


1

- Sponsor, high-value/risk process owner
- Champion, Quality Manager
- Domain experts, Stakeholders

Process outcome:  
Why is *Work Piece Transfer failure* rate *high*? 

Work Piece  
Transfer failed

The diagram is a flowchart illustrating the process of quality conditions and their effects. It is organized into three horizontal sections separated by dashed lines: 'Effects', 'Condition of Interest', and 'Causes'.

- Effects:** The top section shows a green box labeled 'Process quality conditions module' with an arrow pointing to another green box labeled 'Business performance conditions'. The text 'Contributes to' is placed between them.
- Condition of Interest:** The middle section shows a green box labeled 'Work Piece Transfer is successful'. An arrow points from this box up to the 'Process quality conditions module' box, with the text 'Contributes to' above the arrow. To the right of this box is a stick figure icon labeled 'Logistic Manager'.
- Causes:** The bottom section shows three green boxes: 'Process conditions', 'Robot conditions', and 'Conveyor conditions'. Arrows point from each of these boxes up to the 'Work Piece Transfer is successful' box, with the text 'Contributes to' above each arrow. To the right of these boxes is a stick figure icon labeled 'Logistics Manager'.

Below the 'Causes' section, there is a red lightning bolt icon next to the text 'Process quality conditions', followed by an arrow pointing to a red lightning bolt icon next to the text 'Business performance conditions'. To the right of these is a stick figure icon labeled 'Logistics Manager'.

3

```

graph TD
    Product[Product] -- Input --> WPT[Work piece Transfer]
    WP[Work Piece] -- Input --> WPT
    Energy[Energy] -- Input --> WPT
    IC[Input Conveyor] -- Resource --> WPT
    Robot[Robot] -- Resource --> WPT
    WPT -- Output --> OC[Output Conveyor]
    
    WPT --> WPTF[Work piece transferred]
    WPTF -- Output --> PPM[Production performance met]
    
    WPT --> WPL[Work piece lost]
    WPL -- Output --> PD[Production downtime]
    
    subgraph DCM [Desired Conditions Module]
        WPTF
        PPM
    end
    
    subgraph UCM [Undesired Conditions Module]
        WPL
        PD
    end
    
    Maintainer[Maintainer] --> Energy
    QM[Quality Manager]
    LO[Logistic Operator]
    LM[Logistic Manager]
  
```

The diagram illustrates a process flow for 'Work piece Transfer' and its potential outcomes, categorized into 'Desired Conditions Module' and 'Undesired Conditions Module'.

**Inputs and Resources:**

- Product** and **Work Piece** provide **Input** to the **Work piece Transfer** process.
- Energy** (represented by a lightning bolt icon) is provided to the **Work piece Transfer** process by a **Maintainer** (represented by a blue figure icon).
- Input Conveyor** and **Robot** provide **Resource** to the **Work piece Transfer** process.

**Work piece Transfer Process:**

- The **Work piece Transfer** process (green box) receives inputs and resources and produces an **Output**.
- The **Output** is sent to the **Output Conveyor**.

**Desired Conditions Module (Green dashed box):**

- The **Work piece transferred** (green box) leads to the **Production performance met** (green box).

**Undesired Conditions Module (Red dashed box):**

- The **Work piece lost** (red box) leads to the **Production downtime** (red box).
- A **Logistic Operator** (grey figure icon) is associated with the **Production downtime** outcome.
- A **Logistic Manager** (grey figure icon) is also associated with the **Production downtime** outcome.

**Quality Manager:** An orange figure icon with a lightning bolt is shown, representing a role in the process.

The diagram illustrates the information flow in a Robot Vacuum Gripper system. It is divided into two main sections: Robot and AI-System, each with a dashed green border.

**Robot Section:**

- Public Data:**
  - (data) limit-switch home X/Y/Rot-axis (bool) - Connected to **Robot Expert** (orange person icon).
  - (data) position encoder X/Y/Rot-axis (int)
  - (action) activate/deactivate robot (bool)
- Private Data:** (action) work piece lost (bool) - Connected to **HMI** (yellow circle with 'A').

**AI-System Section:**

- Private Data:**
  - (data) env data (object)
  - (data) work piece lost (bool) - Connected to **Logistic Operator** (grey person icon) and **Maintainer** (blue person icon).
  - (data) camera stream (object) - Connected to **AI Expert** (purple person icon).

**External Agents:**

- Robot Expert** (orange person icon)
- HMI** (yellow circle with 'A')
- Logistic Operator** (grey person icon)
- Maintainer** (blue person icon)
- AI Expert** (purple person icon)

**Information Flow:**

- Dashed lines indicate data flow from Robot Public data to Robot Expert.
- Dashed lines indicate data flow from Robot Private data to HMI.
- Dashed lines indicate data flow from AI-System Private data to AI Expert.
- Dashed lines indicate data flow from AI-System Private data to Logistic Operator and Maintainer.
- A red lightning bolt symbol is shown between the Maintainer and the AI-System.

## Gherkin Scenarios

Scenario: Transfer of the Work-Piece in undesired conditions

Given	"Robot-Vacuum-Gripper" gripper positioning	is "inaccurate"
Given	"Robot-Vacuum-Gripper"	has picked "the Work-Piece"
When	"Robot-Vacuum-Gripper" transfers	"the Work-Piece" to "destination"
Then	"Robot-Vacuum-Gripper"	"adhesion" is "insufficient"
Then	"Work-Piece Transfer"	"failed" # Undesired outcome

## IS Solution Architecture

IT  
Expert

**Production Knowledge/Database**

## Answers to stakeholder questions

6

## IS User Interface

