

Lean Six Sigma Green Belt Certification Course

DIGITAL
OPERATIONS





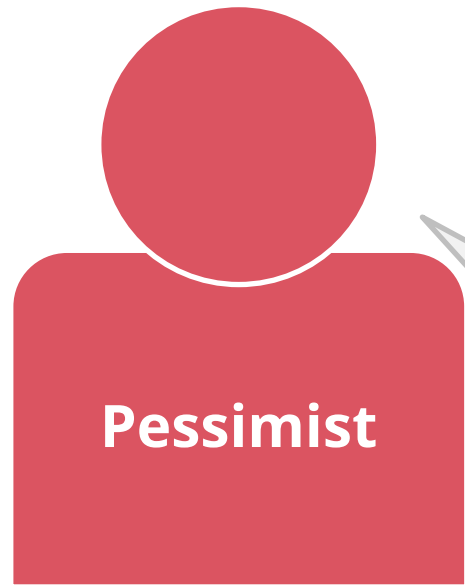
Learning Objectives

By the end of this lesson, you will be able to:

- 👁️ Identify the Six Sigma process and tools
- 👁️ Explain the impact of Six Sigma in an organization
- 👁️ Measure organizational performance

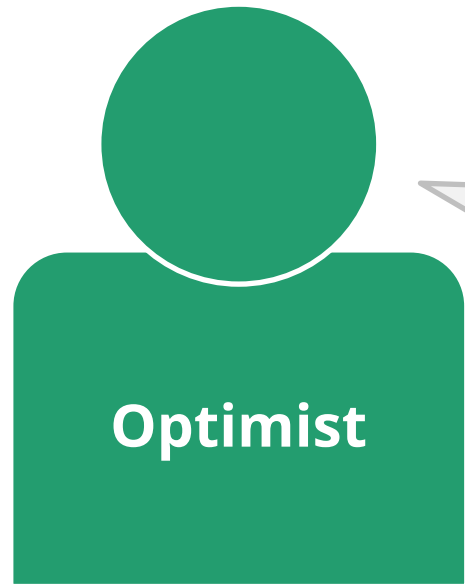


Introduction



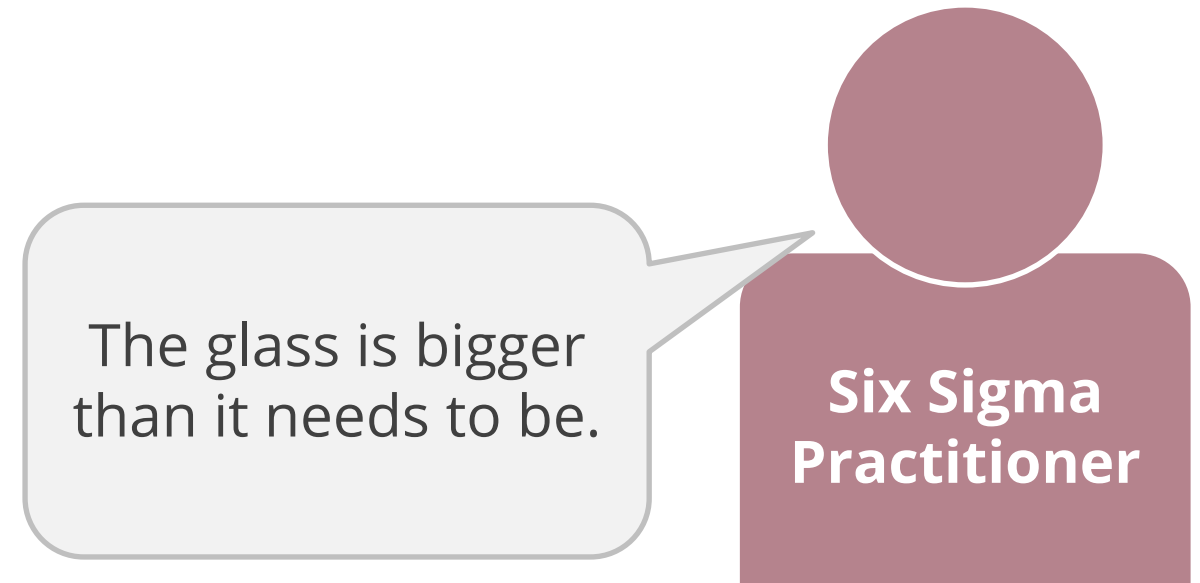
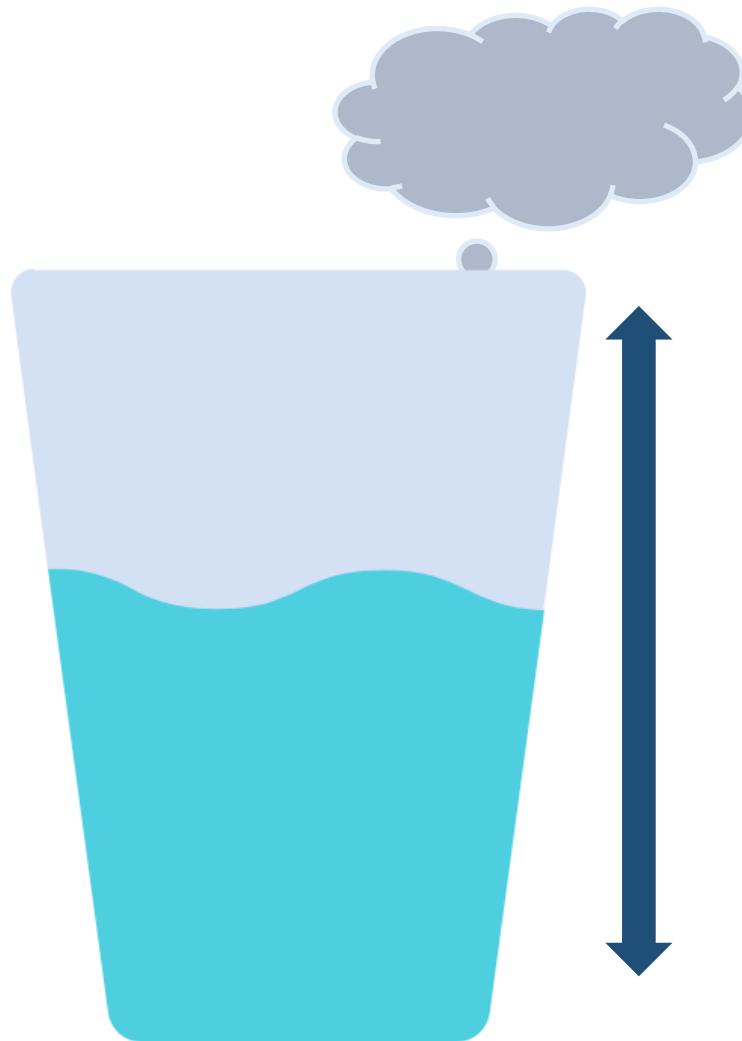
Pessimist

The glass is half empty.



Optimist

The glass is half full.



**Six Sigma
Practitioner**

The glass is bigger
than it needs to be.



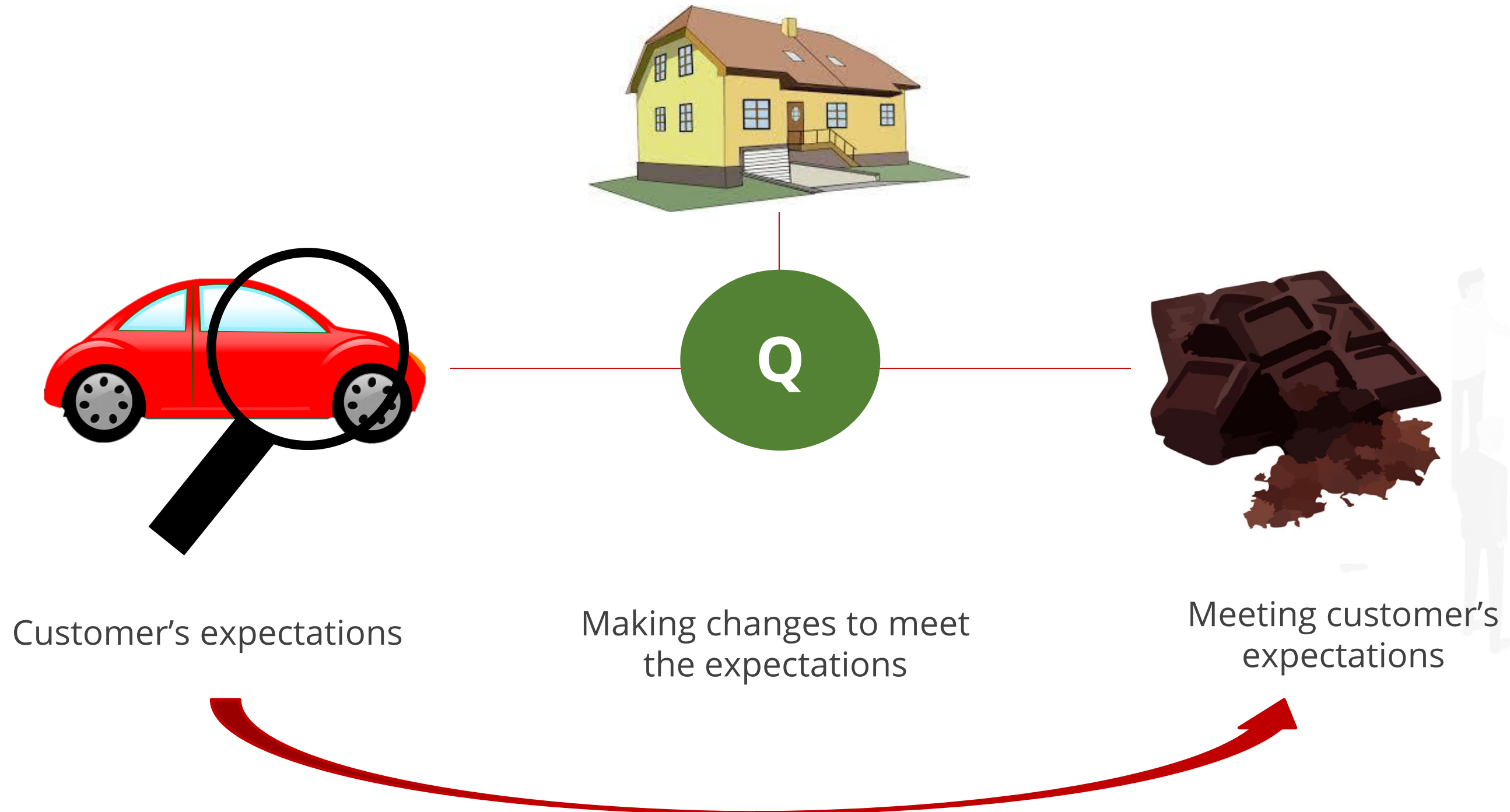
Realist

The glass is full with
water and air.

Value of Sigma

Introduction to Quality

Quality is defined as *meeting the requirements of the customer.*



The Journey of Quality

Milestones in the history of Quality

1930s
Statistical Process
Control

1960s
Quality Circles

1987
• ISO 9000
• Baldrige
Award Criteria

1988
Benchmarking

1990s
Balanced
Scorecard (BSC)

1996
Re-engineering

Quality Management Gurus

Leaders and quality management consultants who set the foundation of modern quality improvement and strategic change are:

- 14 key principles for management
- Seven wastes
- Plan-Do-Study-Act cycle
- System improvement

W. Edwards Deming

- Statistical Process Control charts
- Assignable cause vs. chance cause
- Statistics for quality management

Walter A. Shewhart

- Quality trilogy
- Top management involvement

Joseph M. Juran

- Ishikawa's cause-and-effect diagram
- Company-wide quality control
- Quality circle

Kaoru Ishikawa

- Quality loss function concepts
- Signal-to-noise ratio
- Robust design
- Experimental design methods

Genichi Taguchi

- Crosby's 14 steps to quality improvement
- Do It Right First Time
- Zero Defect

Philip Crosby

Meaning of Six Sigma



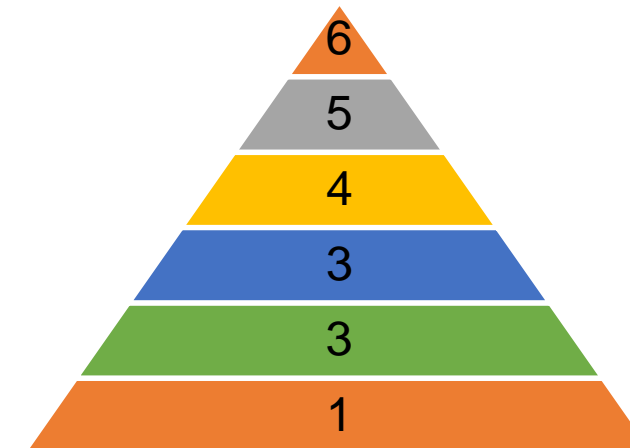
Sigma (σ) is a Greek letter used in the statistical world to represent a measure of variability.



Six Sigma is a business strategy to change company culture with top management support.



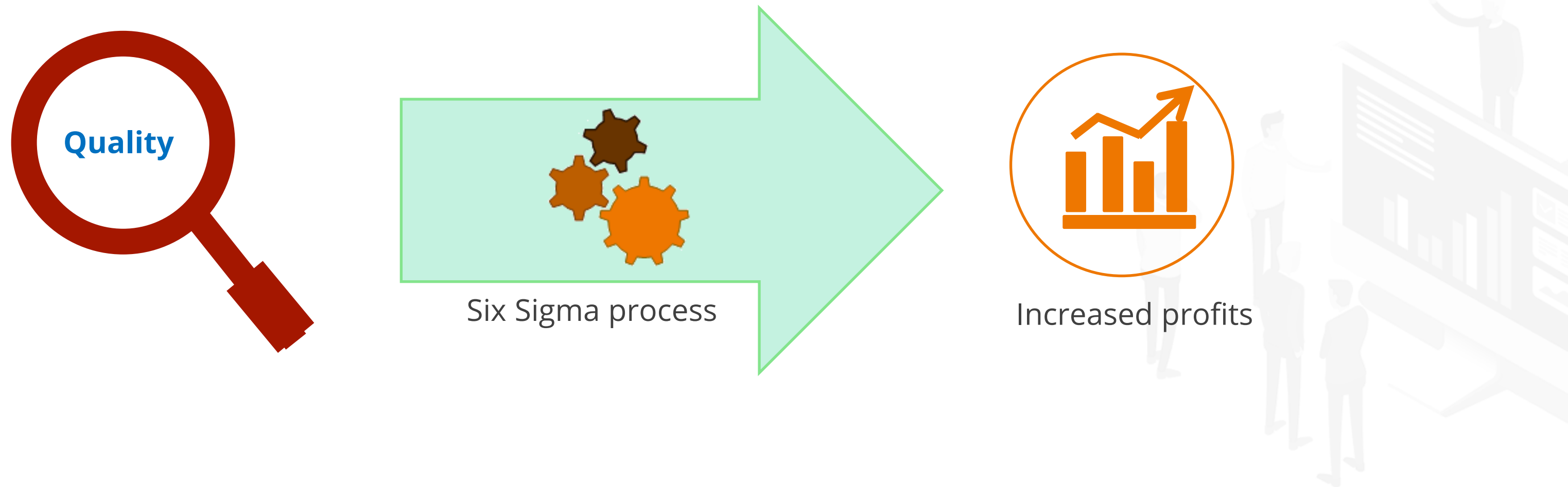
The Six Sigma process is an improvement method of quality principles and techniques.



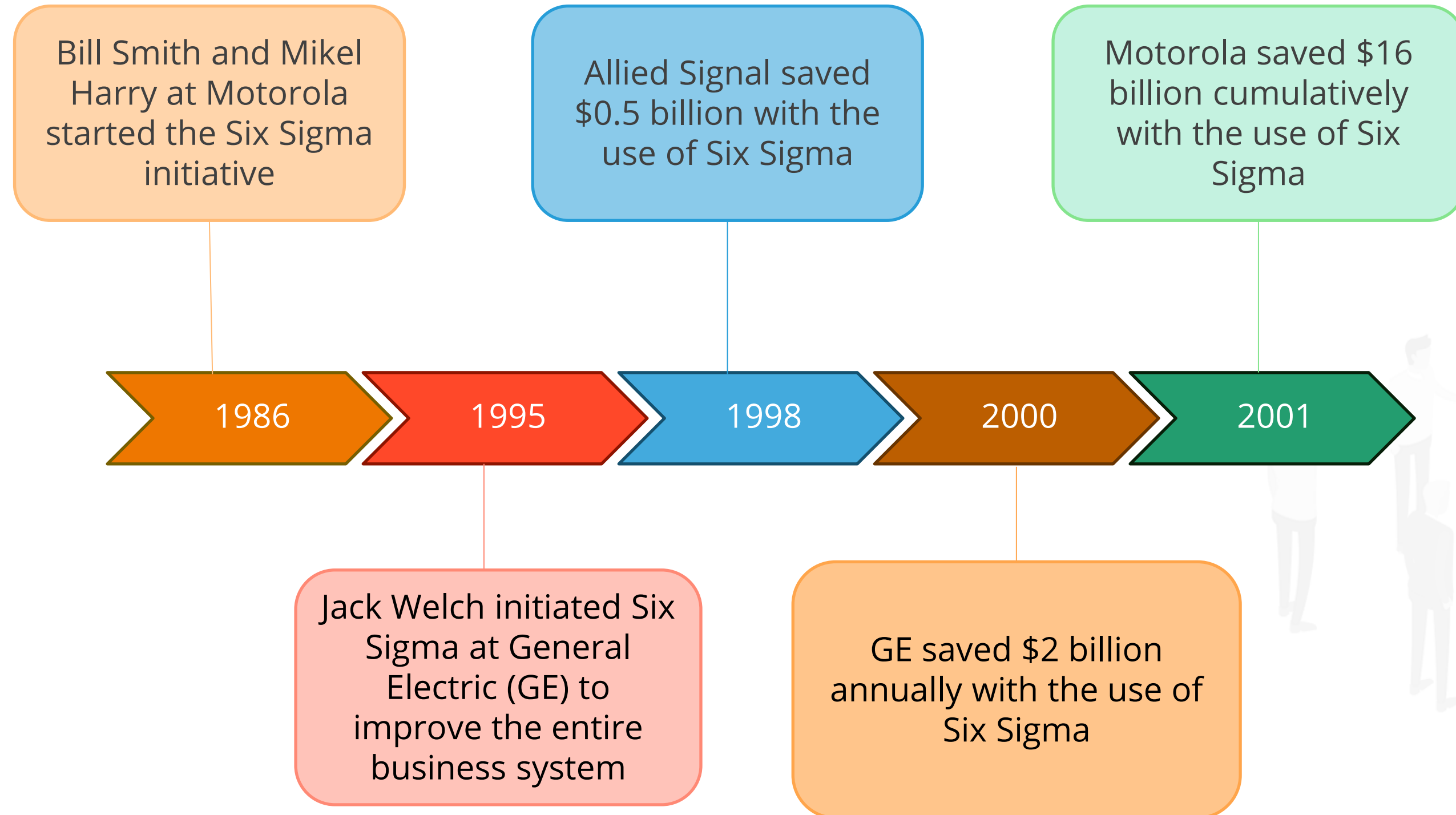
Sigma level is a measure of performance for a business processes or service.

Six Sigma and Quality

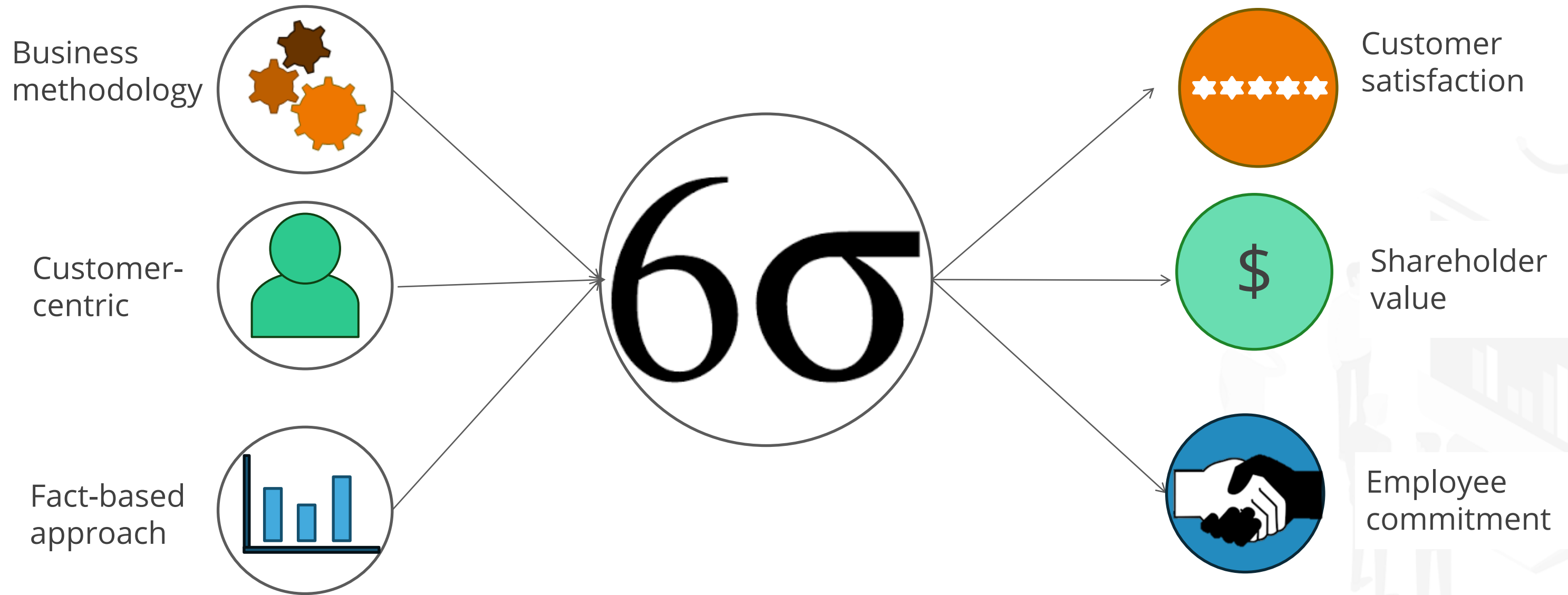
How Six Sigma impacts the quality of products and services.



Milestones in the Six Sigma Journey



Purpose of Six Sigma



Organizational Benefits of Six Sigma

Eliminates the root cause of problems and defects in a process

Creates robust products and services

Reduces process variation and waste

Ensures customer satisfaction

Achieves process standardization

Reduces rework by getting it right the first time

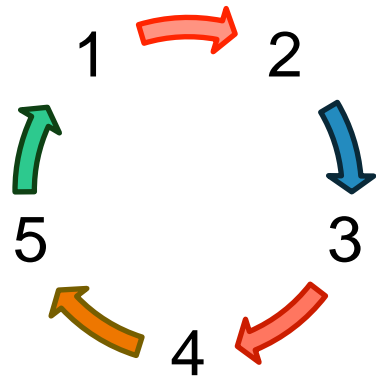
Addresses the key business requirement

Helps gain competitive advantage

Achieves the organizational goals

Benefits to an Organization

Organizations successful with Six Sigma:



Have proven systematic problem-solving methodology

Focus on the customer



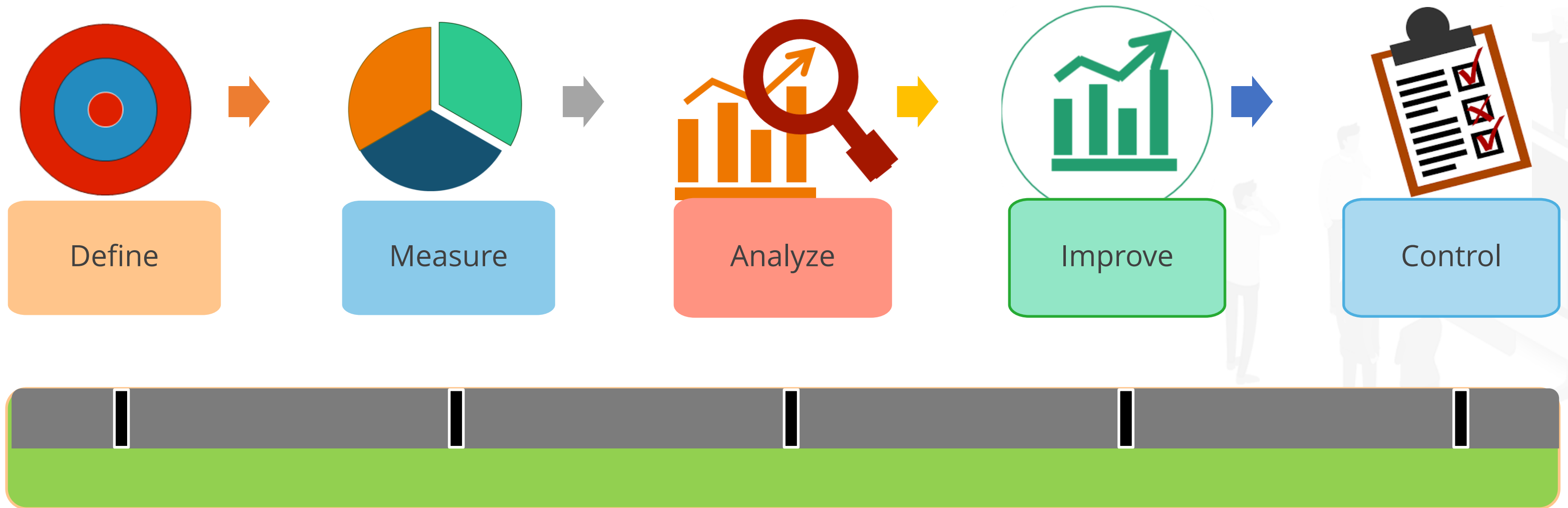
Achieve long-term improvements



The Six Sigma Process

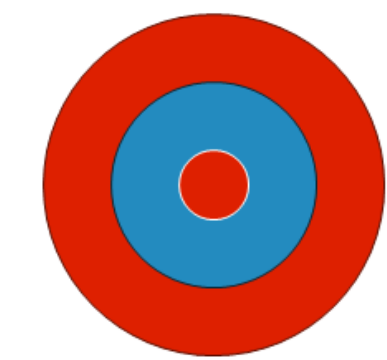
Each phase has

- An over-arching objective
- Specific deliverables that need to be completed

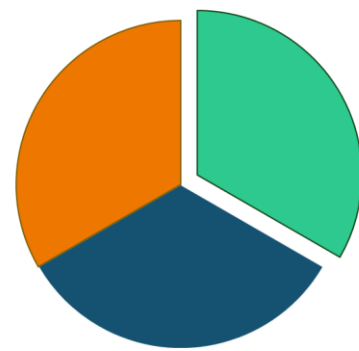


The Six Sigma Process

Document the problem and the desired outcome



Define



Measure



Analyze



Improve

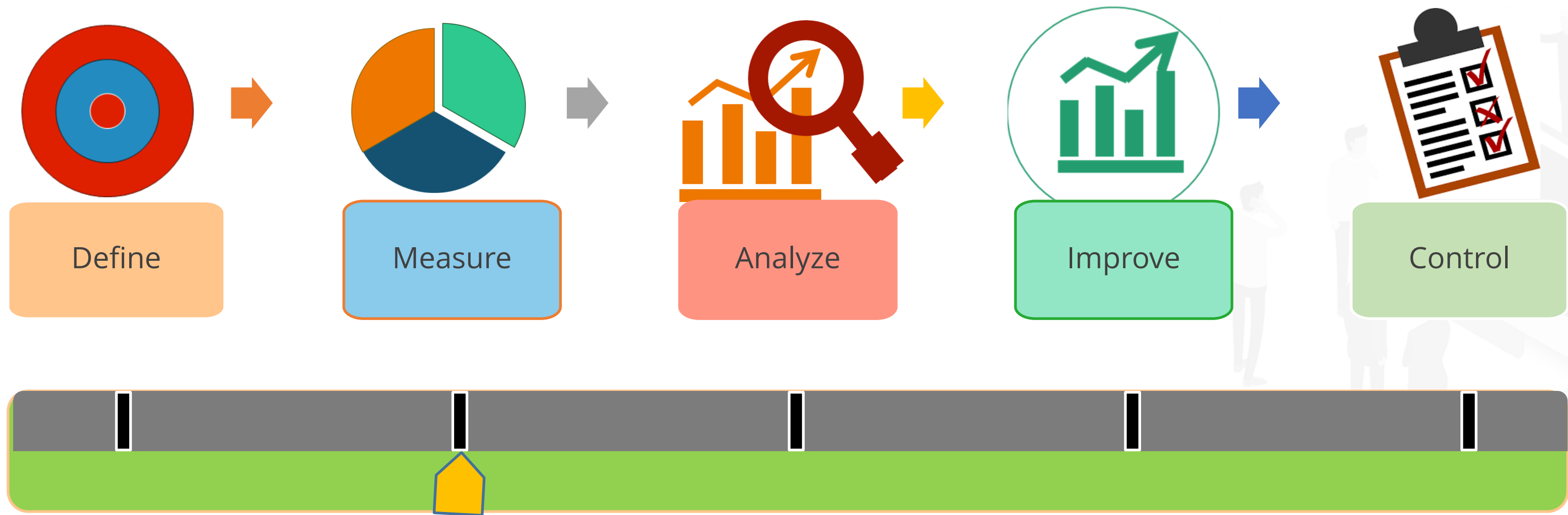


Control



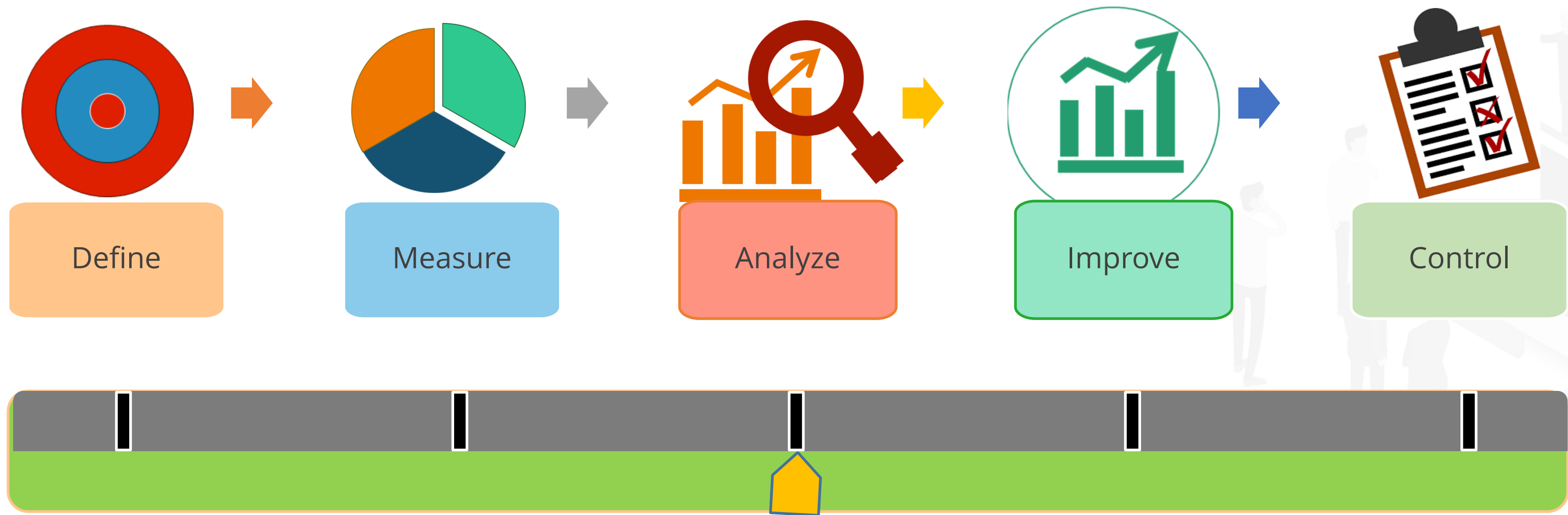
The Six Sigma Process

Obtain baseline process performance levels



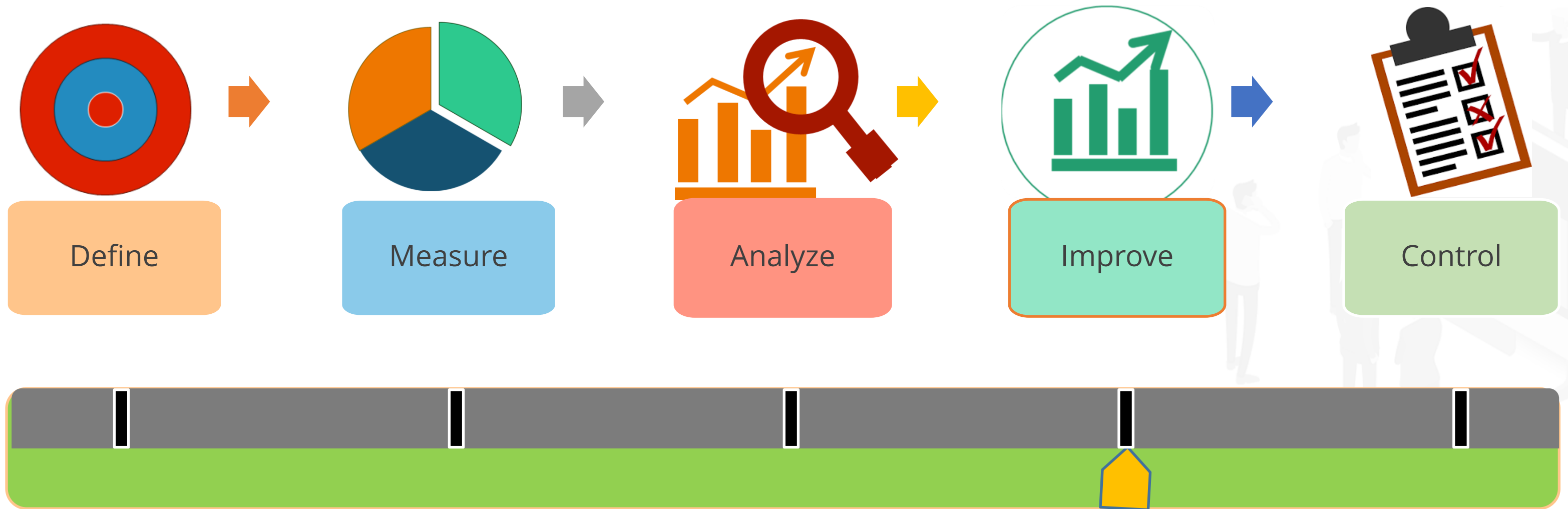
The Six Sigma Process

Identify key root causes for process variation



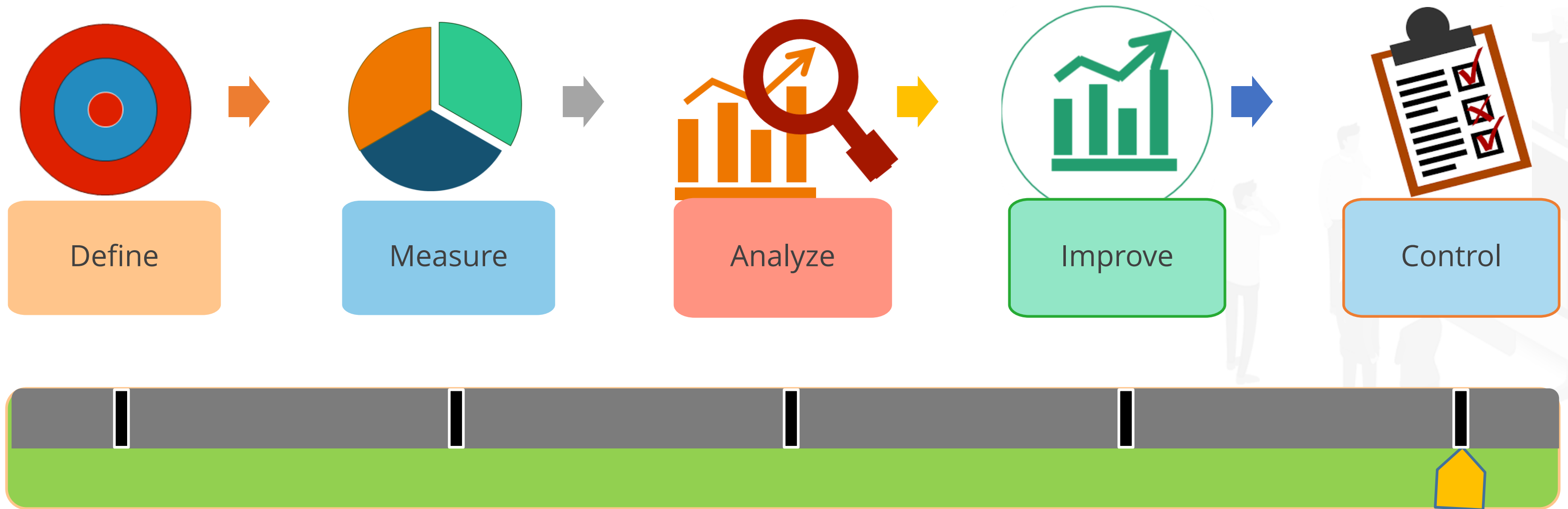
The Six Sigma Process

Develop, test, and implement solutions

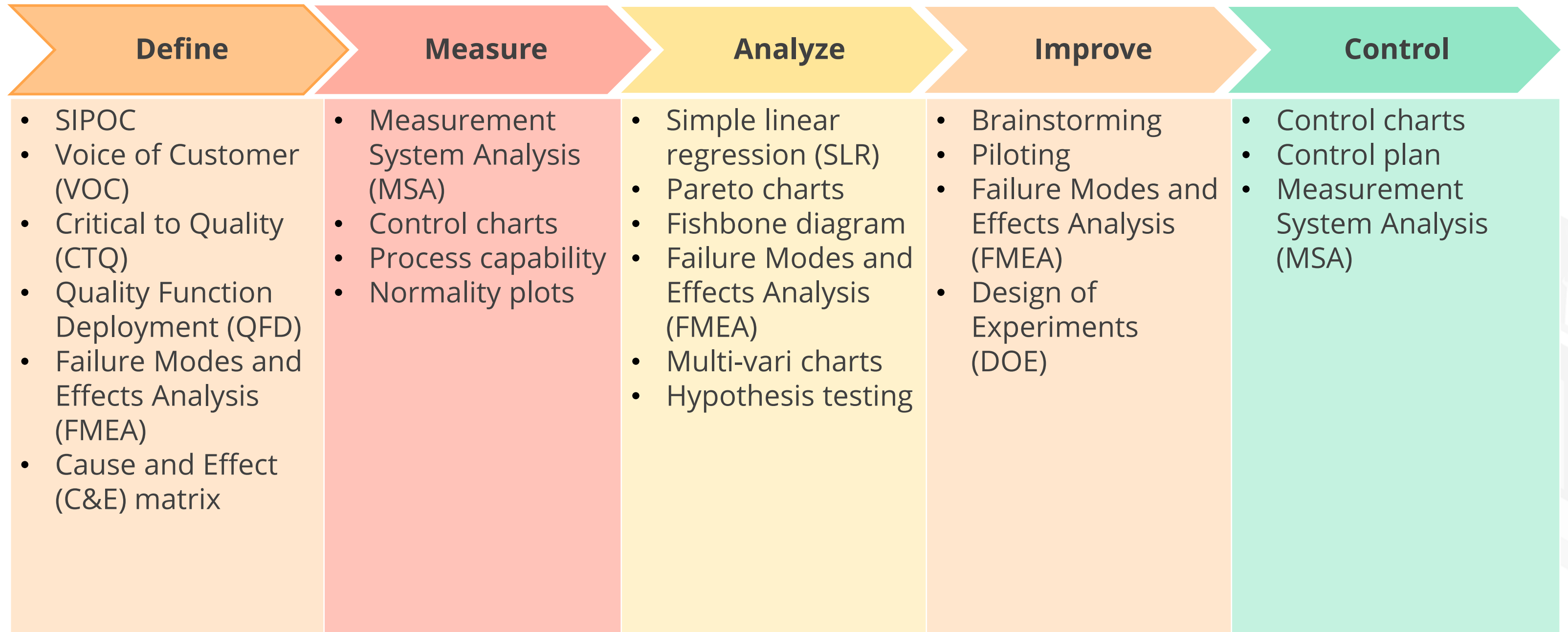


The Six Sigma Process

Monitor key factors and maintain the gains



The Six Sigma Tools



Some of the tools are not required in every Six Sigma Green Belt (GB) project.

Applying the Six Sigma DMAIC Process



A cup of coffee is either too hot or too cold.

Customers' feedback

The problem



Java House Coffee



Ideal temperature for a cup of coffee should be between 160F (71C) to 180F (82C).

Management's feedback

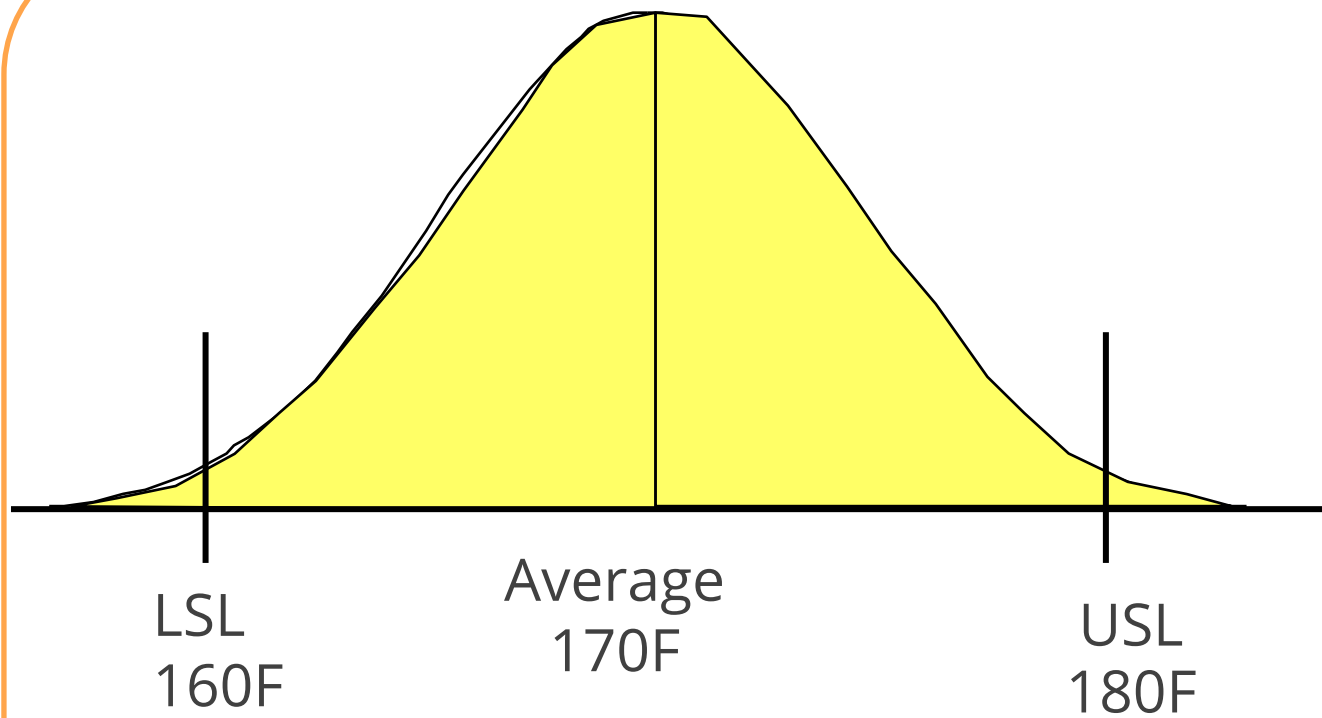
Applying the Six Sigma DMAIC Process

The solution

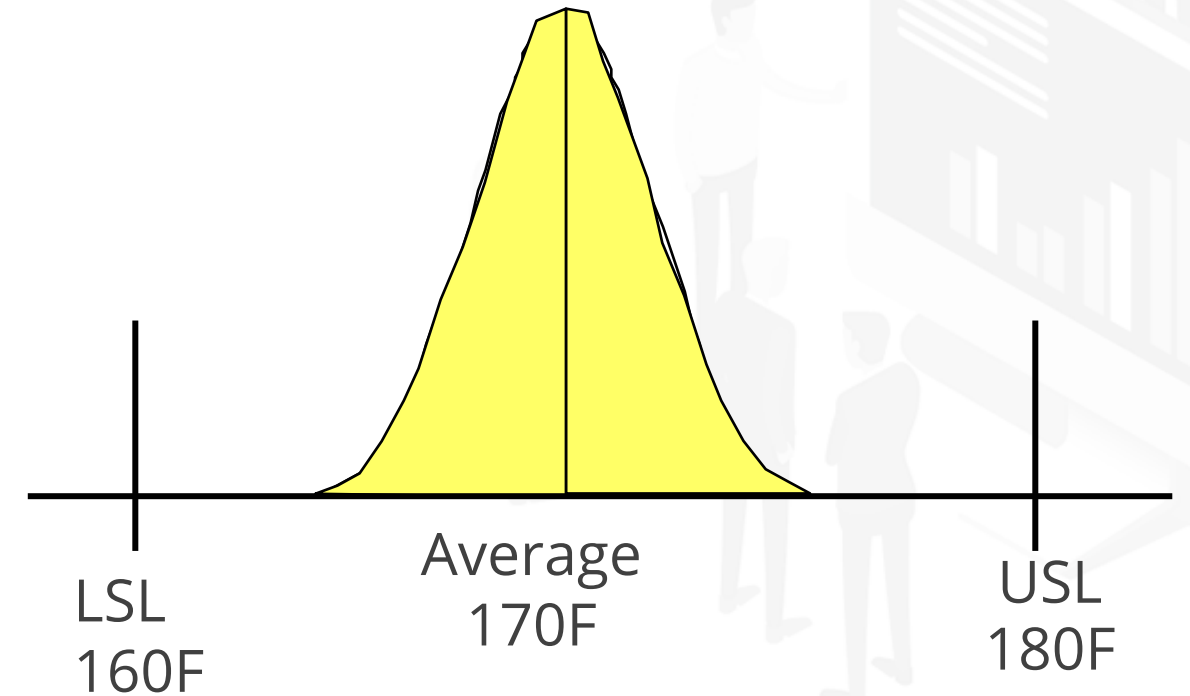


6σ

DMAIC
process
and tools



Poor process capability



Excellent process capability

Key Terms Used in Six Sigma

Specification limits

Opportunity

Defect


Defective

Rolled Throughput Yield (RTY)

Defects per Million Opportunity (DPMO)



Key Terms Used in Six Sigma

Specification Limits	Meaning
Opportunity	Limits set by a customer representing the range of variation the customer can tolerate or accept
Defect	Explanation with regard to the Java House coffee example
Defective	The Java House Coffee customers had an acceptable coffee temperature range of 160F to 180F
Rolled Throughput Yield (RTY)	
Defects per Million Opportunity (DPMO)	

Key Terms Used in Six Sigma

Specification Limits

Opportunity

Defect

Defective

Rolled Throughput Yield (RTY)

Defects per Million Opportunity (DPMO)

Meaning

Every chance for a process to deliver an output characteristic that is either “right” or “wrong” as per the customer specifications

Explanation with regard to the Java House coffee example

The coffee temperature was the only output characteristic identified from the customer, which would represent one opportunity per cup of coffee



Key Terms Used in Six Sigma

Specification Limits

Opportunity

Defect

Defective

Rolled Throughput Yield (RTY)

Defects per Million Opportunity (DPMO)

Meaning

Every result of an opportunity that does not meet customer specifications and does not fall within Upper Specification Limit (USL) and Lower Specification Limit (LSL)

Explanation with regard to the Java House coffee example

When a cup of coffee does not fall within the specified temperature limit (<160F or >180F)



Key Terms Used in Six Sigma

Specification Limits

Opportunity

Defect

Defective

Rolled Throughput Yield (RTY)

Defects per Million Opportunity (DPMO)

Meaning

Results when the entire unit is identified has a nonconforming product regardless of the number of defects observed

Explanation with regard to the Java House coffee example

Every cup of coffee fails to meet the customer requirements
Example: Temperature and taste



Key Terms Used in Six Sigma

Specification Limits

Opportunity

Defect

Defective

Rolled Throughput Yield (RTY)

Defects per Million Opportunity (DPMO)

Meaning

Measure of process efficiency expressed and indicates percentage of units that are defect free. Also referred to as Yield value

Explanation with regard to the Java House coffee example

The percentage of cups of coffee that meet customers expectations



Key Terms Used in Six Sigma

Specification Limits

Opportunity

Defect

Defective

Rolled Throughput Yield (RTY)

Defects per Million Opportunity (DPMO)

Meaning

Also known as Non-Conformities per Million Opportunities (NPMO), it is a measure of process performance

Explanation with regard to the Java House coffee example

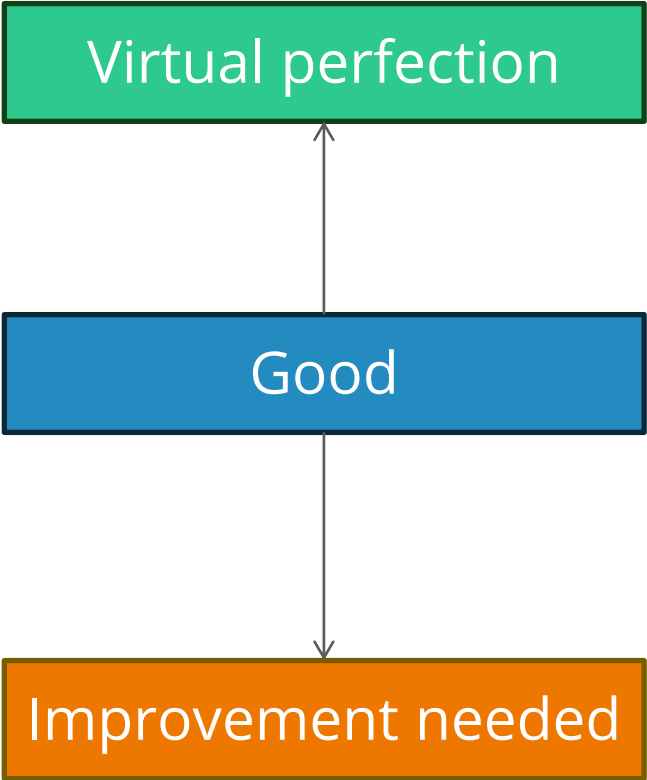
For 100 cups of coffee measured, the ratio of defects observed to total number of opportunities is multiplied by one million.

$$\text{DPMO} = \frac{\text{Defects observed}}{\text{total number of opportunities}} * 1,000,000$$



Sigma Conversion Table

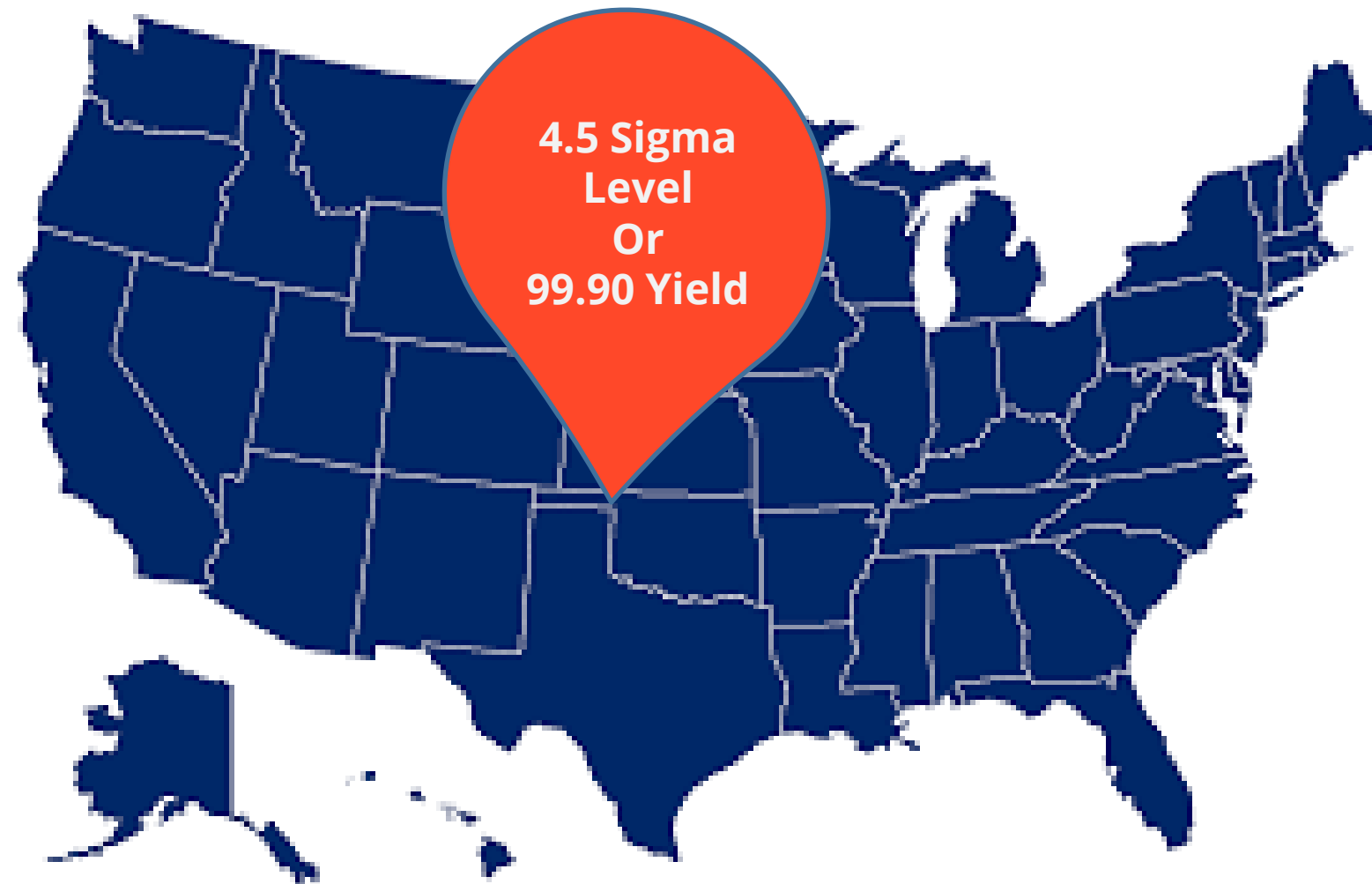
The Six Sigma Level is a measure of quality performance for a business process or service.



Sigma Level	DPMO	Yield/Accuracy (%)
6	3.4	99.99966%
5	230	99.977%
4	6,210	99.38%
3	66,800	93.32%
2	308,000	69.15%
1	690,000	30.85%

Quality Measures and Real-World Impact

What would be the consequence in the U.S. if a quality goal of 4.5 Sigma Level or 99.90% yield is accepted?

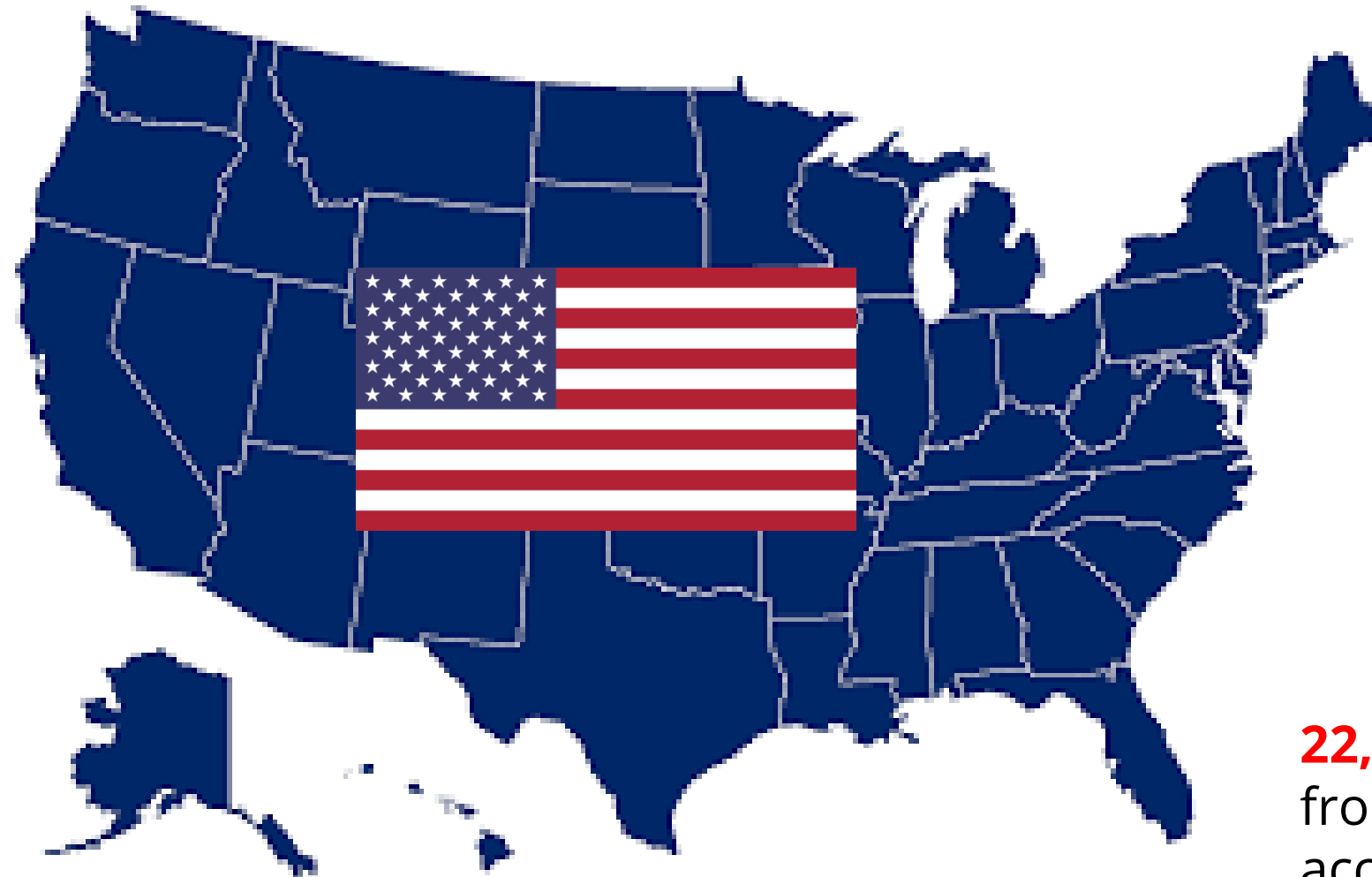


Quality Measures and Real-World Impact

500 incorrect surgical operations each week

1 hour of unsafe drinking water every month

2 unsafe plane landings per day at O'Hare International Airport in Chicago



16,000 pieces of mail lost by the U.S. postal service every hour

50 new born babies dropped at birth by doctors each day

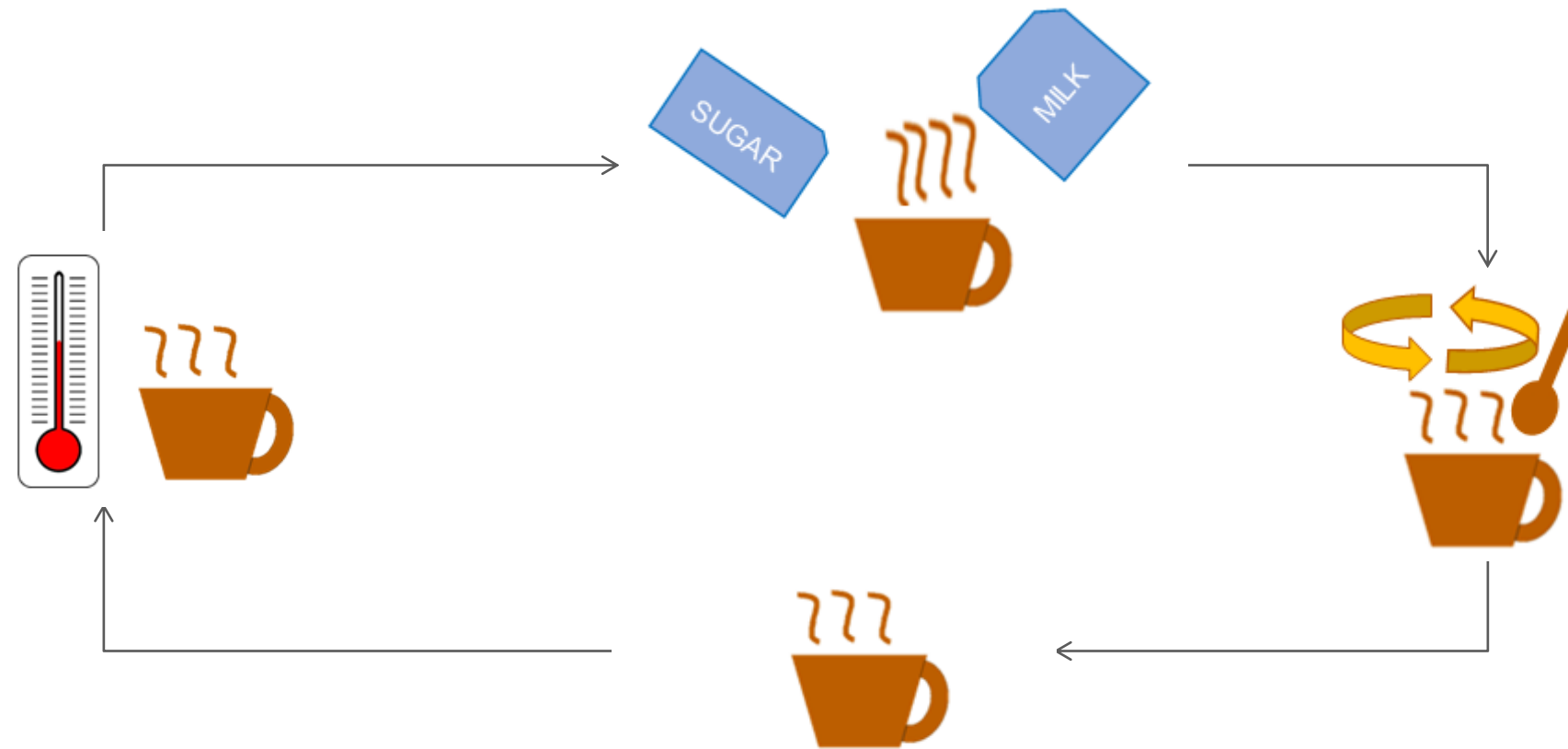
22,000 checks deducted from the wrong bank accounts each hour

32,000 missed heartbeats per person, per year

Goals and Six Sigma Projects

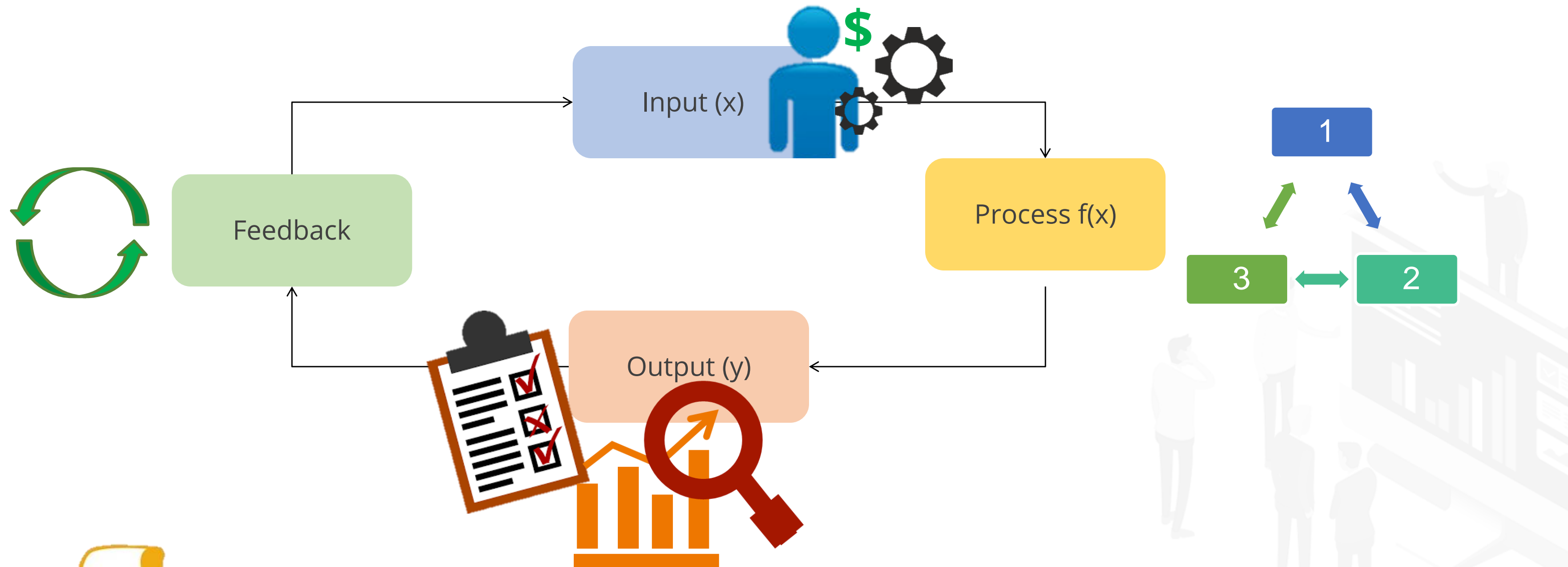
Meaning of Process

A process is a series of steps designed to produce a product and/or service as required by the customer.



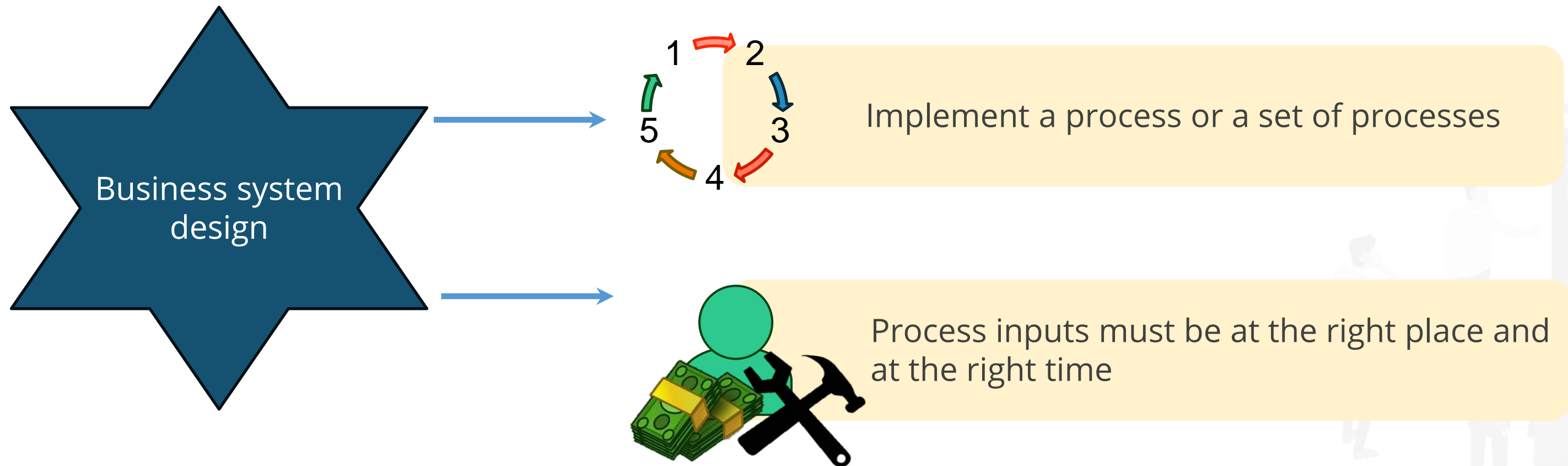
Focussing on the inputs is like driving a car. It transforms organizations from a pattern of driving forward by looking in the rear view mirror to driving forward by looking ahead on the road.

Components of a Business Process

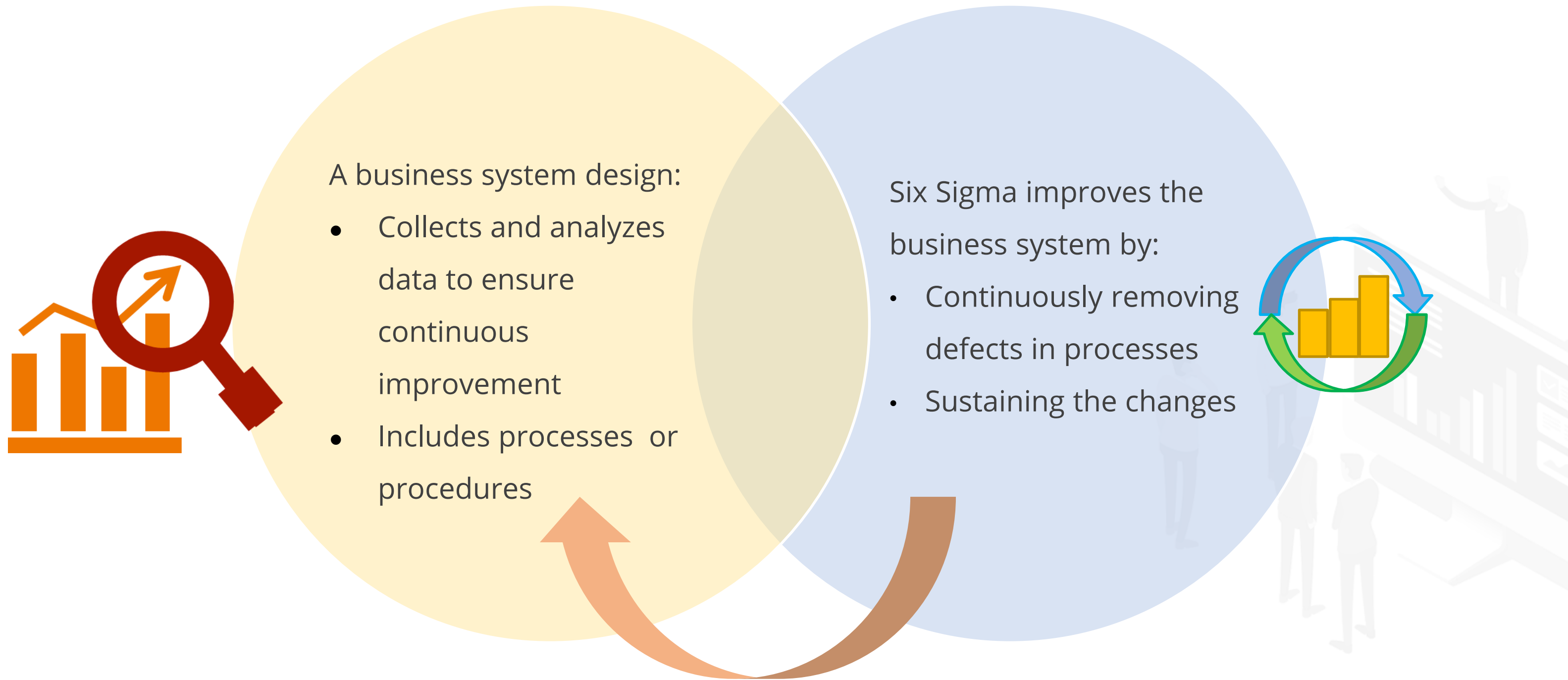


A process will have inputs (x) and delivers outputs (y). Therefore, $y = f(x)$. Any change in the inputs causes change in the output

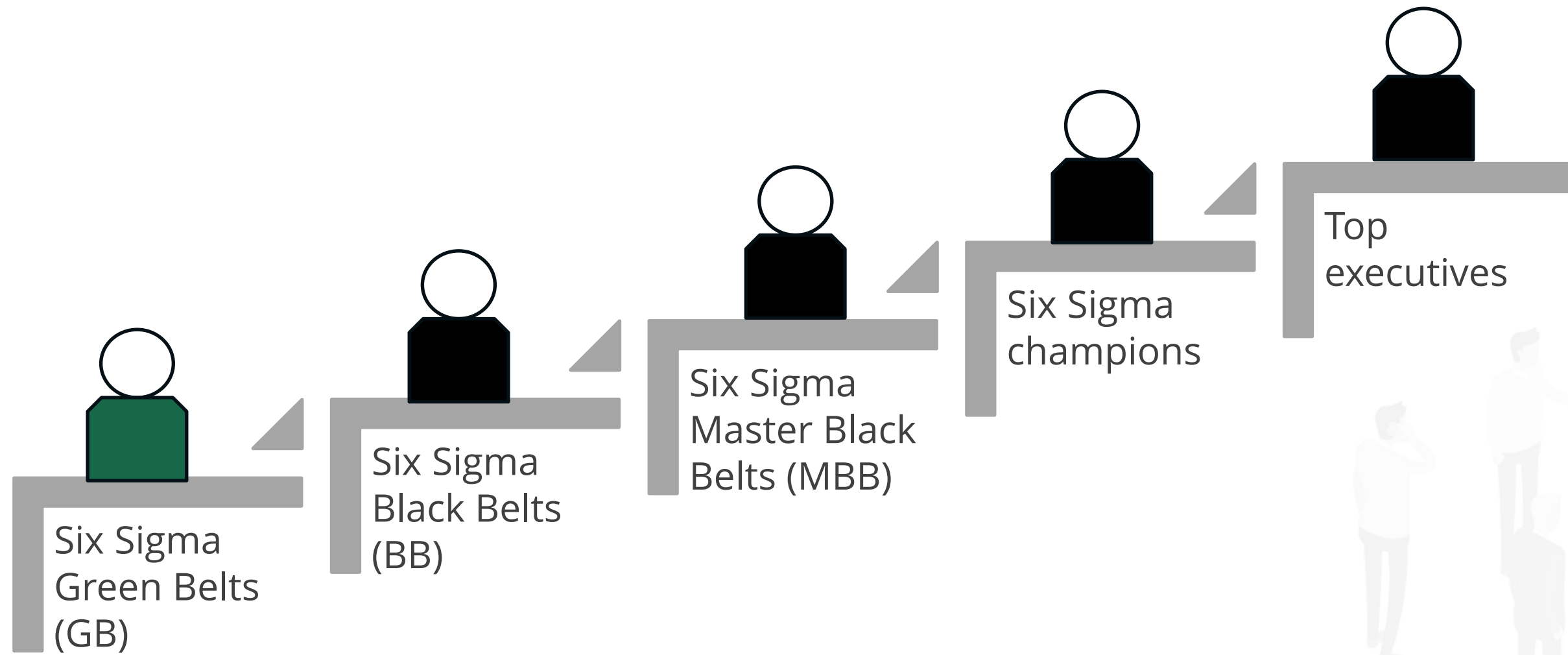
Six Sigma and the Business System



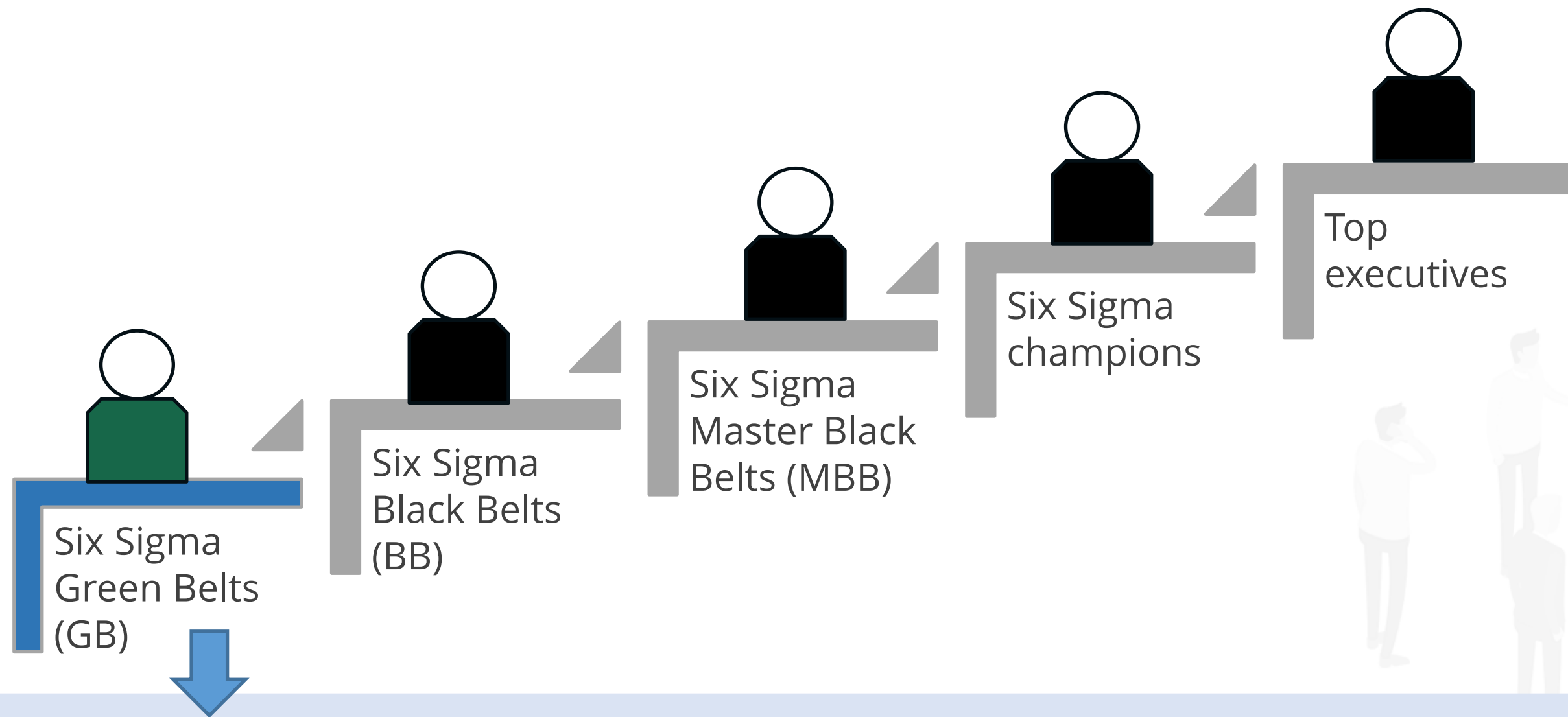
How Six Sigma Impacts a Business System Design



Structure of a Six Sigma Team

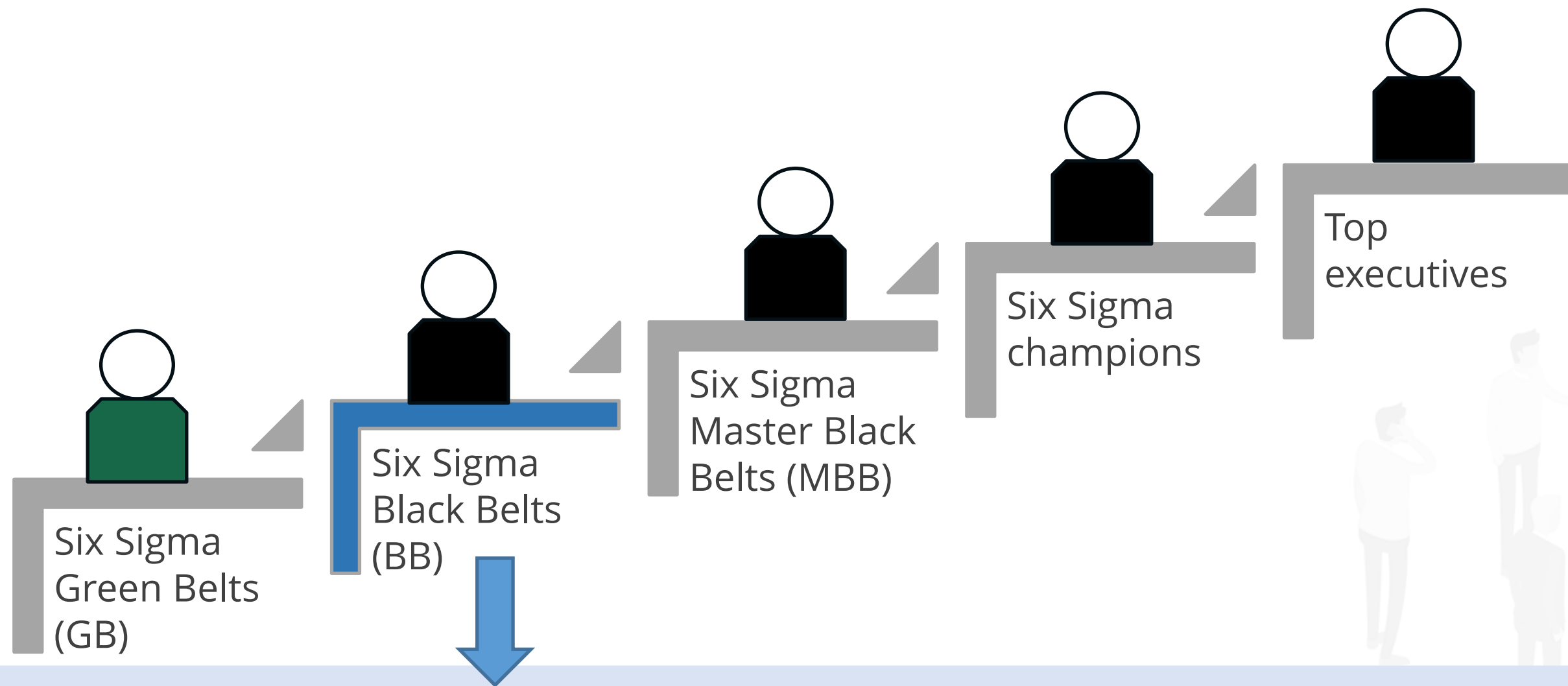


Structure of a Six Sigma Team



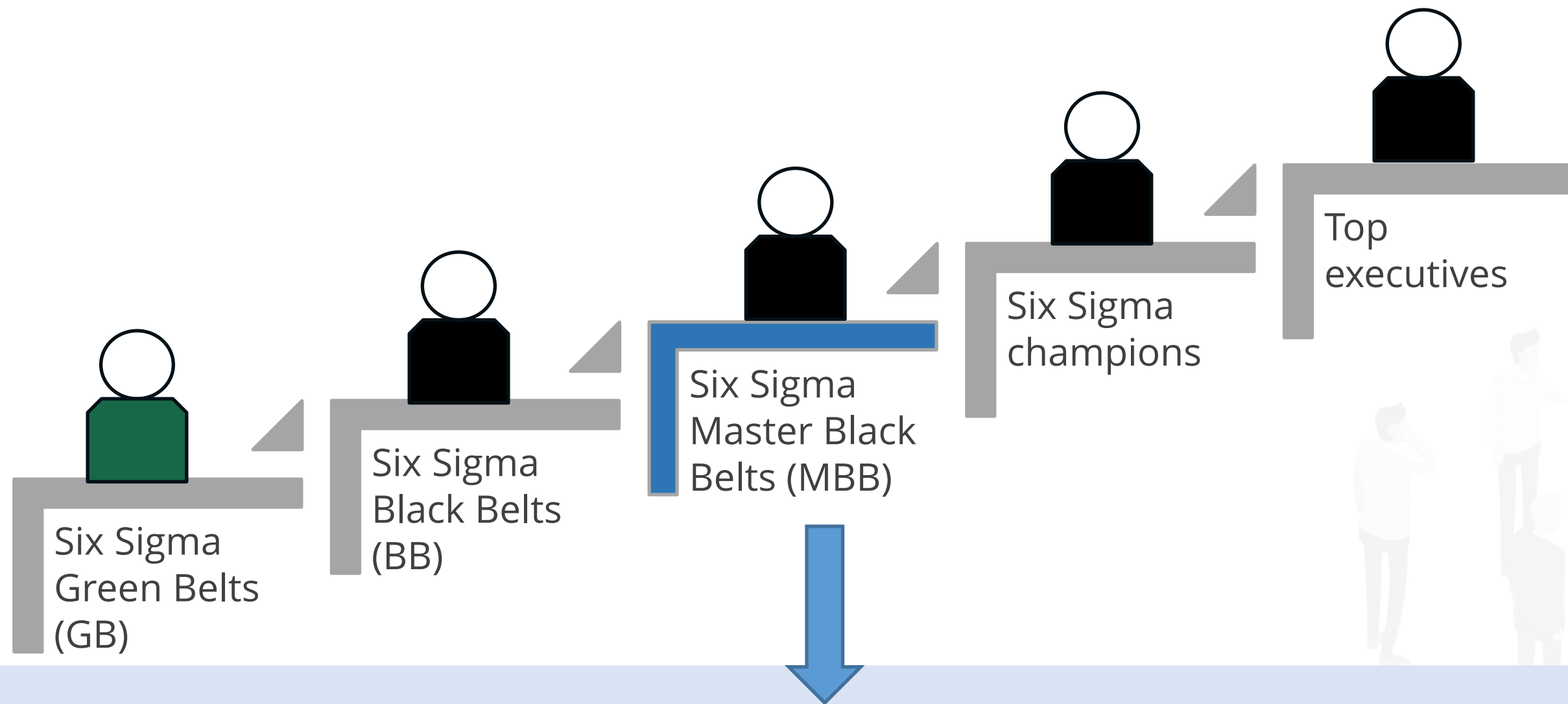
Six Sigma green belts support the black belts by working on the project and performing day-to-day jobs.

Structure of a Six Sigma Team



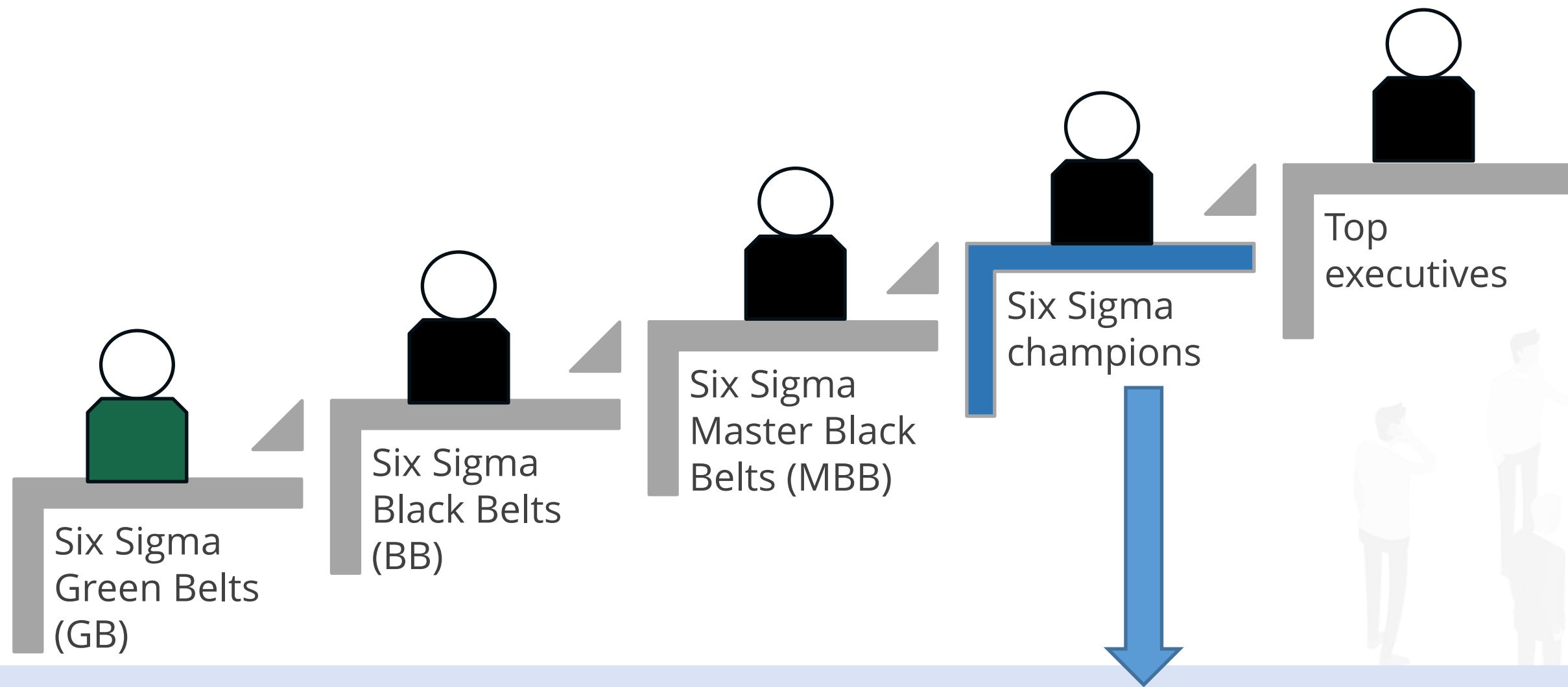
Six Sigma black belts apply strategies to specific projects, and lead and direct teams to execute projects.

Structure of a Six Sigma Team



Six Sigma master black belts train and coach black belts, green belts, and various functional leaders of the organization.

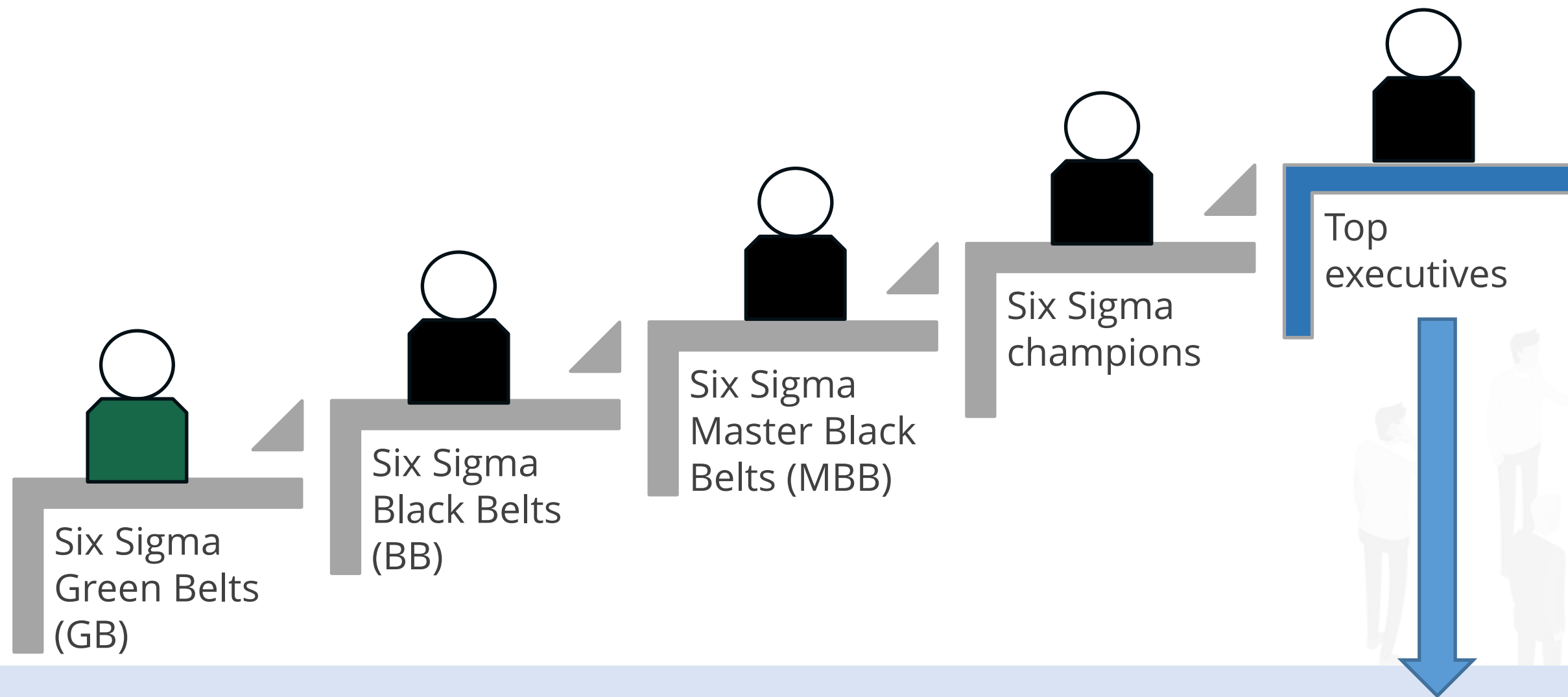
Structure of a Six Sigma Team



Six Sigma Champions:

- Identify and scope projects and develop strategy
- Identify and coach master black belts

Structure of a Six Sigma Team



Top Executives:

- Lead change and provide direction
- Own the Six Sigma initiatives

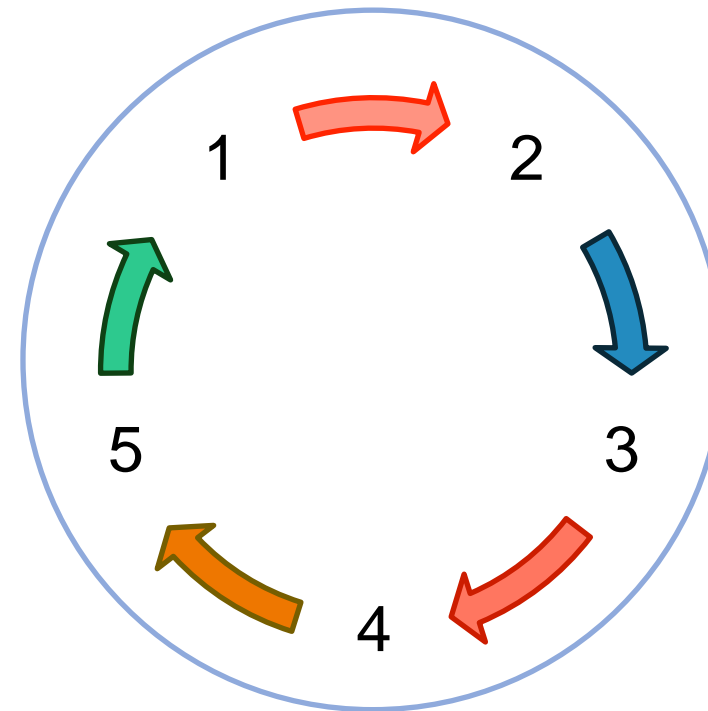
Organizational Drivers and Metrics

Key Business Drivers

Financial accounting



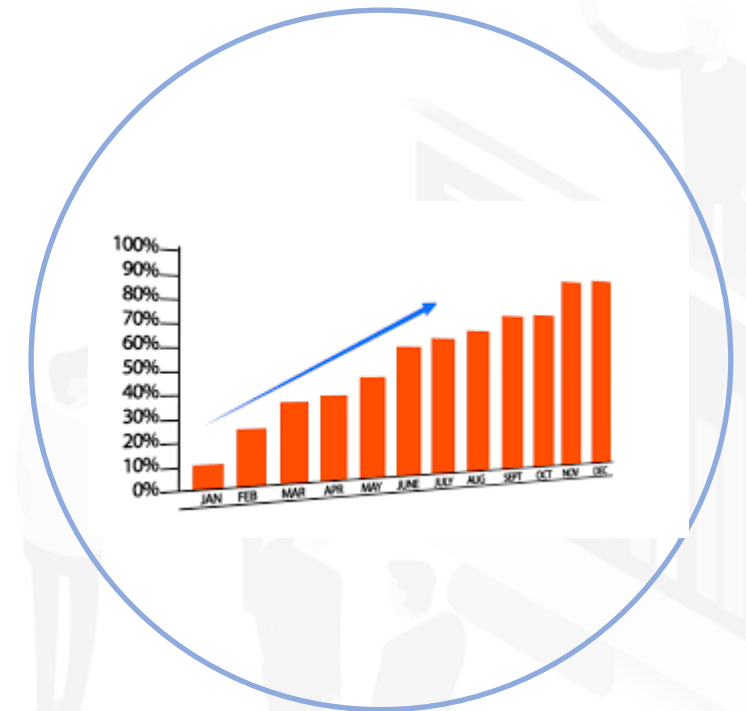
Physical assets



Internal or business processes



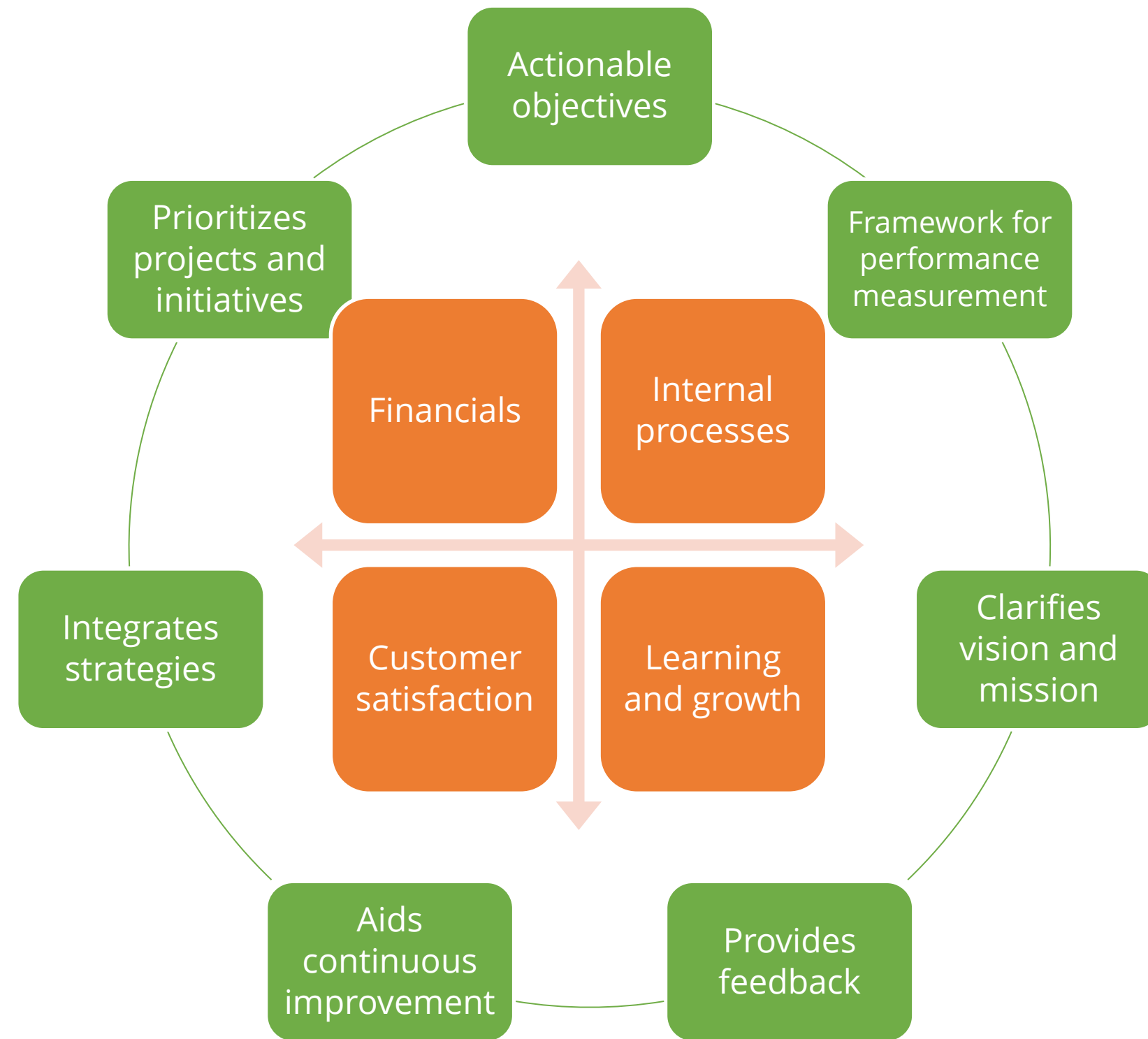
Customer satisfaction



Learning and growth

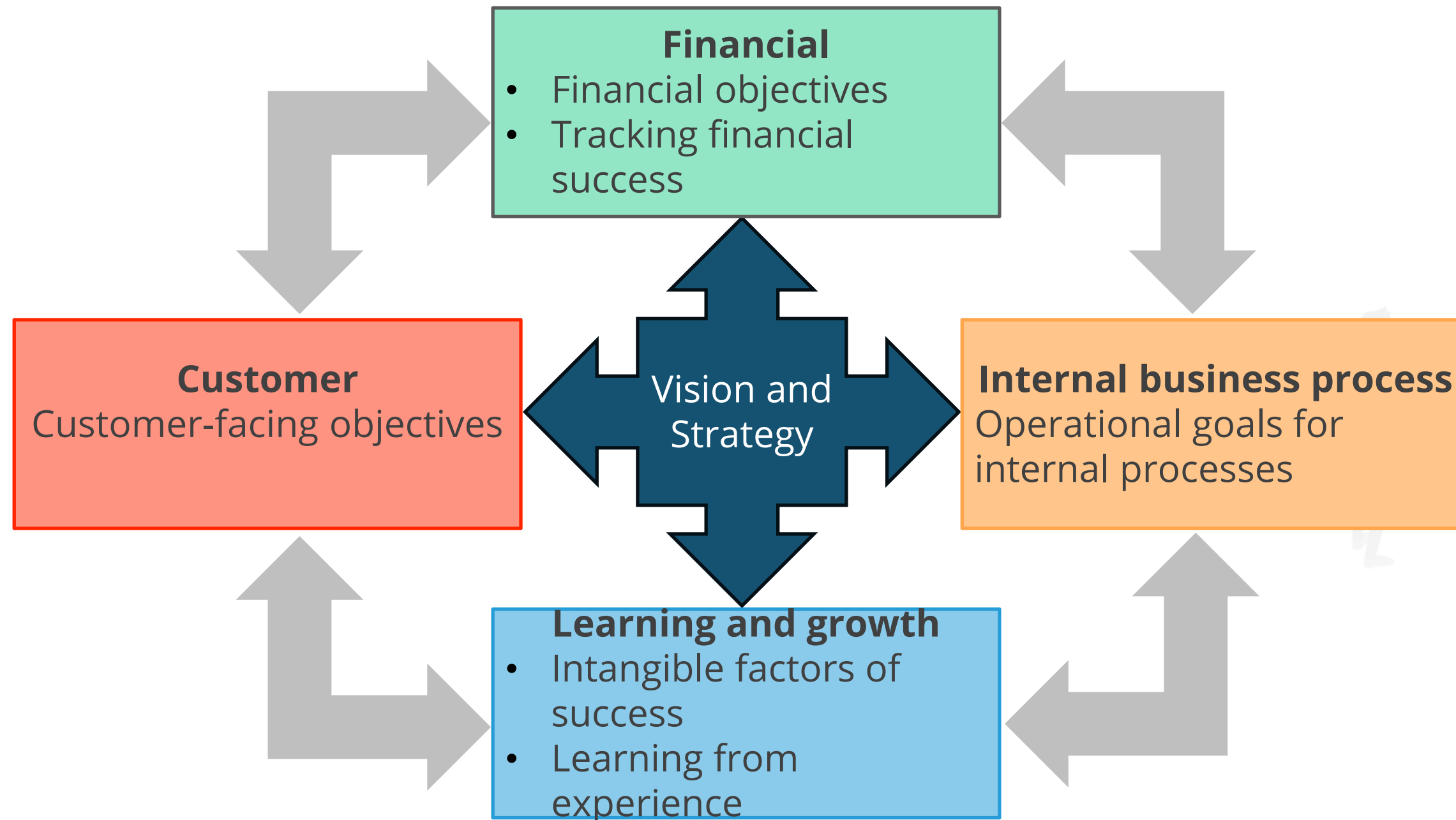
BSC (Balanced Scorecard)

Benefits of BSC



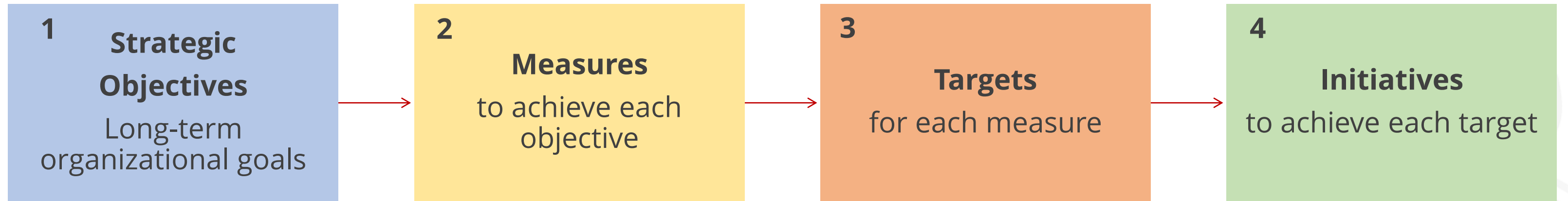
Four Perspectives in BSC

By using BSC, an organization maps its strategic objectives to the specific metrics of performance.



Developing a BSC

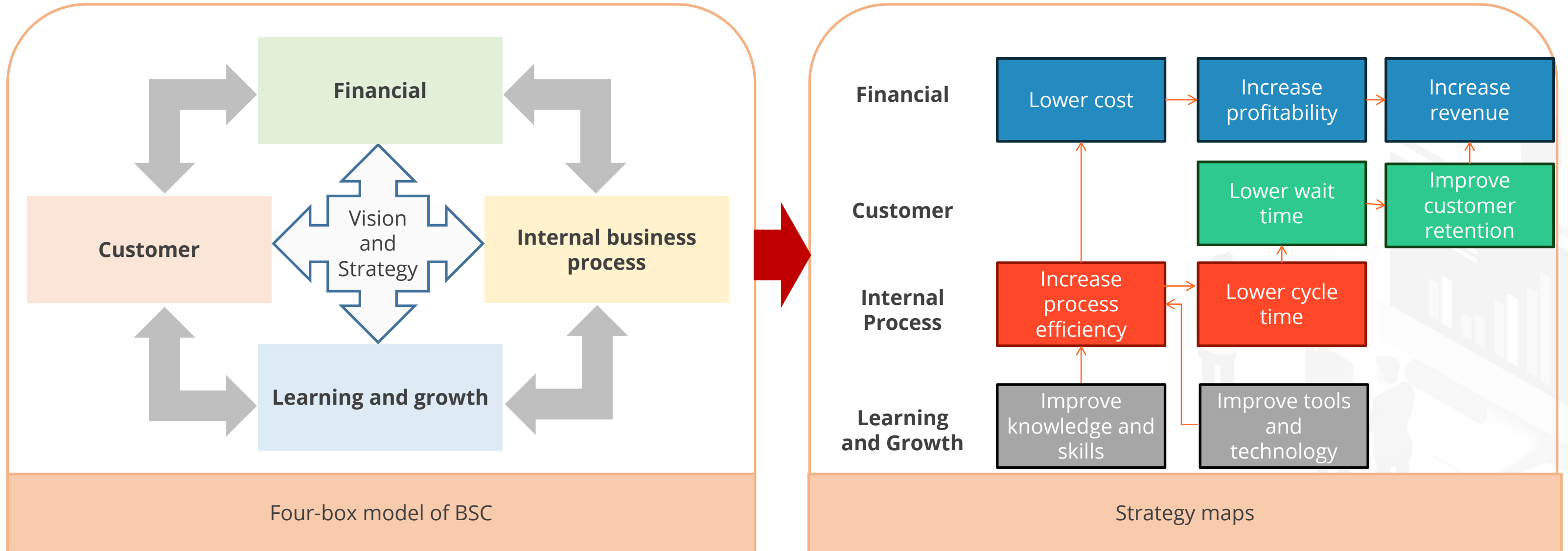
Interactions between perspectives or business units are considered to prevent uneven optimization.



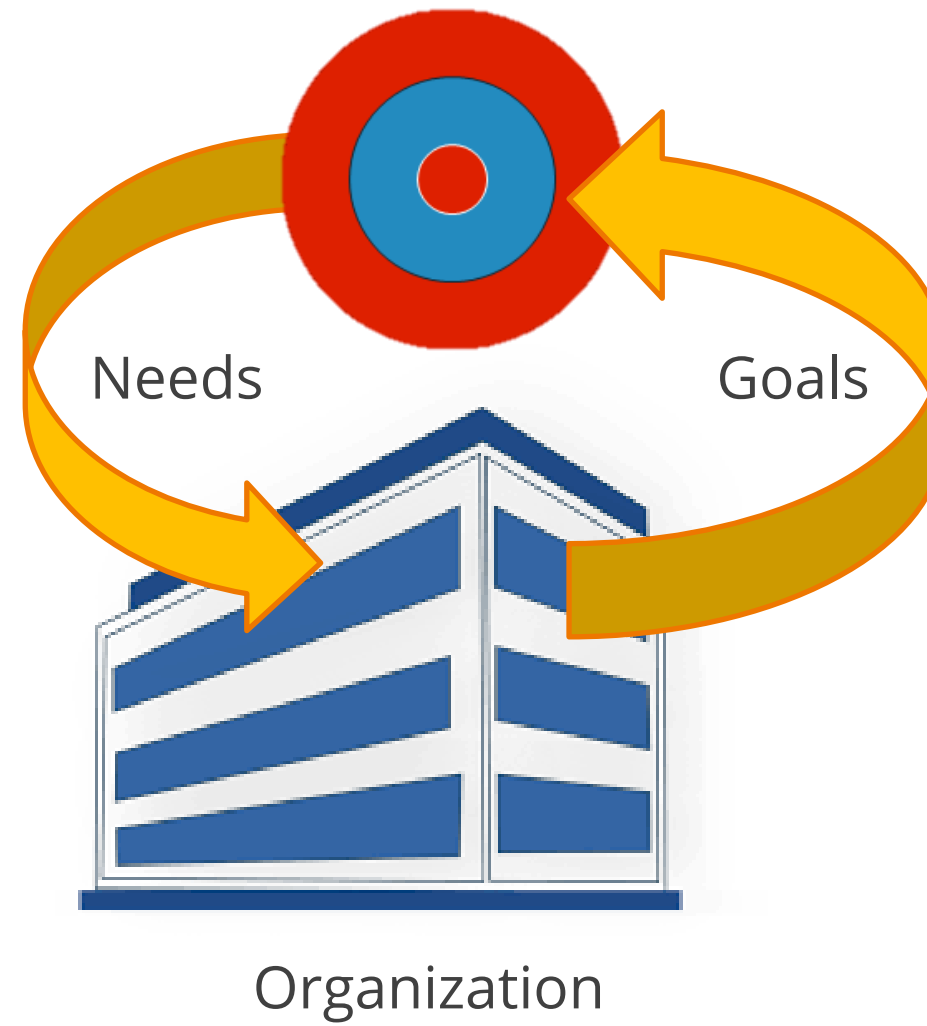
Not every initiative identified should be worked as a Six Sigma project, but some could be.

Four-box Model vs. Strategy Maps

Alternatives to BSC



Impact to the Organization



Impact to the Organization



Timelines



Personal goals



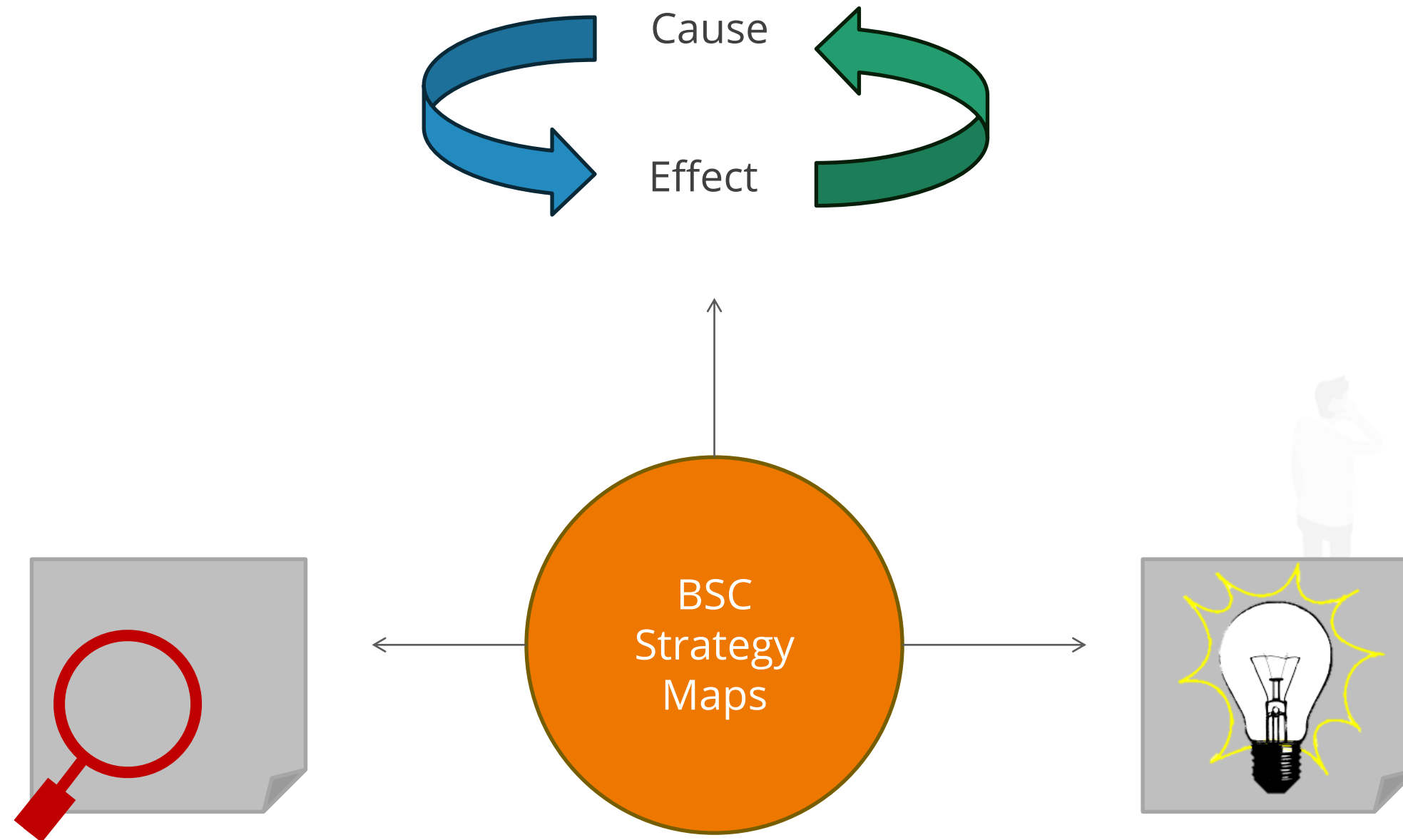
Work goals



Resources

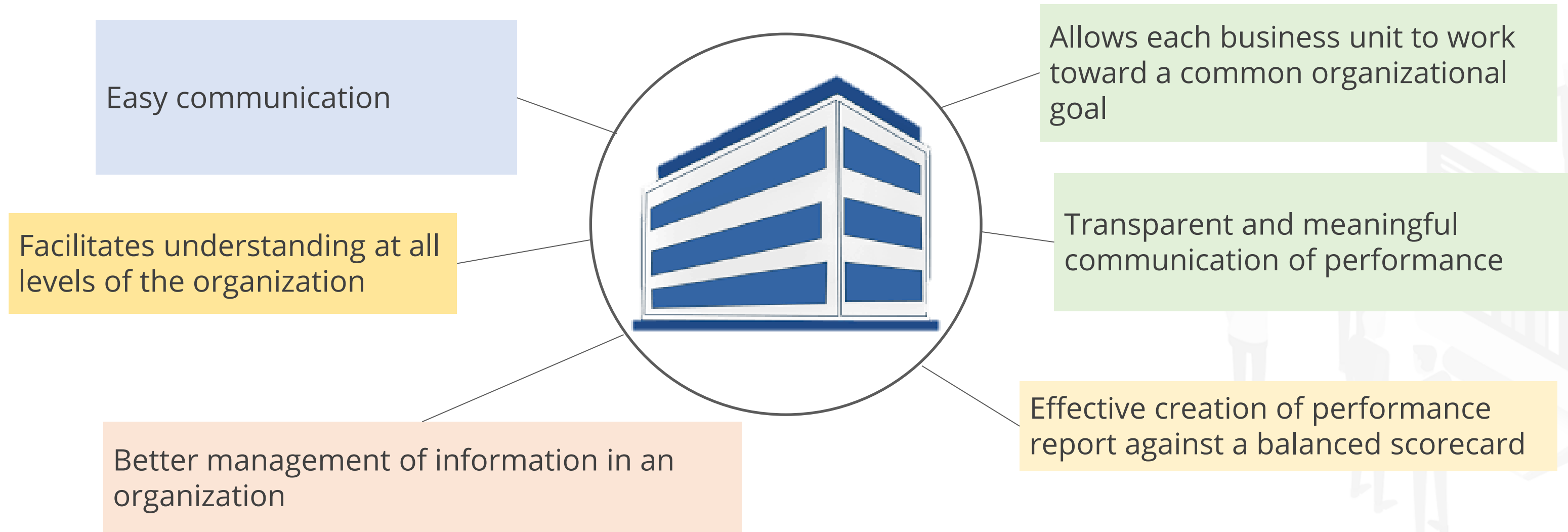
Impact to the Organization

How the use of BSC strategy maps affect an organization?



Benefits of BSC Strategy Maps

The BSC enables the organization to improve in the following ways:



Key Takeaways

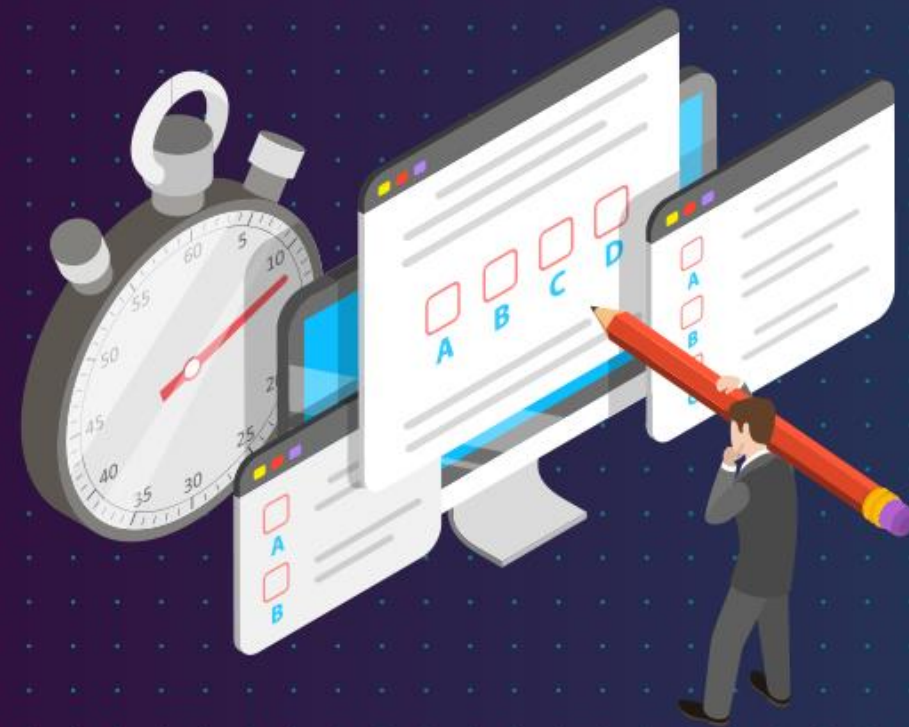
- Quality is defined as the degree of excellence of a product or service and conformance to customer requirements
- Six Sigma is a business methodology that employs a customer centric and fact-based approach to reduce process variation and waste
- There are five phases in the DMAIC process: Define, Measure, Analyze, Improve, and Control
- The five levels in the Six Sigma team are: Six Sigma Green Belts, Six Sigma Black Belts, Six Sigma Master Black Belts, Six Sigma Champions, and Top Executives



Key Takeaways

- Apart from financial accounting, the BSC also considers internal processes, customer satisfaction, and learning and growth
- Strategy map depicts a chain of cause and effect relationships between the perspectives and the relationships that are represented by interlinked objectives





Knowledge Check

Knowledge Check

1

Customers have asked for products from an IT company to be delivered within two weeks. In this case, a product delivery that takes longer than two weeks would be considered as:

- A. An opportunity
- B. A defect
- C. A specification limit
- D. Defective



Knowledge Check

1

Customers have asked for products from an IT company to be delivered within two weeks. In this case, a product delivery that takes longer than two weeks would be considered as:

- A. An opportunity
- B. A defect
- C. A specification limit
- D. Defective



The correct answer is **D**

A product delivery is a unit that could be right or wrong.

Knowledge Check

2

Which of the following phase is not included in the Six Sigma process?

- A. Define
- B. Analyze
- C. Control
- D. Implement



Knowledge
Check

2

Which of the following phase is not included in the Six Sigma process?

- A. Define
- B. Analyze
- C. Control
- D. Implement



The correct answer is **D**

The Six Sigma Process is known as DMAIC, which consists of Define, Measure, Analyze, Improve, and Control.

Knowledge Check

3

What is a defect?

- A. When there is a limit to the customer specification
- B. When an output meets the customer's expectations
- C. When an opportunity does not meet customer expectations
- D. When there is a non-conforming part or unit



Knowledge Check

3

What is a defect?

- A. When there is a limit to the customer specification
- B. When an output meets the customer's expectations
- C. When an opportunity does not meet customer expectations
- D. When there is a non-conforming part or unit



The correct answer is **C**

A defect is defined as an opportunity that does not meet customer requirements or expectations.

Knowledge Check

4

Which of the following perspectives belong to the BSC approach?

- A. Customer, supplier, input, and output
- B. Process, people, technology, and policies
- C. Financial, customer, internal processes, and learning and growth
- D. Internal processes, customer, financial, and objectives



Knowledge Check

4

Which of the following perspectives belong to the BSC approach?

- A. Customer, supplier, input, and output
- B. Process, people, technology, and policies
- C. Financial, customer, internal processes, and learning and growth
- D. Internal processes, customer, financial, and objectives



The correct answer is **C**

The four perspectives in a Balanced Score Card are financial, customer, internal processes, and learning and growth.