UNIT-5
IMPLEMENTATION OF BI

Business Activity Monitoring
Complex Event Processing
Business Process Management
Metadata Root Cause Analysis

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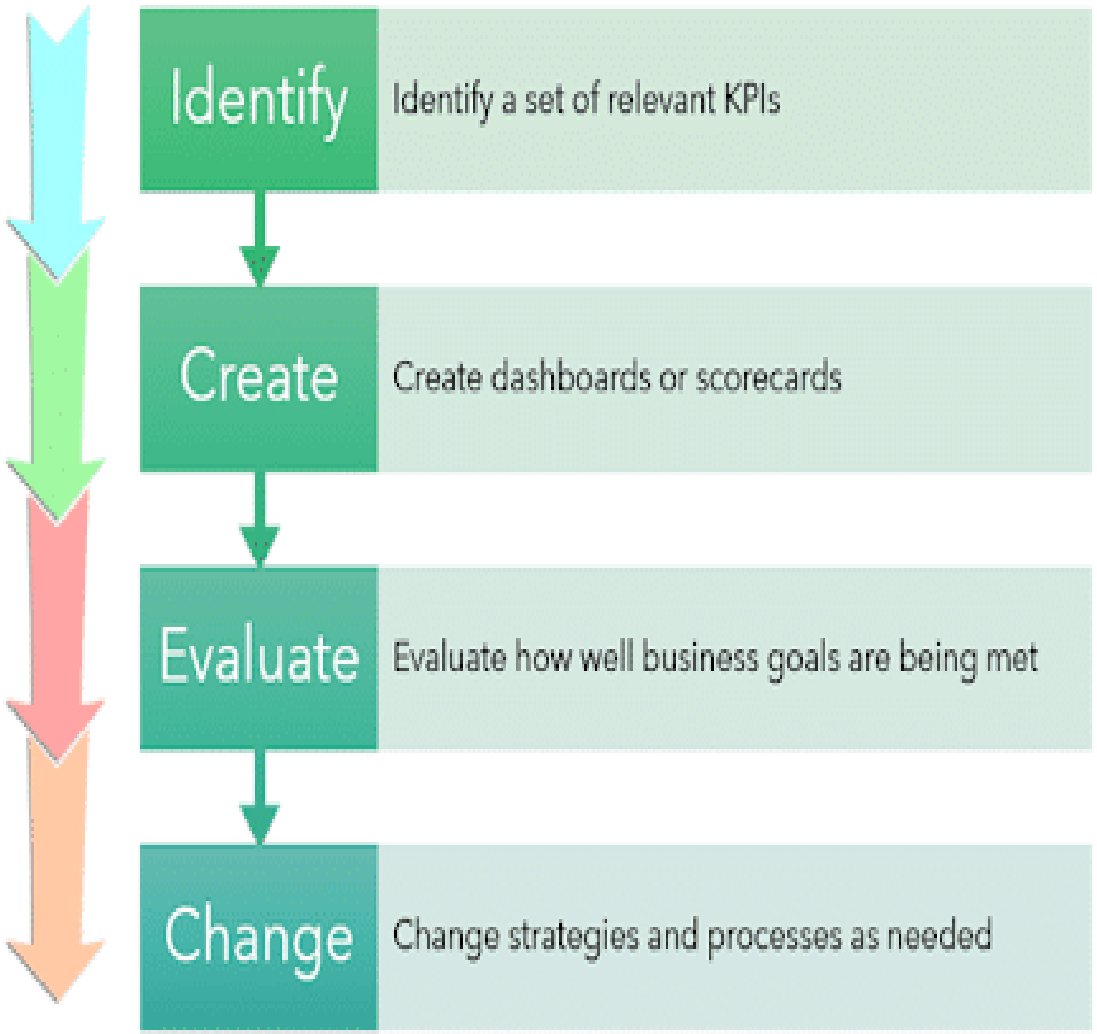
Business Activity Monitoring

'Business activity monitoring' ('BAM') is software that aids in monitoring of business activities, as those activities are implemented in computer systems.

- To gain a clear understanding of business operations, key performance indicators (KPIs) must be set to monitor performance. KPIs vary depending on the product or service in question and the organization’s goals and functions, but can include metrics like application usage, runtime errors, unplanned downtime, return on investment (ROI) or sales totals.

Key Steps in KPI Process

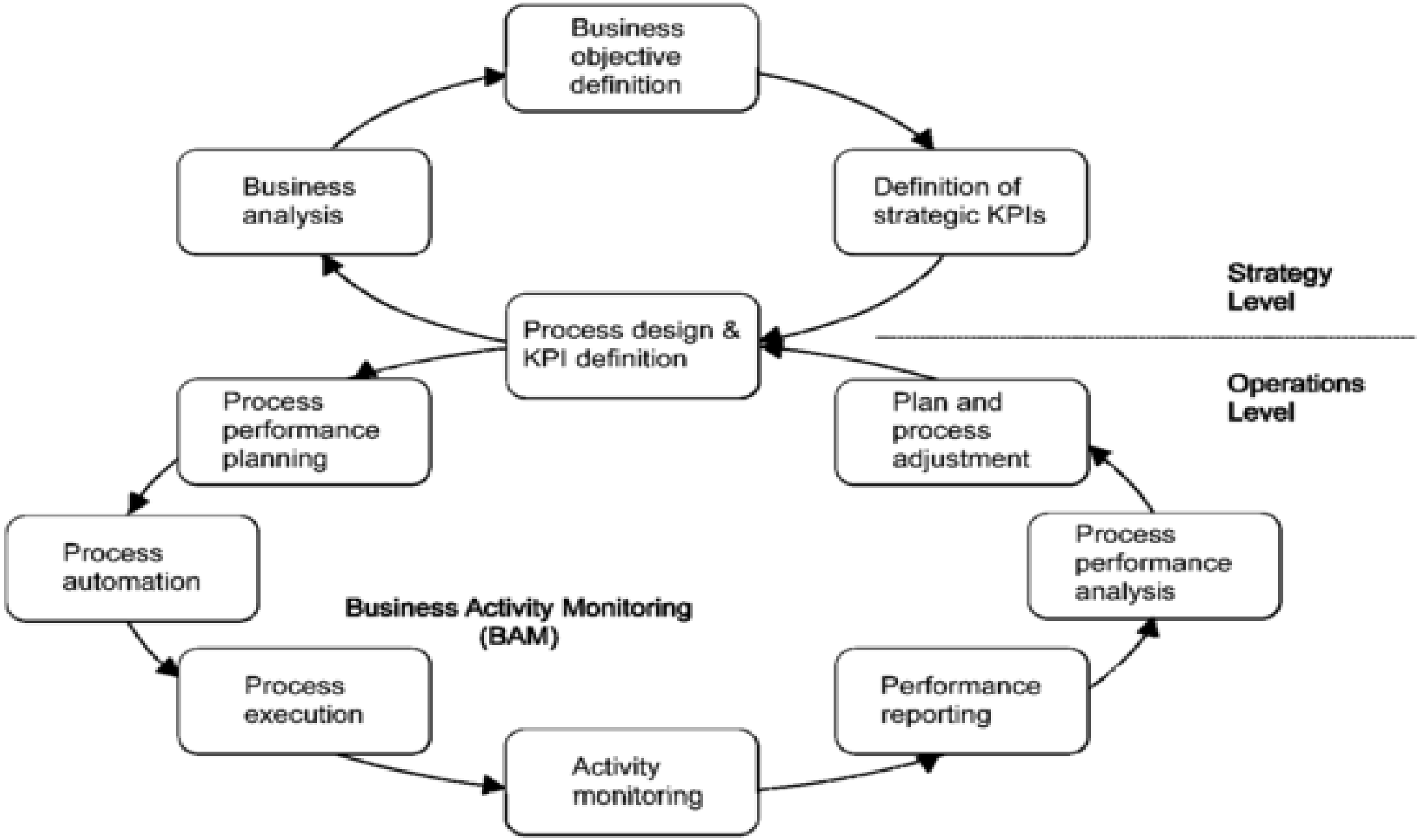


KPI selection criteria

- Relevant
- Clearly defined
- Balanced

Other popular characteristics, less relevant during the selection workshop

- Accessible
- Actionable
- Controllable
- Cost-effective
- Incentivized
- Standardised
- Timely
- Verifiable


Business objective definition
Business analysis
Definition of strategic KPIs
Strategy Level
Process design & KPI definition
Operations Level
Process performance planning
Plan and process adjustment
Process automation
Process performance analysis
Business Activity Monitoring (BAM)
Process execution
Performance reporting
Activity monitoring

Business Activity Monitoring (BAM)

- Business activity monitoring (BAM) is the real-time monitoring of an organization's business processes.
- It is a method used to identify bottlenecks, non-standard activities, and inefficiencies in an organization's business process.
- Business activity monitoring supports operational decisions and ensures adherence to legal requirements, service level agreements (SLAs), and corporate policies by providing valuable information about daily business operations.
- BAM can be used for both internal and external processes by combining data analysis and process interpretation to determine how well the business is performing or where it needs improvements.
- This can also be done by analyzing data from different sources, including ERP systems, CRM systems, ERP logs, and other processes. BAM also provides some advanced features like SAP BW integration and BI tool integration which make it possible for you to develop custom dashboards based on your requirements.

Need for Business Activity Monitor

The following are some of the benefits that you can get from using BAM:

Customer satisfaction

- BAM gives you an insight into how your customers feel about your business and its products/services.

- This information will help you decide whether there are any areas where further improvements can be made so as to make them more satisfied with what they buy from your company.

Cost savings

- By monitoring operational activities such as inventory levels or product usage patterns, it becomes easier for managers at any level to identify which processes need improvement or optimization.

- You can save time and resources by implementing new ones without first checking if those improvements will actually result in cost savings over time.

Business Activity Monitor (BAM): Real-Time Analytics - Cflow

Activities	**Process Monitoring**	
	Traditional monitoring	**Business activity monitoring**
	Complements ←	→
Measurement	Measures data from other heterogenous sources	
Analysis	Request pulled & Time pushed Manual processing Database requests Storing and analyzing Business intelligence	Event (direct push) Real time event processing (low latency) Steam mining Stream and analyze Complex event processing
	Operational intelligence ←	→
Report and presentation	Ad hoc and done periodically	Permanently produced with very short intervals for refreshing
Cause, analysis and decision	Mid-term and long term	Immediate and short term

Real-Time Process Analytics Using BAM

- Real-time process analytics refers to processing data for automation, process optimization, and management. Business activity monitor aims to measure your business process activities with minimal delay possibly in real-time.

- It records all your process-related data and transforms it into ratios which are then used to measure the KPI targets.

- These KPI targets are defined by your business and with BAM, managers can become aware of the exceptions.

- These exceptions can either be opportunities or problems. Due to the nature of the BAM, managers can react to these exceptions proactively as they can use real-time information.

- Cflow's BAM can be used to observe all your process-relevant activities that happen across your organization. You can integrate activity information and commute metrics and implement business rules to set thresholds for easy visualization of the monitored data.

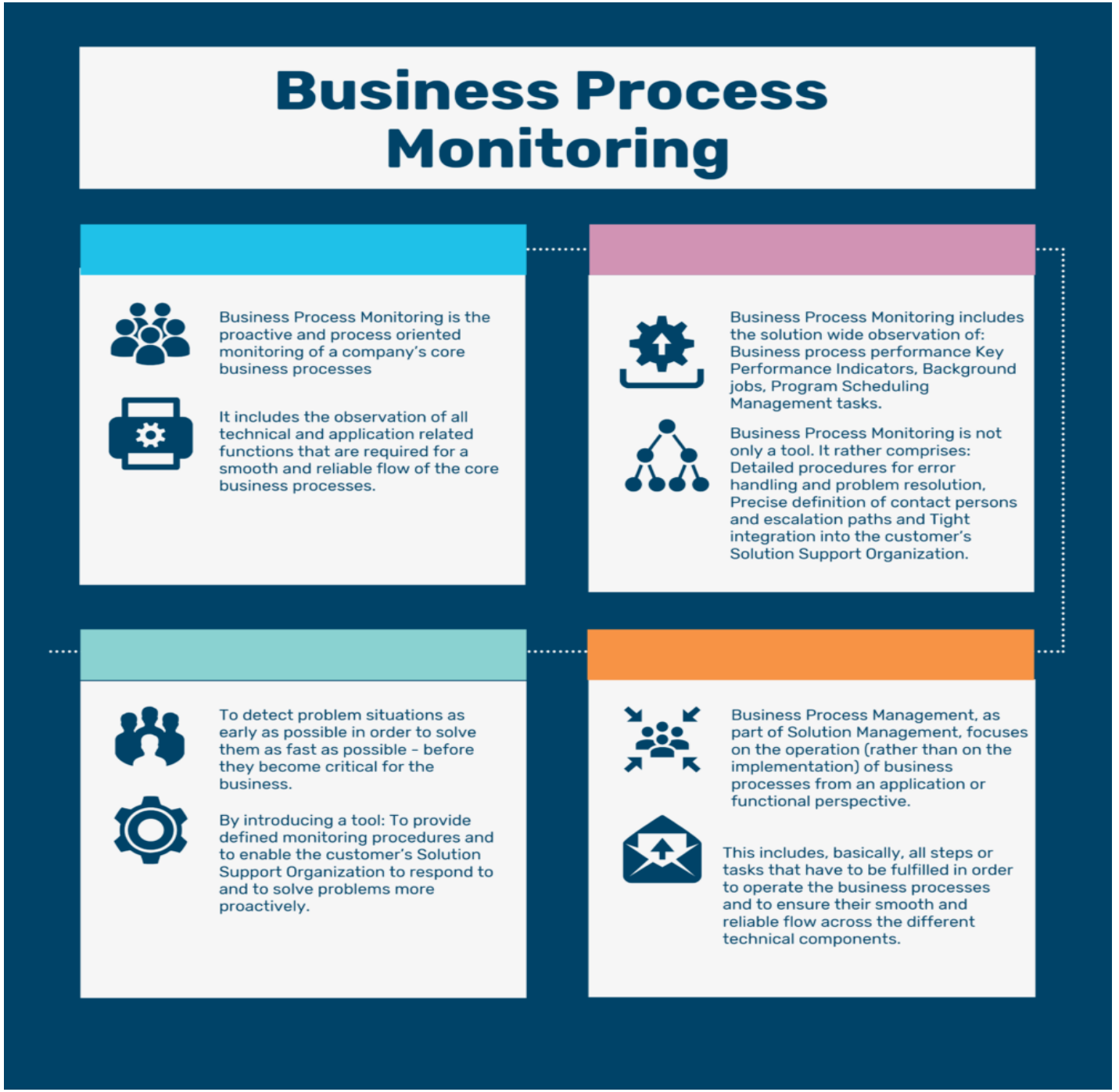
Elements of Business Activity Monitor

Business Activity Monitor (BAM) will help managers and executive teams understand their business units' performance. It consists of multiple elements that constitute a monitoring system.

- **Business process measurement**
- **Item instance monitoring**
- **Metric**
- **KPIs**
- **KPI definitions**
- **Metrics definition**
- **Trigger**
- **Timer**
- **Counter**
- **Monitoring scopes**
- **Business situations**
- **Monitoring the archetype**
- **Interactions and business situations**
- **BAM results in visualization**

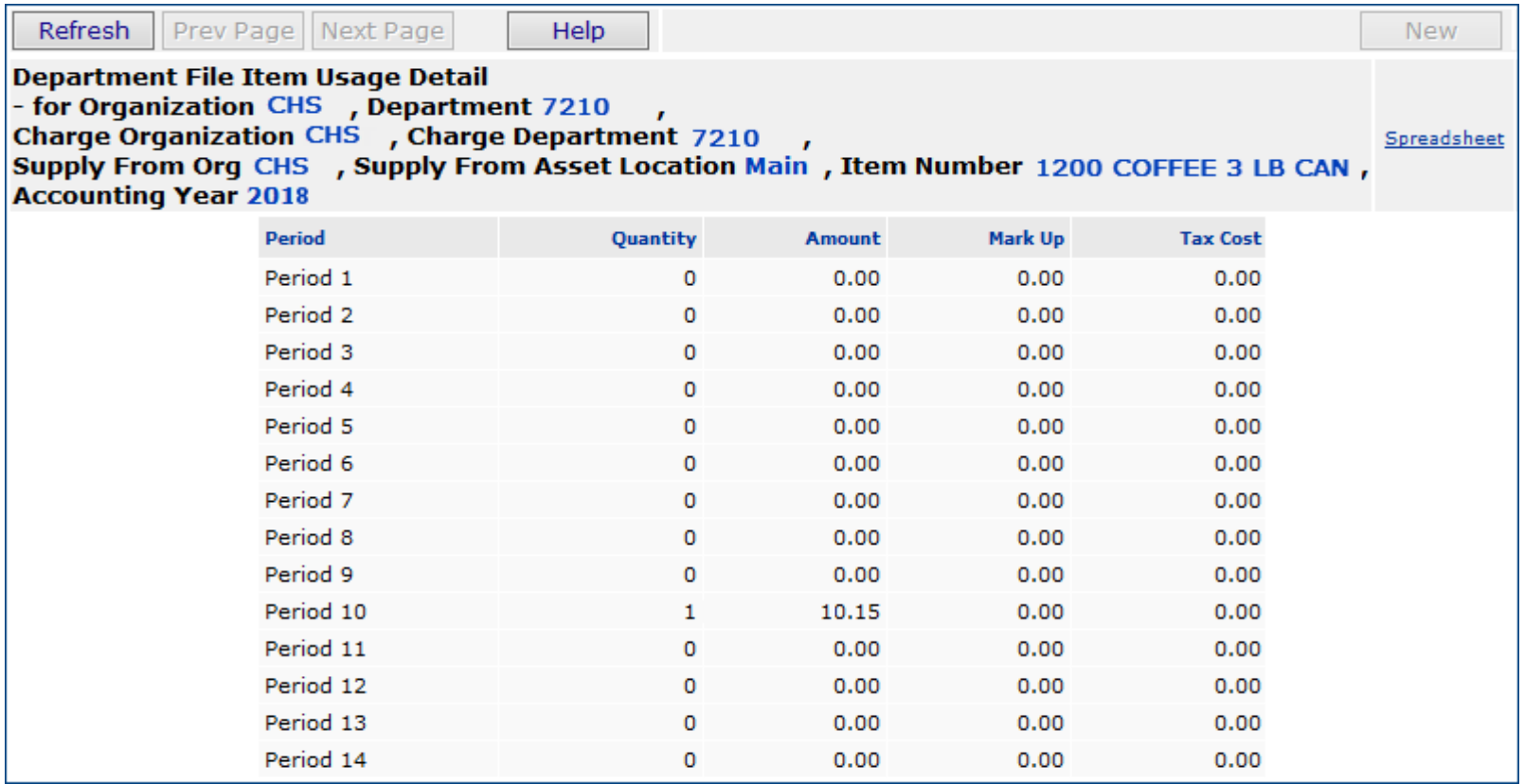
Business process measurement:

- Business Process Measurement (BPM) is a way to monitor and measure business processes, which can be used for:
- Measuring the performance of a process or process improvement.
- Automating business processes.



Item instance monitoring:

- An item instance is a business object that has been instantiated in your system. It represents the smallest unit of business process monitoring, which can be used to monitor individual instances of an item by using its unique identifier (ID).



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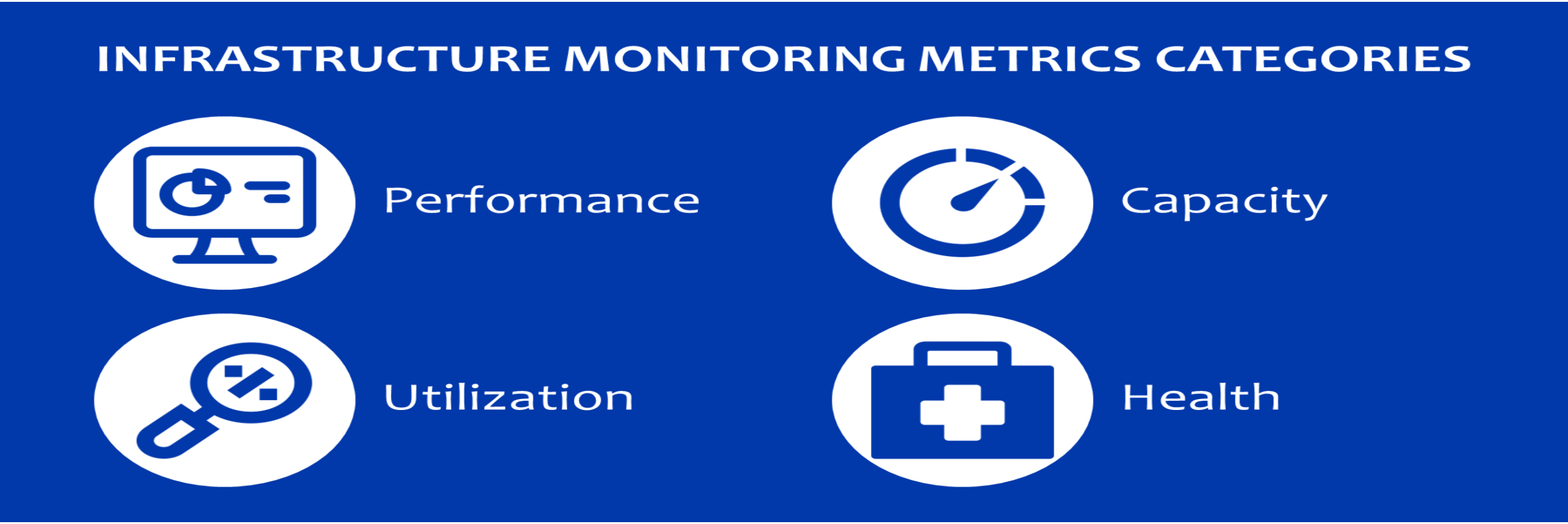
Department File Item Usage Detail
- for Organization CHS , Department 7210 ,
Charge Organization CHS , Charge Department 7210 ,
Supply From Org CHS , Supply From Asset Location Main , Item Number 1200 COFFEE 3 LB CAN ,
Accounting Year 2018

Spreadsheet

Period	Quantity	Amount	Mark Up	Tax Cost
Period 1	0	0.00	0.00	0.00
Period 2	0	0.00	0.00	0.00
Period 3	0	0.00	0.00	0.00
Period 4	0	0.00	0.00	0.00
Period 5	0	0.00	0.00	0.00
Period 6	0	0.00	0.00	0.00
Period 7	0	0.00	0.00	0.00
Period 8	0	0.00	0.00	0.00
Period 9	0	0.00	0.00	0.00
Period 10	1	10.15	0.00	0.00
Period 11	0	0.00	0.00	0.00
Period 12	0	0.00	0.00	0.00
Period 13	0	0.00	0.00	0.00
Period 14	0	0.00	0.00	0.00

Metric:

- A metric is a value that is calculated from data. It's an aggregation of data points and can be used to measure the performance of a business process. A metric is often expressed as an objective or goal, such as sales revenue per employee or customer satisfaction rate.



KPIs:

- KPIs are key performance indicators. They measure the performance of a business process and help you identify where your organization needs improvement. KPIs can be used to monitor every aspect of your business, from sales through customer service to operations efficiency.

- KPIs are especially useful for businesses that need more than one data point for their processes. If there were only one metric for each process, it would be difficult to determine whether those metrics were improving or declining over time.

- For instance: A salesperson is responsible for generating leads but also has another role as an account manager who handles follow-up calls after those leads have been generated. Both roles involve different types of activity so having two different KPIs would be difficult. Using just one KPI may not accurately reflect the true state of either process. Therefore, using multiple KPI metrics helps ensure that management has access to relevant information at all times throughout their day-to-day operations.

- So what is your KPI ? Is it
  - ✓ OEE metric
  - ✓ Customer Satisfaction Index
  - ✓ Number of Sales
  - ✓ Social Media following
  - ✓ Total Website traffic
  - ✓ Total Revenue
  - ✓ Total complaints

KPI definitions:

- A key performance indicator (KPI) is a measurement of progress toward the achievement of a specific goal. KPIs are used to measure the success or failure, as well as other aspects, of projects, departments, and organizations.

The most common types of KPIs include:

- Revenue targets
- Return on investment (ROI) metrics
- Profit margin percentages

Metrics definition:

- Metrics are a way to measure and monitor the performance of a business. Metrics are specific to the business and should be defined before starting any BAM project. It is important that metrics be defined by the business users, not IT or marketing professionals.

Step 1:

Set your company's goal

Step 2:

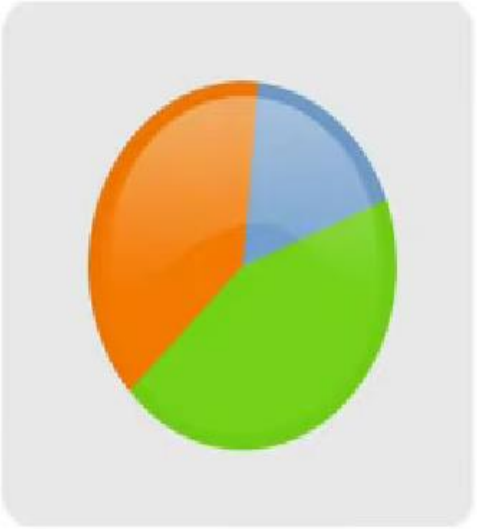
Define your success factors

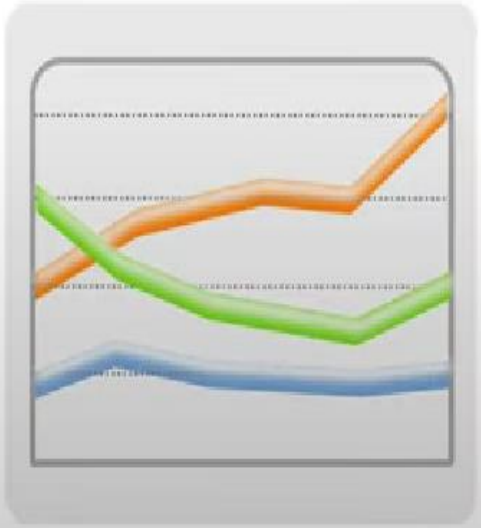
Step 3:

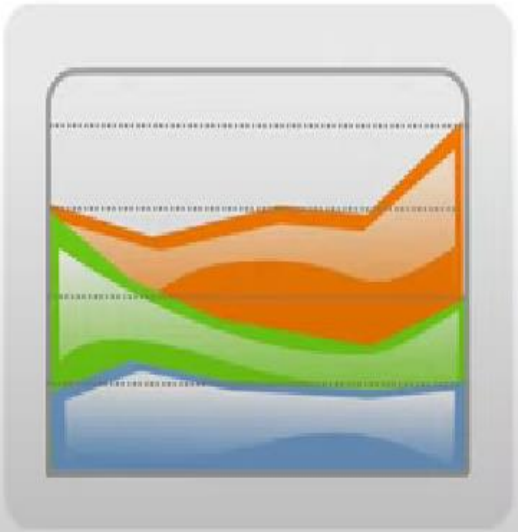
Establish Key performance Indicators

Step 4:

Calculate KPI's metric and Keep track

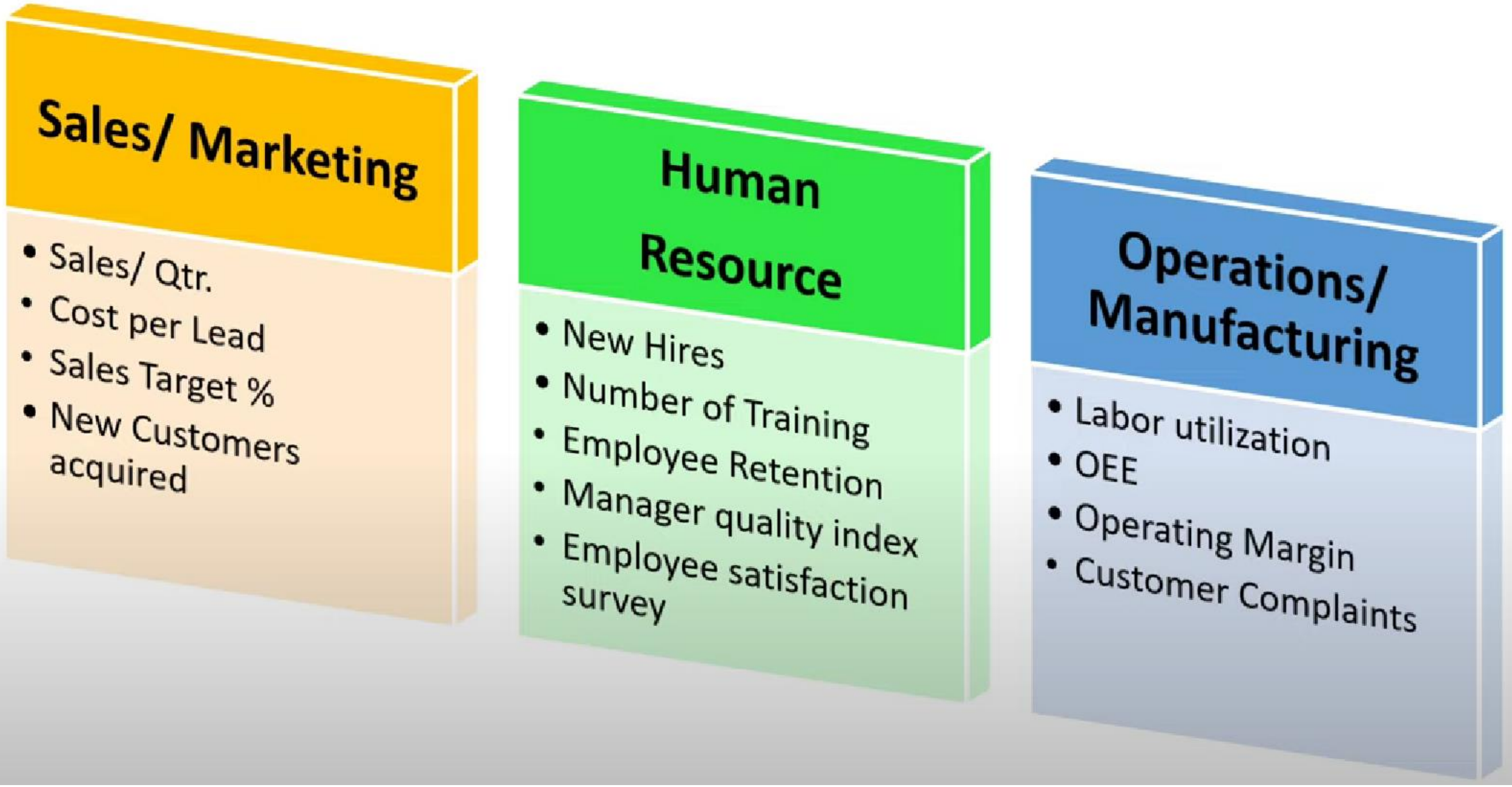






- Quantitative indicators
- Qualitative indicators
- Leading indicators
- Lagging indicators
- Input indicators
- Output indicators
- Process indicators

Overall Equipment Effectiveness


Sales/ Marketing
• Sales/ Qtr.
• Cost per Lead
• Sales Target %
• New Customers acquired
Human Resource
• New Hires
• Number of Training
• Employee Retention
• Manager quality index
• Employee satisfaction survey
Operations/ Manufacturing
• Labor utilization
• OEE
• Operating Margin
• Customer Complaints

Trigger:

Triggers are used to start and stop the process of monitoring. They can be set up either on a schedule (e.g., once per day) or manually. In addition, triggers can be set up to run asynchronously (i.e., at different times).

Triggers may also run when specific events occur in your system:

- An event notification will be triggered if an email has been sent successfully or failed because of an error condition. For e.g., when an email was sent successfully but there was no recipient address stored for that person, this would cause the trigger to fire off an alert about “no recipients”.

- A debug log is generated after each event has occurred. This helps you know what happened during that time period without needing any extra information from users who logged into their accounts during those moments. People using the application during that time period might notice some changes done by others. Without the debug log, it will become difficult to restore the lost data and to keep track of the changes that happened between the events.

Timer:

- A timer is a component that measures the time interval between two events. The most common use of timers is to measure the time interval between two events, such as when a user presses the “Start” button and starts running the program. A timer can also be used to measure the time interval between two events in real-time systems (for eg. a game).

Counter:

- A counter is a measure of the number of times a specific activity has occurred. It is often used to track the number of times a business process has been executed or the number of times an application has been used.

Monitoring scopes:

Each monitoring scope must be defined before it can be used in BAM. There are two types of monitoring scopes: item level and user level.

- **Item Level Monitoring Scope (ILM):** This scope defines what items you want to monitor, such as users or transactions. You can use this to track specific events related to an item, like when it was created and last modified, among other things.

- **User Level Monitoring Scope (ULM):** This scope defines which users will be monitored at all times regardless of whether they are logged into your system or not. This scope will help to understand what data they will have access to when logged in.

Business situations:

Business situations are the context for a business process. They are the environment in which a process occurs, with specific parameters and rules that must be followed. Businesses have several different types of business situations, including:

Financial situation

The financial health of a company depends on its ability to generate revenue from operations and reserve funds for future expansion or growth. A good example is how Walmart uses its balance sheet as a tool to determine when it needs additional capital investment from shareholders or lenders.

Market situation

- Competitive pressure can create uncertainty about demand for products or services from competitors. They may be offering similar products at lower prices than yours. This creates an opportunity for you if you are able to lower prices without losing sales volume (and vice versa).

- *For example, if there is too much competition in your industry then you will need more resources like advertising campaigns to let customers know about all available options before making their final purchasing decision!*

- The BAM offers necessary feedback to help you focus on the important business situations that will improve your business performance and increase your competitive advantage.

Monitoring the archetype:

- One of the most important things to remember when designing a business activity monitor is that you must first define the problem before starting on a solution. Goals are only useful if they are specific and measurable. So it is crucial that you set them before you start working on anything else.

- The model that you develop should enhance your monitoring efficiency. Since the whole of the model is made top-down it is necessary to define all the KPIs and metrics.

Interactions and business situations:

Business situations are a set of actions that can be performed by the user. Once the model is designed, KPIs and metrics defined, triggers defined and actions processed then it's time to measure the reaction to a specific business situation.

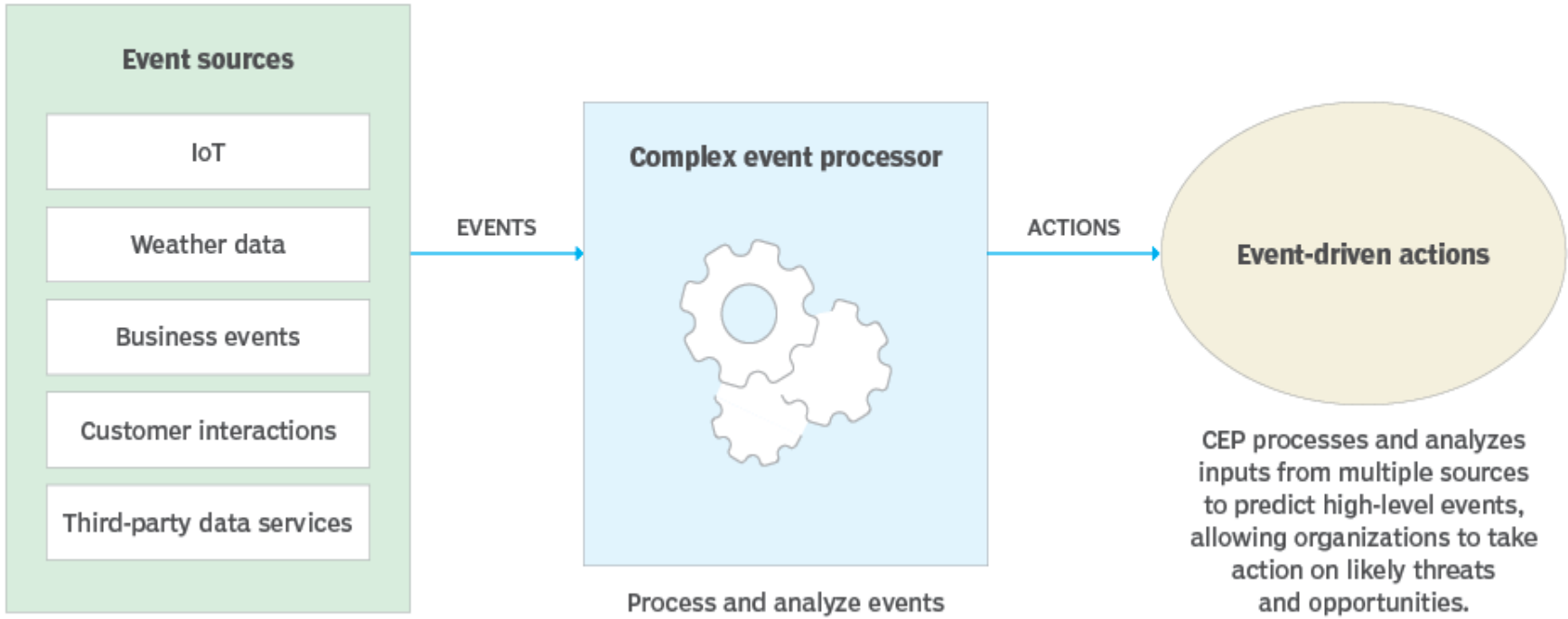
BAM results in visualization:

- BAM results visualization is a graphical representation of the information from **business activity monitoring**. It can be used to find trends and patterns in your data, compare different metrics, and more.

Best Business Activity Monitoring Tools

- **Cflow**
- **IBM MQ**
- **TIBCO**
- **Oracle BAM**
- **Infrared360**
- **Aurea CX Messenger**
- **Knowledge Sync**

Complex event processing (CEP)



- **Simplified Workflow:**

1. **Data Source**: Sensors, logs, or APIs provide data streams.
2. **Ingestion**: Data flows into the CEP engine.
3. **Processing**: The engine applies predefined rules to find patterns.
4. **Action**: Insightful events trigger responses.

Complex event processing (CEP)

- Complex event processing (CEP) is the use of technology to predict high-level events likely to result from specific sets of low-level factors.

- By identifying and analyzing cause-and-effect relationships among events in real time, CEP allows personnel to take effective actions in response to specific opportunities or threats.

- For example, a team might create an event that aggregates several low-level risk indicators, such as change of address, new spending habits and new types of purchases to elevate fraud risks.

- **Example: Monitoring an Online Store for Fraudulent Activity**

1. Collect Events

Imagine an online store where customers log in, browse, and make purchases. Each action generates an event, such as:

1. **Login Event:** A customer logs in with their username.
2. **Purchase Event:** A purchase is made.
3. **Address Change Event:** The customer changes their delivery address.

2. Define Patterns

The store owner is worried about fraud and defines a suspicious pattern:

1. A customer logs in.
2. Within 5 minutes, they make a big purchase.
3. They immediately change their delivery address.

3. Process Events in Real Time

CEP software watches the stream of events in real-time. Here's what it does:

1. **Filter:** It ignores events not related to fraud (like browsing or small purchases).
2. **Match Patterns:** It checks if the defined pattern (login + big purchase + address change in 5 minutes) occurs for any customer.

4. Trigger Action

If the suspicious pattern is detected, CEP immediately takes action:

1. Sends an alert to the fraud team.
2. Flags the order for manual review.
3. Blocks the account temporarily.

Benefits of complex event processing

CEP's ability to detect complex patterns in multiple sources of data provides many benefits, including the following:

- makes it easier to understand the relationship between events
- helps connect individual events into more complex chains
- simplifies the development and tuning of business logic
- can be embedded into fraud detections, logistics and IoT applications
- helps build more accurate simulations, models and predictive analytics.

Use cases for complex event processing

The ways in which organizations use CEP today include the following:

- improve stock market trading algorithms
- develop more responsive real-time marketing
- create more adaptable and accurate predictive maintenance
- fraud detection
- develop more nuanced IoT
- enable more resilient and flexible supply chains and logistics.

Link for CEP

- Refer the given link

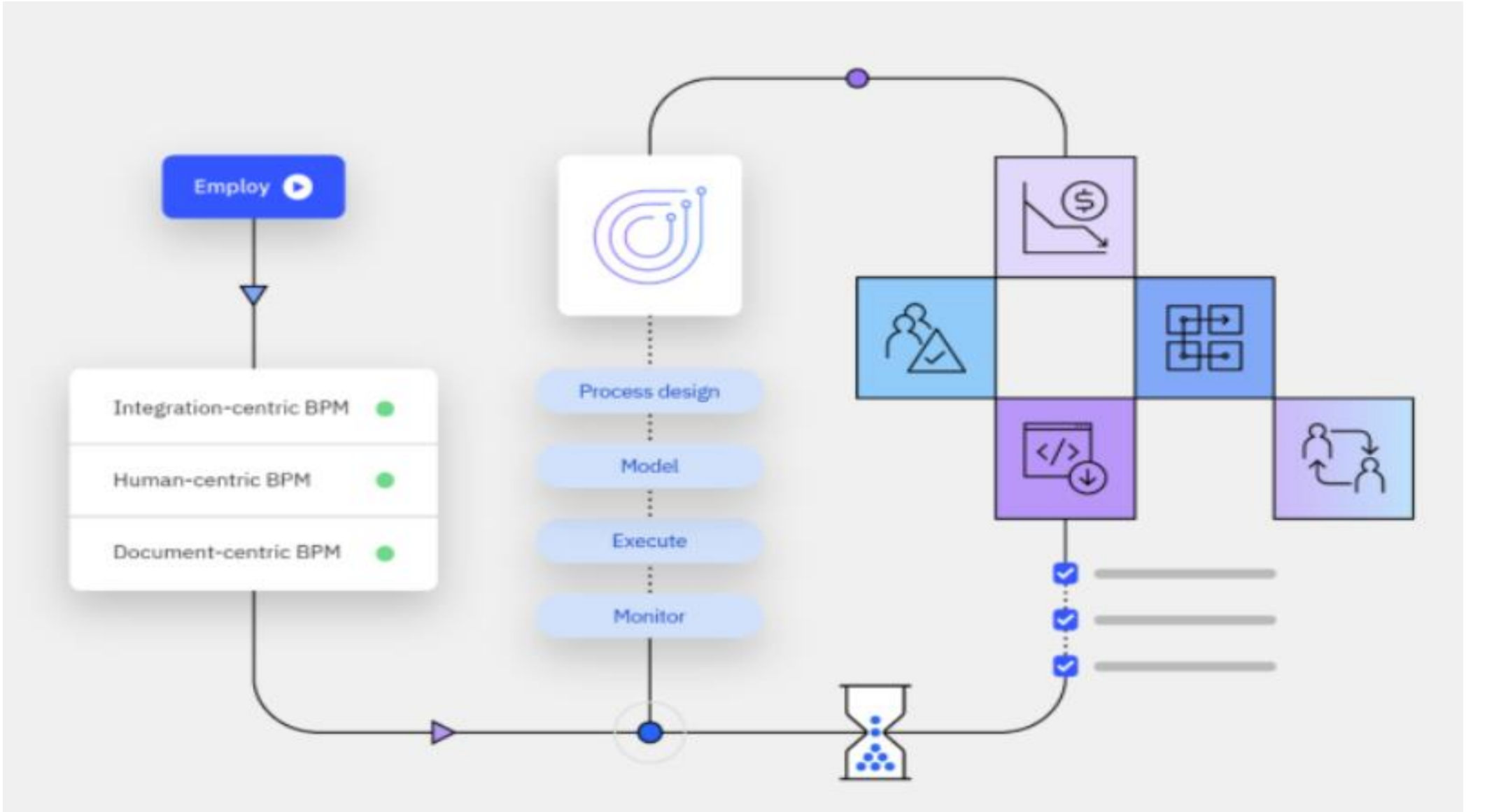
- https://www.geeksforgeeks.org/complex-event-processing-cep-system-design/

Business Process Management (BPM)

- Business process management (BPM), as defined by Gartner,employs methods to discover, model, analyze, measure, improve and optimize business strategy and processes. While it is sometimes confused with task and project management, its scope is broader than these adjacent topics. Task management focuses on individual tasks whereas BPM observes the whole end-to-end process.

- **Key Components of Business Process Monitoring**

1. **Monitoring Tools**: Software solutions (like SAP Solution Manager, Appian, or Pega) monitor the execution of business processes, providing real-time insights.
2. **KPIs (Key Performance Indicators)**: Metrics like process duration, success rate, error rate, and bottleneck identification help evaluate the efficiency and effectiveness of a process.
3. **Alerts and Notifications**: BPM systems generate alerts for anomalies or deviations from expected performance, enabling immediate action.
4. **Dashboards and Reports**: Visual representations of process performance help stakeholders understand data and make informed decisions.
5. **Integration with Systems**: BPM tools integrate with enterprise systems (ERP, CRM, etc.) to collect data and ensure processes align with broader business goals.


Employ
Integration-centric BPM
Human-centric BPM
Document-centric BPM
Process design
Model
Execute
Monitor

Types of BPM

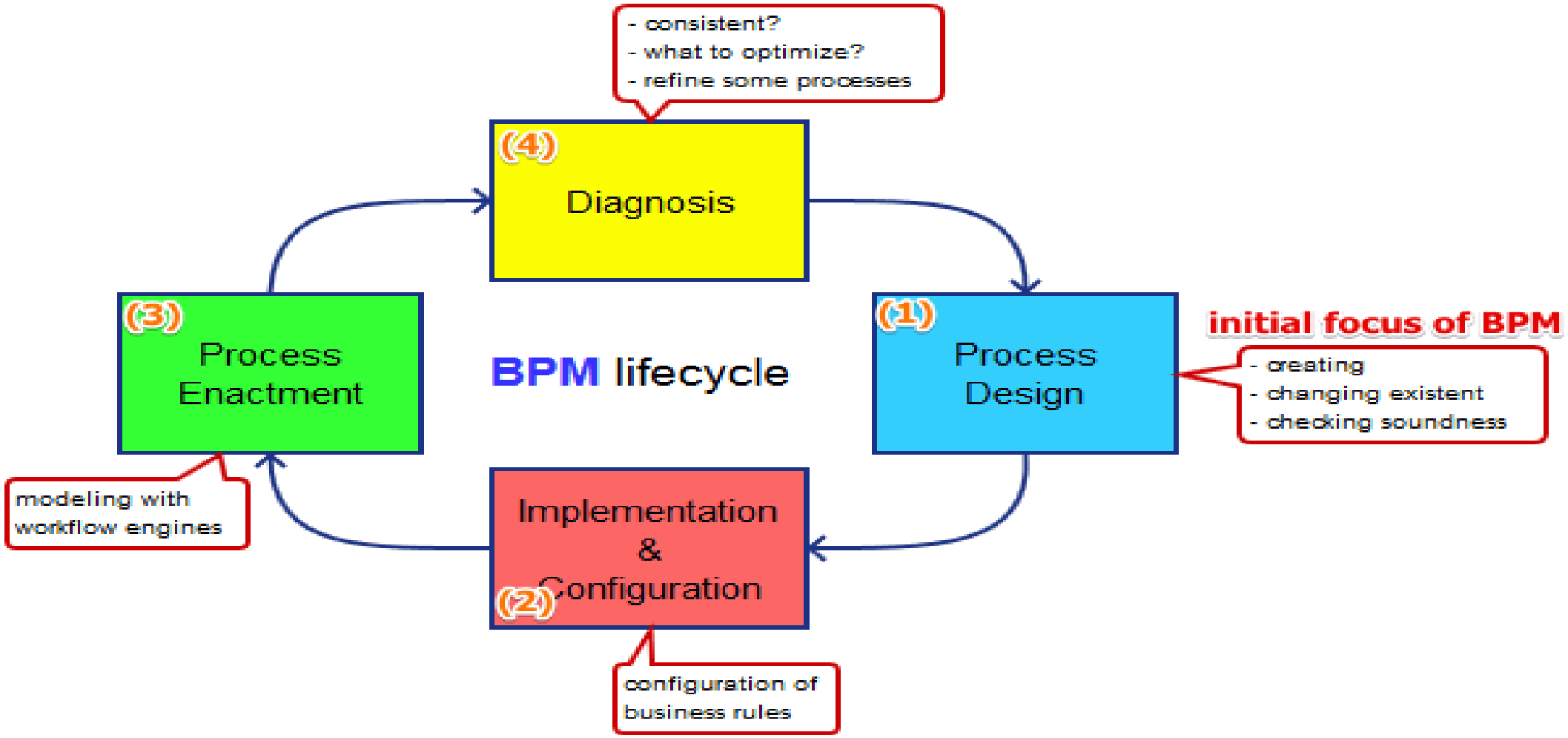
There are three main types of business process management: integration-centric, human-centric, and document-centric

- **Integration-centric BPM:** This type of BPM focuses on processes that do not require much human involvement. These processes are more dependent on APIs and mechanism which integrate data across systems, like human resource management (HRM) or customer relationship management (CRM).

- **Human-centric BPM:** Unlike integration-centric BPM, this type centers around human involvement, typically where approvals are required. Intuitive user interfaces with drag-and-drop features allow teams to assign tasks to different roles, making it easier to hold individuals accountable along the process.

- **Document-centric BPM:** This type of BPM centers around a specific document, such as a contract. When companies purchase a product or service, it needs to go through different forms and rounds of approval to develop an agreement between the client and vendor.

Business Process Management Lifecycle



Business Process Management Lifecycle

Here are the five lifecycle steps:

1. **Process design:** The team should start by outlining the milestones within the process. From there, individual tasks within the overall BPM process should be identified along with task owners for each step in the workflow. The steps should be clearly defined so that the team can identify the areas for process optimization and the subsequent metrics to track its improvement.

2. **Model**: During this step, the team should create a visual representation of the process model. This should include specific details, such as timelines, task descriptions, and any flow of data in the process. Utilizing business process management software is helpful during this stage.

3. **Execute:** The team should conduct a proof of concept, testing the new BPM system with a limited group. After incorporating any feedback, the team can begin to roll out the process to a broader audience.

4. **Monitor:** During this phase, the team should monitor the process, measuring improvements in efficiency and identifying any additional bottlenecks.

5. **Optimize:** At the final step, the team make any final adjustments to the process to improve business activity.

BPM working

- **1. Process Identification and Configuration**
- **Define Key Processes**: Identify the critical business processes to monitor (e.g., order-to-cash, procurement, or customer onboarding).
- **Set Monitoring Goals**: Determine what needs to be monitored, such as performance, compliance, or error detection.
- **Establish KPIs**: Define key performance indicators (KPIs) to measure success (e.g., process time, error rates, resource utilization).

- **2. Data Collection**
- BPM tools integrate with business systems like ERP, CRM, or custom applications to collect data related to process execution.
- **Sources of Data**:
- System logs
- Transaction records
- Workflow management tools
- IoT devices (for operational processes

- **3. Data Processing**
- **Event Correlation**: BPM tools correlate data from different sources to map the steps of a process.
- **Real-Time Analysis**: The data is analyzed as it flows in, allowing for immediate insights into performance.
- **Pattern Recognition**: Advanced tools use algorithms to recognize patterns and identify trends, anomalies, or bottlenecks.

- **4. Visualization and Reporting**
- BPM tools provide dashboards and reports that display process metrics and KPIs in real time.
- Users can see:
  - Current process status.
  - Historical trends.
  - Bottlenecks or deviations.
- **5. Alerts and Notifications**
- When a process deviates from expected behavior (e.g., an order takes too long to process), BPM tools generate alerts.
- Notifications can be sent to responsible personnel via email, SMS, or in-app messages.
- **6. Issue Resolution**
- BPM tools often integrate with workflow or task management systems to help users address detected issues.
- Actions can include:
  - Escalating issues to managers.
  - Automatically re-initiating failed processes.
  - Triggering predefined workflows for resolution.

- **7. Continuous Improvement**
- **Root Cause Analysis**: Historical data is analyzed to identify recurring issues or inefficiencies.
- **Optimization Suggestions**: Insights from monitoring help refine processes by updating workflows or reassigning resources.
- **Feedback Loop**: The results of monitoring feed into process redesign, making the organization more agile.

- **Example Workflow of BPM:**
- **Order-to-Cash Process:**

1. **Data Collection**: Monitor events like order creation, payment processing, and shipment.
2. **Analysis**: Check if orders are processed within the defined SLA (e.g., 48 hours).
3. **Alerting**: Notify the manager if payment fails for more than 5% of orders.
4. **Resolution**: Trigger automatic retries for failed payments or escalate them to the billing team.
5. **Optimization**: Analyze historical data to reduce average order processing time.

Business Process Management Benefits

- Increased efficiency and cost savings
- Enhanced employee and customer experience
- More scalable processes
- Greater transparency
- Less dependency on development teams

Business process management use cases

- **Content distribution**: Media firms can use BPM to automate the process of content preparation and delivery, from content creation to distribution. A business process management system can be designed to interact with content management, rights management, content traffic and work order systems.

- **Customer service:** Customer service representatives can identify frequently asked questions for chatbots to handle, alleviating the team when there is a high volume of service requests. Transcript data from call centers and chatbots can also help automate processes further as well as inform more personalized answers for customers.

- **Finance:** Companies can create templates to standardize purchase orders submissions from various teams, allowing them to procure business software or hardware more quickly. In addition, customize workflows can be established for unique scenarios.

- **Human resources**: HR can employ BPM to streamline document and workflow management. It provides a more structured environment for processing HR forms, such as employee onboarding and off-boarding, performance evaluations, vacation requests and timesheet approval.

- **Banking**: When processing individuals or businesses for loans, banks need to evaluate applicants for potential credit risk. This involves collecting information from multiple sources, such as the applicants, employers, and credit rating agencies. BPM expedites decisions around loan eligibility by managing the flow of information throughout the process and reducing errors in documentation.

Metadata

- Refer the given link

- https://www.bi4dynamics.com/the-significance-of-metadata-in-bi-projects/

Root cause analysis

- Refer the given link
- https://www.ibm.com/topics/root-cause-analysis
- https://www.tableau.com/analytics/what-is-root-cause-analysis#:~:text=Root%20cause%20analysis%20(RCA)%20is,symptoms%20and%20putting%20out%20fires.