: Communication Strategy for Process Improvement Effort. The improvement team found that the mass of data generated by a project was overshadowing the data showing improvements resulting from the process improvement effort. In order to make the improvement more visible, they decided to provide an executive summary along with every report, not only to management, but also in the information shared with other groups. This strategy crystallized achievements, made data comprehensible, and made gradual improvement in the process more visible.

.....

End of Part One

About the Author

Nilakantasrinivasan (Neil), is a Certified Lean Six Sigma Master Black Belt & Founding Principal of Canopus Business Management Group. He has spearheaded Lean Six Sigma deployments across various Banking & Financial Services, Manufacturing, IT & ITES and functional areas such as Sales & Marketing, Operations, HR, IT & Admin.

He designed, developed & delivered several workshops & training sessions on Lean Six sigma, Customer Experience, Business Excellence across geographies.

He is passionate about making organizations & individuals “Future Fit”.

About Six SigmaCertificationCourse.Com

SixSigmaCertificationCourse is an online initiative of *Canopus Business Management Group* that provides competitive career advantage to young professionals powering them with a highly affordable Lean Six Sigma Qualification.

We have certified over 3000 associates across US, Europe & Asia as of 2017. We conducted world’s Lean Six Sigma MOOC (Massive Open Online Course) that had over 1200 students across globe.

We offers online certification courses. Visit our website(SixSigmaCertificationCourse.com) for more details.