

LEANOhio

Transforming the Public Sector

Green Belt

Measurement Systems Analysis

SIMPLER. FASTER. BETTER. LESS COSTLY.

Define

1. Identify CTQ

2. Develop PAF

3. Visualize the Process

Purpose: To identify and prioritize the business improvement opportunity, define critical customer requirements, document the processes and build effective teams

Deliverables:

Project Approval Form; Project Team – TRAIL; CT Flow Down (CTs); SIPOC; Process map (current process) ; Project benefits; Project plan major milestones; Data Collection Plan; Data Integrity Audit (if applicable)

Measure

4. Understand Metrics

5. Validate measurement System

6. Determine Process Performance

Purpose: To determine what to measure, manage the measurement data collection, develop and validate measurement systems and determine process performance

Deliverables:

TRAIL Chart – updated; Detailed Process Map; Cause & Effect Matrix; FMEA; Decision Tree; Operational Definitions; MSA Evaluation; Data Collection Plan; Capability Study with Control Charts; Project Status

Analyze

7. ID potential Sources of Variation

8. Characterize the X's

9. Determine Significant X's

Purpose: To determine the root causes, estimate population parameters with confidence intervals and to construct hypothesis about the data and test them to determine significance.

Deliverables:

Data Collection Plan- updated; Hypothesis Testing; Decision Tree; MSA Analysis; Capability Analysis- updated; Executive Summary- updated; TRAIL- updated; Analysis Summary; Control Charts- updated

Improve

10. Establish level for X's

11. Develop Solutions

12. Pilot and Implement

Purpose: To develop and quantify potential solutions, improve/optimize the process, evaluate and select final solution and implement the pilot.

Deliverables:

DOE; Lean Analysis; Simulation; Optimal settings for X's; Executive Summary- updated; TRAIL- updated; Implementation plan; Control Charts- updated; Capability Analysis- updated

Control

13. Evaluate Process Performance

14. Develop Control Plan

15. Transition to Project Owner

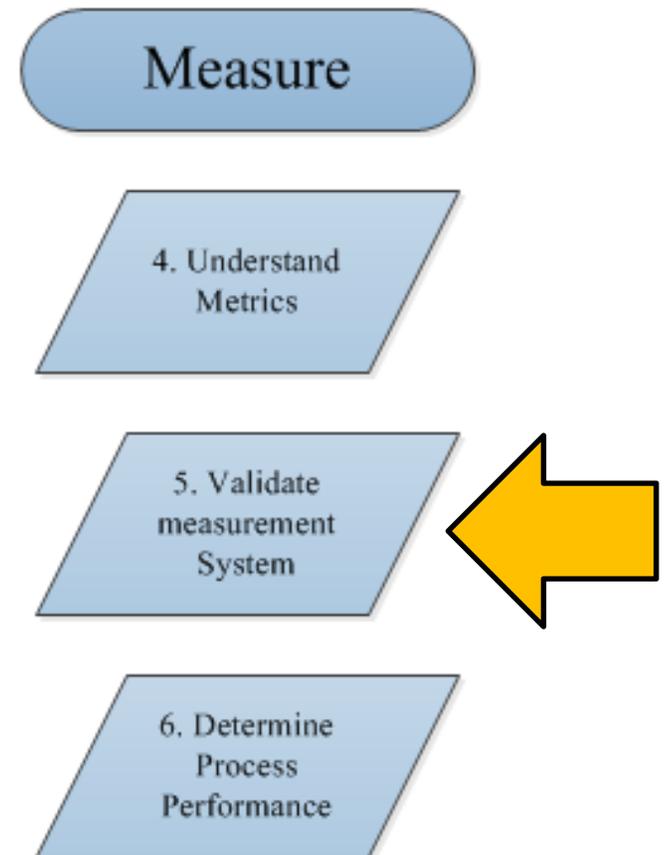
Purpose: Implement final solution, maintain process improvements, ensure new process problems are identified & quickly corrected, disseminate lessons learned. Identify areas for replication & standardization.

Deliverables:

Control Plan; Transition Plan; Capability Analysis- updated; Executive Summary- updated; TRAIL- updated; Control Charts- updated

DMAIC Flow: Measurement System Analysis

- Measure:
 - Understand Metrics
 - Validate Measurement System
 - Determine Process Performance
- Measure Purpose:
 - To determine what to measure
 - Manage the measurement data collection
 - Develop and validate measurement systems
 - Determine process performance.



Learning Objectives

- Understand the concepts of Measurement Systems Analysis
- Understand how to conduct an Attribute Agreement Analysis
- Recognize when to consider conducting a data integrity audit

Data Collection Review

Important questions for data collection:

- What type of data do I have? (Continuous vs. Discrete)
- What do you want to know?
- From who do you want to know it?
- What will you do with the data?

Continuous and Discrete Data

Continuous Data/Measuring Examples:

- Weighing something
- Measuring the length of something
- Measuring how long something takes

Discrete Data/Evaluating Examples:

- Evaluating if something is pass or fail
- Evaluating type of support (category)
- Evaluating what code group for a purchase

Key Factors of Data Collection

- Length of time: per hour, day, shift, batch, etc.
- Type: cost, errors, ratings, etc.
- Source: reports, observations, surveys, etc.
- Cost: internally and externally
- Collector: team member, associate, expert, etc.

Measurement System Analysis

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MSA Definition

Measurements System Analysis (MSA) refers to the analysis of precision and accuracy of measurement methods. Three characteristics contribute to the effectiveness of a measurement method:

- Repeatability
- Reproducibility
- Accuracy

Repeatability

A measurement method must be **repeatable**. A user of the method should be able to repeat the same results given multiple opportunities with the same conditions

Repeatability describes the minimum variability in results and implies that the variability of the measuring instrument itself is consistent

Reproducibility

The method must then be **reproducible**. Several different users must be able to achieve the same results

Reproducibility describes the variability in results and implies that variability across operators is consistent

Repeatability and Reproducibility

Repeatability and **reproducibility** often come under the heading of **precision**

Precision requires that the same measurement results are achieved for the condition of interest with the selected measurement method

Accuracy vs. Precision

Accuracy
describes
Centering



How close to
target?

Precision
describes
Spread.



How close
together?

Causes of Error

- Process variation
- Operator variation
- Operator-to-operator variation
- Equipment variation

Measurement Systems Analysis: Three Types

Data Integrity Audits

- ✧ Used to assure that captured data is handled and reported without error or distortion

Attribute Agreement Analysis

- ✧ Used when making assessments or judgments involving discrete (nominal and ordinal) data

Gage R&R

- ✧ Used when making assessments or judgments involving continuous (interval and ratio) data

Goal of MSA - Assure Reliable Data

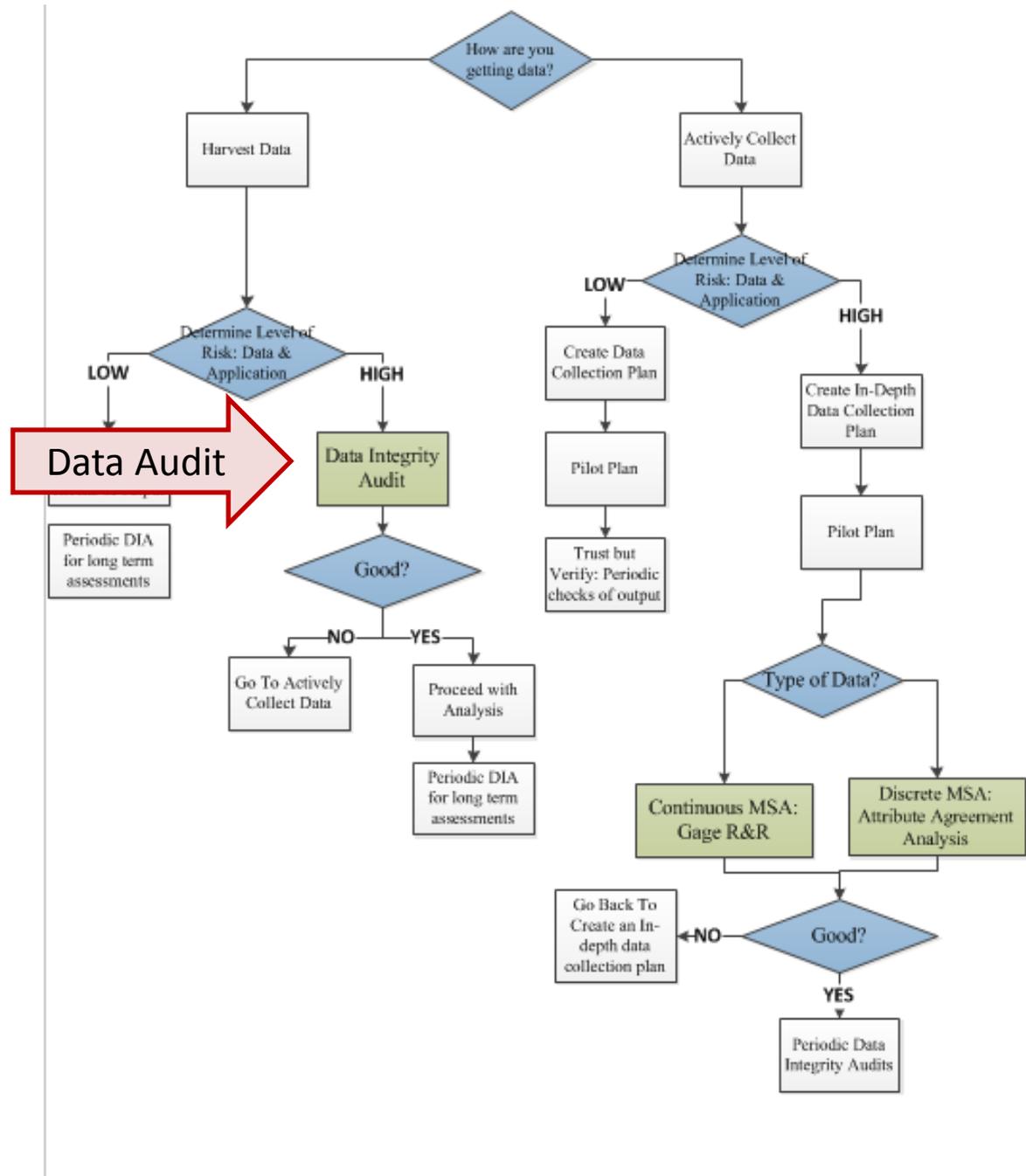
- Determine the magnitude (impact) of the measurement error
- Determine if the measuring system is “capable” for this study
- Determine sources of measurement error
- Determine if measuring system stable over time

Data Integrity Audit

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Data Collection: Road Map



Data Audit →

Audit Exercise

- You are an inspector at the Department of Prevention and your job is to find defects in a form you have been given
- **Defect Definition**: The Letter F/f
- **Task**: Count the defects without altering the product in 60 seconds

Audit Exercise

The Necessity of Training Farm Hands for First Class Farms in the Fatherly Handling of Farm Live Stock is Foremost in the Eyes of Farm Owners. Since the Forefathers of the Farm Owners Trained the Farm Hands for First Class Farms in the Fatherly Handling of Farm Live Stock, the Farm Owners Feel they should carry on with the Family Tradition of Training Farm Hands of First Class Farmers in the Fatherly Handling of Farm Live Stock Because they Believe it is the Basis of Good Fundamental Farm Management.

Audit Exercise

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Data Integrity Audits

Data comes to us from various places:

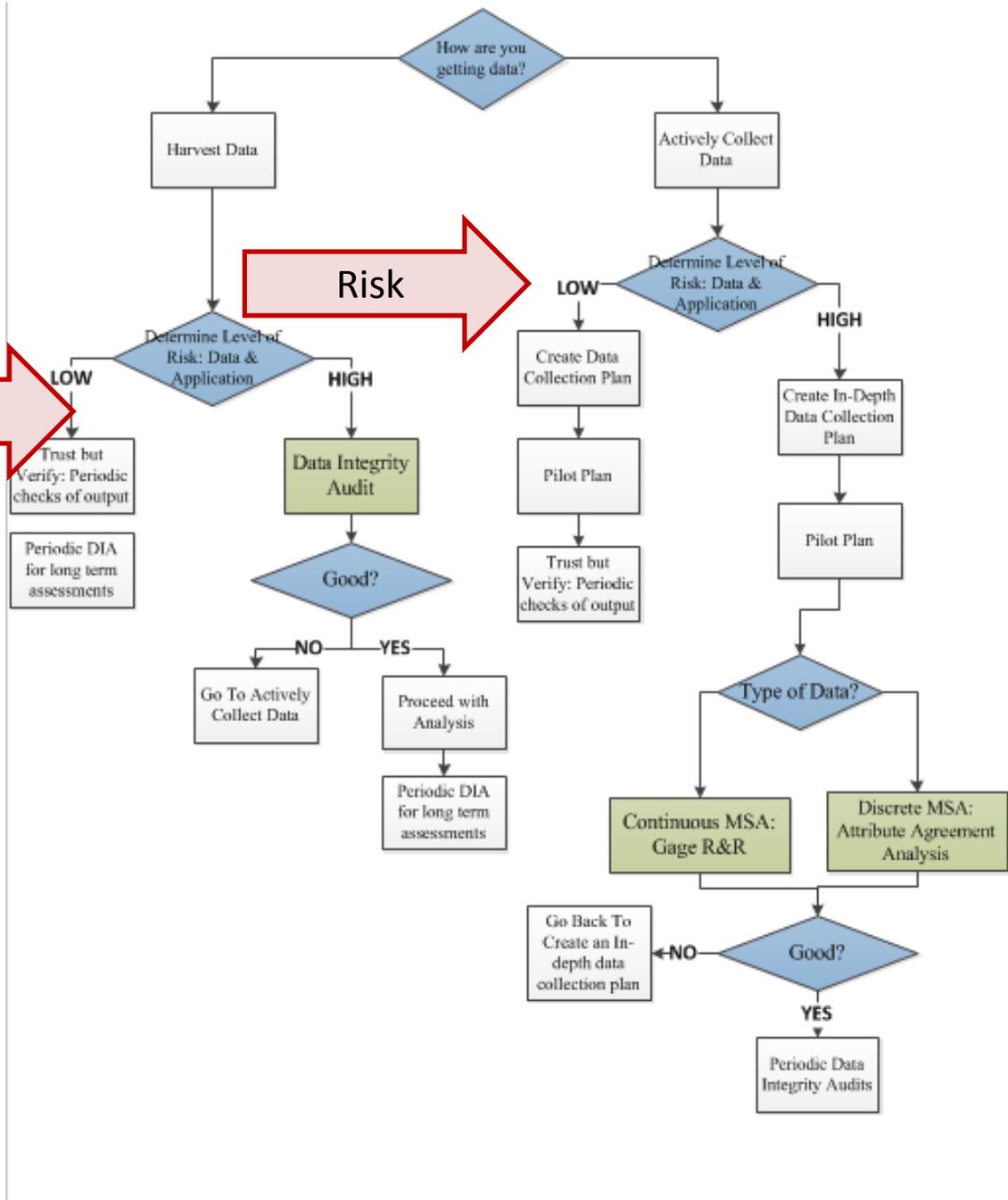
- Databases
- Customers
- Co-workers
- OAKS

How can we be sure this data is good?

Data Collection: Road Map

Risk

Risk



Data Analysis: Evaluating Risk

- Is there a data entry process? Is the process being followed?
- How many points of entry are there for the data entry process?
- Where are you getting the data?
- Is the data system historically reliable?
- What is the experience level of data collector?
- Is there a secondary source to check the data?
- Is the process politically sensitive?

Data Spreadsheets: Common Issues

- Formulas are incorrect
- Spreadsheet is not protected or locked
- Lose data through errors or computer issues
- Omitted information
- Added information
- Data collectors can make mistakes

Requesting Data

When you are requesting information:

- Be clear
- Be concise
- Time bound
- Realistic timeframes
- If possible ask for all information once

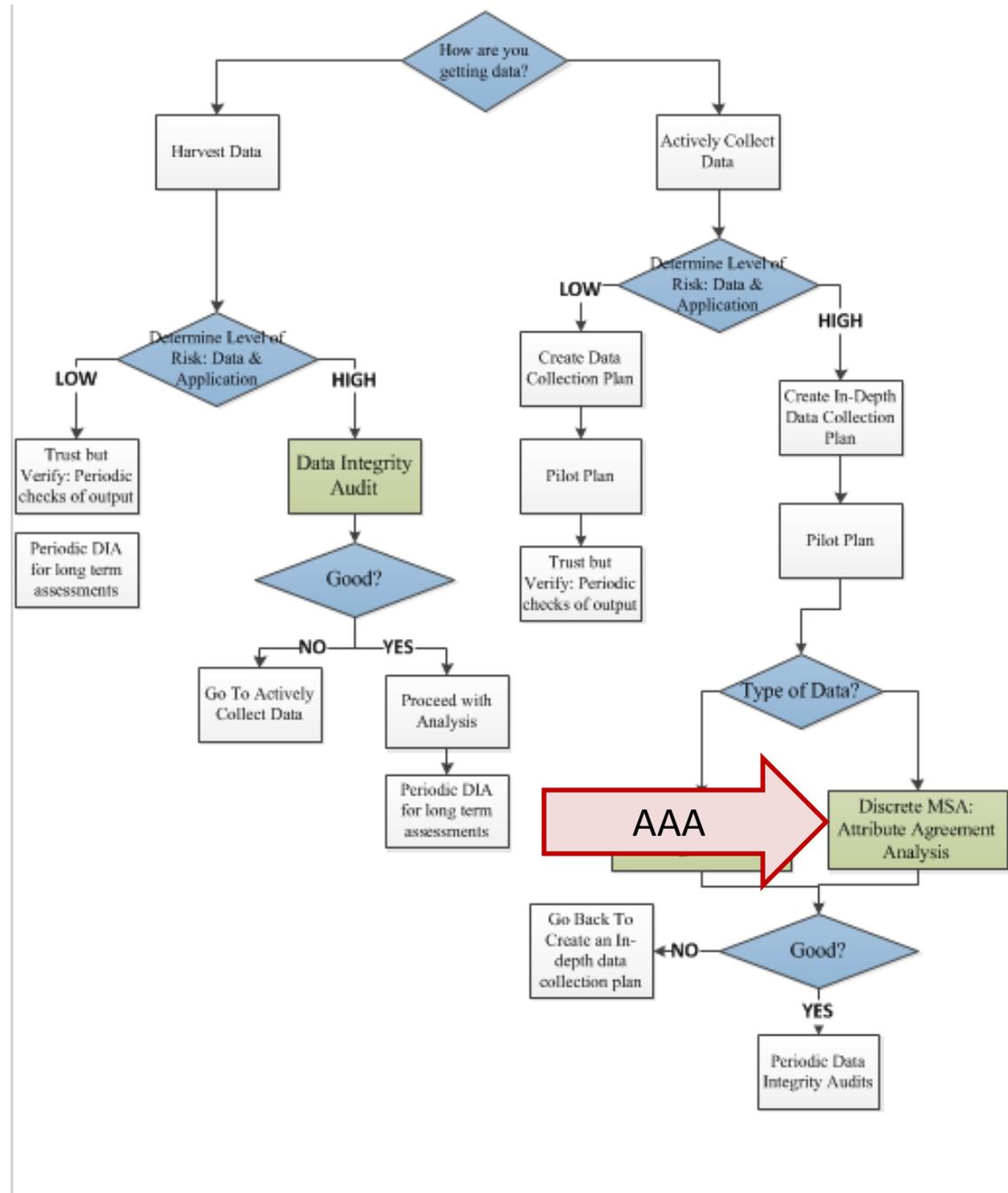
Time Component

- The data you collect may be a snapshot of the current state
- Use your time as productively as possible
- Be realistic when collecting and analyzing data
- Collect data in a time frame that is specific and relevant to your project or process

When Is Enough Actually Enough?

- You may have to rely on your gut reaction with your data...
- Determine what your level of acceptable risk is and do your best to work with what data is available
- BUT note any issues or concerns as disclaimers with your project stakeholders and in your project charter

Data Collection: Road Map



How do you make sure the data is valid?

Taking steps to ensure accuracy and consistency of measurements through analysis and review is necessary to obtain process control

Attribute Agreement Analysis

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Attribute Agreement Analysis

- Used with Discrete Data (human judgement required)
- When categorizing items (good/bad; type of call; reason for leaving) you need a high degree of agreement on which way an item should be categorized
- Disagreements should be used to clarify operational definitions for the categories

Attribute Agreement Analysis Purpose

- Determines whether everyone involved in the process is using the same process/criteria

Discover areas where:

- Additional training is needed
- Procedures are weak or non-existent
- Standards are not defined

Setting Up an Attribute Agreement Analysis

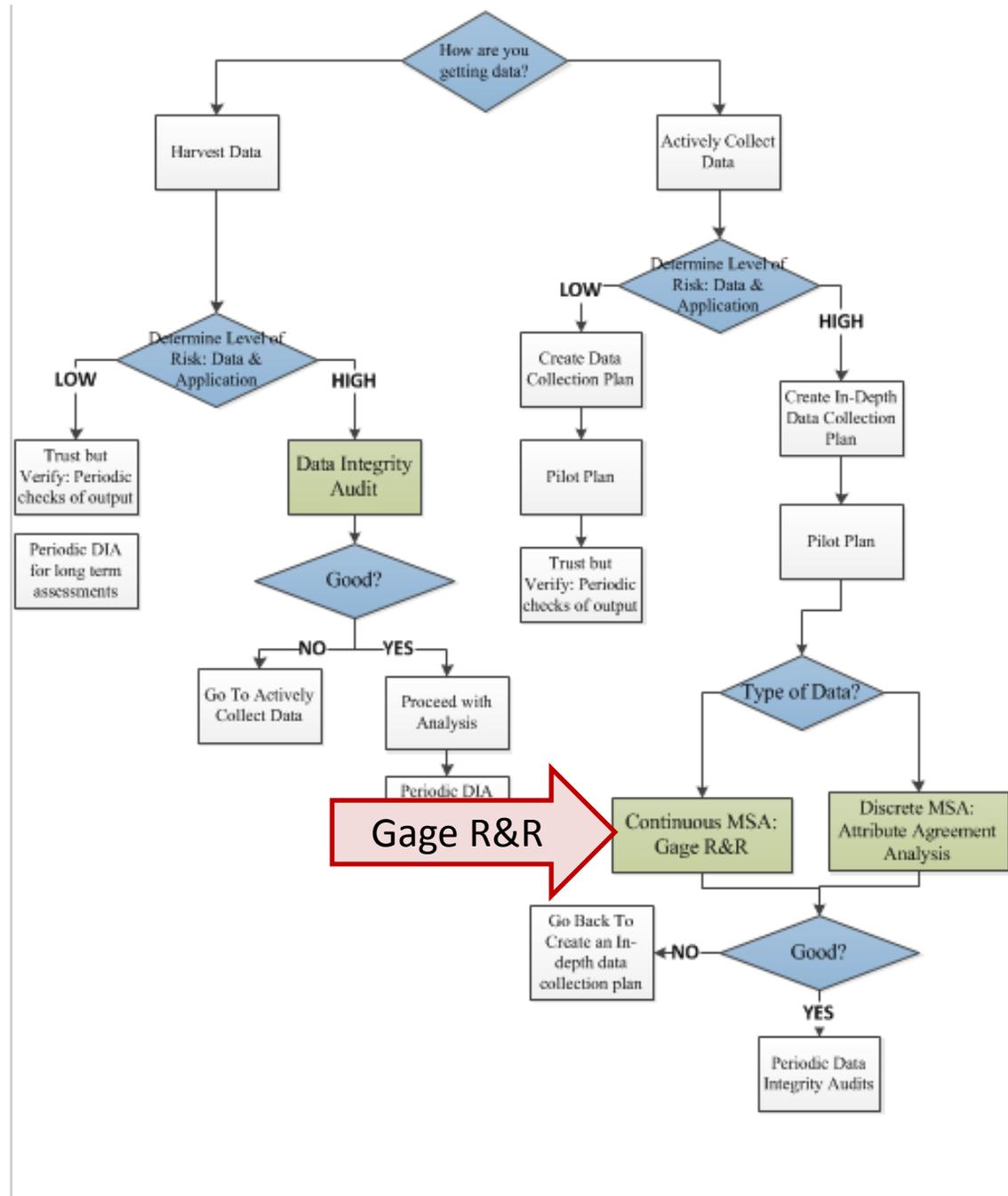
- Select a set of samples in your process
- Identify the appraisers
- Have each appraiser, independently and in random order, assess the sample and determine whether or not the selected samples are pass or fail
- Enter the data into Minitab to report the effectiveness of the attribute measurement system (or eyeball it)
- Implement solutions to remedy defects
- Complete another Attribute Agreement Analysis after control measures are in place to assess improvements

Gage R&R

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Data Collection: Road Map



Gage R&R

- Used with Continuous Data
- This topic is covered in Black Belt

Key Learning Points

The Green Belt should now be able to:

- Know the basic concepts of data integrity auditing
- Know when to consider conducting a data integrity audit
- Recognize that data integrity audits should evaluate reliability and validity considerations
- Understand how to conduct an attribute analysis

Questions?

Attribute Agreement Exercise

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Attribute Agreement Exercise

Groups of Three:

Sales Tax is an important to government

- Sandwiches and Candy/Confectionary are generally subject to sales tax. It is important to have clear operational definitions and test these definitions so we as an agency know what to tax.
- Your task is to develop the operational definition that can be used by the public and your agency for sales tax purposes. This definition should be clear and will be tested by your other team members.

Attribute Agreement Exercise

Groups of three:

- Deputy Director Taxation: identifies the Standard or “truth” for each of the pictures provided. Do not show these “truths” to anyone else.
- Tax Analyst #1: reads the operational definition and defines the pictures as meeting the taxable standard or not.
- Tax Analyst # 2 :reads the operational definition and defines the pictures as meeting the taxable standard or not.
- Deputy Director Taxation: records the answers without letting the Analysts see the information. Then shuffles the cards
- Tax Analyst #1: evaluate the samples again
- Tax Analyst #2: evaluate the samples again
- Deputy Director Taxation: records the answers without letting the Analysts see the information.
- All 3 team members review the results

New York Tax Department: Candy and Confectionery

Introduction

Most sales of candy and confectionery are subject to sales tax. This bulletin outlines items that are considered candy and confectionery for sales tax purposes, as well as items that are not.

Candy and confectionery

Candy and confectionery includes candy of all types, and similar products that are regarded as candy or confectionery based on their normal use or marketing. *Candy and confectionery* also generally includes preparations of fruits, nuts, popcorn, or other products in combination with chocolate, sugar, honey, candy, etc. Some examples of candy and confectionery include (**note:** any brand name product shown in italics is included as an example and is not to be construed as an endorsement of the product):

- candy bars;
- chocolates;
- fruit, nuts, and popcorn covered with caramel, chocolate, honey, sprinkles, or other similar coatings;
- honey-roasted nuts;
- chewing gum;
- fudge;
- maple sugar candy;
- candy or chocolate covered marshmallows in decorative shapes (for example, *Peeps*®);
- mints;
- peanut brittle;
- cotton candy;
- licorice;
- dietetic candy; and
- candied apples.

Products that are not considered candy and confectionery

Candy and confectionery does not include:

- baked goods, including cupcakes, cookies, pretzels, donuts, and pastries, or any similar products such as granola or cereal bars;
- baking or cooking ingredients, such as candied fruitcake ingredients, chocolate chips or bars, and marshmallows of any size (other than the candy or chocolate covered marshmallows described above);
- maple sugar products, unless labeled *candy* or *confection* or advertised as candy; and
- dried fruit, including *Craisins*®, *Fruit Roll-Ups*®, or other similar snacks (unless coated or covered in candy, etc., as described above).

Questions?

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