Institute for Manufacturing

Automation Assessment

"Making the Right Decisions about Automation"

Liz Salter, 14th November 2019

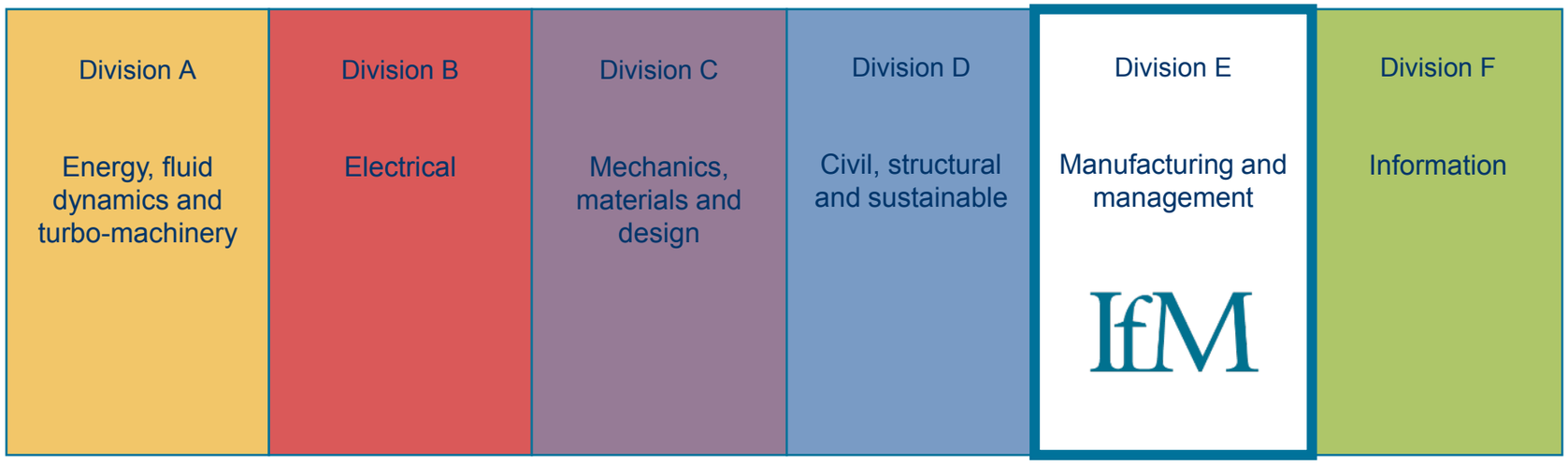
UNIVERSITY OF CAMBRIDGE
Department of Engineering

IfM Education and Consultancy Services

SMART FACTORY EXPO

Introducing IfM

- University of Cambridge, Department of Engineering



Introducing IfM

Introducing IfM Research

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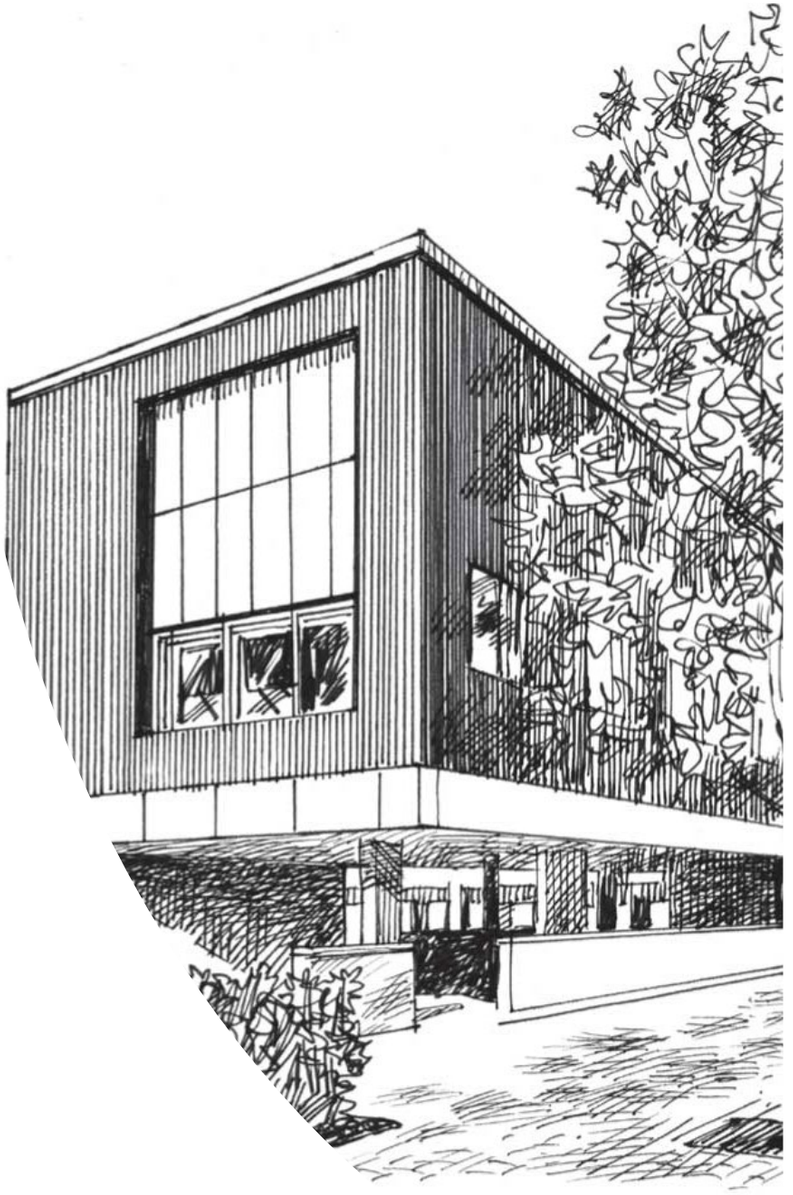
Introducing IfM Practice via ECS

"A rapid dissemination route for research and education outputs developed at the Cambridge University Institute for Manufacturing (IfM)"

- Industrial practitioners help companies of all sizes in all industries to apply research-based improvement techniques.
- Practical solutions based on the latest applied research
- Live feedback to help set the agenda for new research
- An income stream to support future research activities
- Single point of access to relevant expertise
- Education programmes configured to client company needs and context



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SMART FACTORY EXPO

Automation Assessment

1. Motivation and background
2. Tool overview
3. Opportunity discussion
4. Feasibility discussion
5. How the tool works
6. Application

Automation Assessment

1. **Motivation and background**
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Motivation

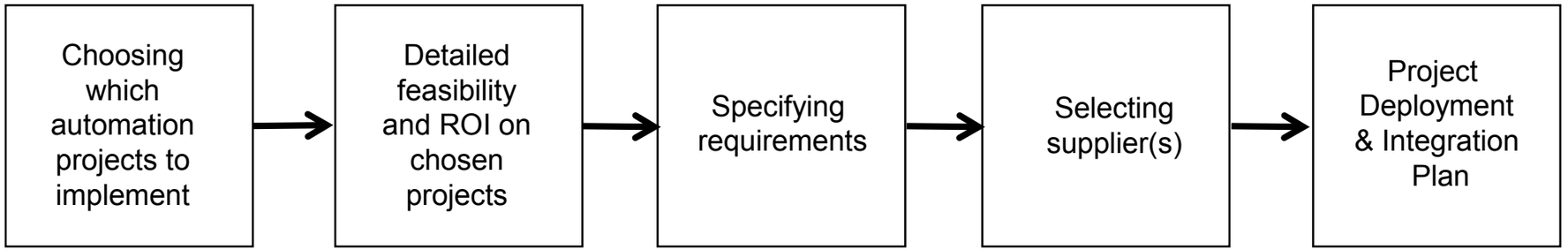
- Labour costs keep going up
- Jack is off with strain injury again
- Keep get product returns with quality issues
- Bill & Fred retire at the end of the year!
- Industry 4.0 ? Data Sharing ?

- Increased customer demand
- New product launches
- New technologies available
- Joe wants me to look at some new robot

Automation Projects
Key steps

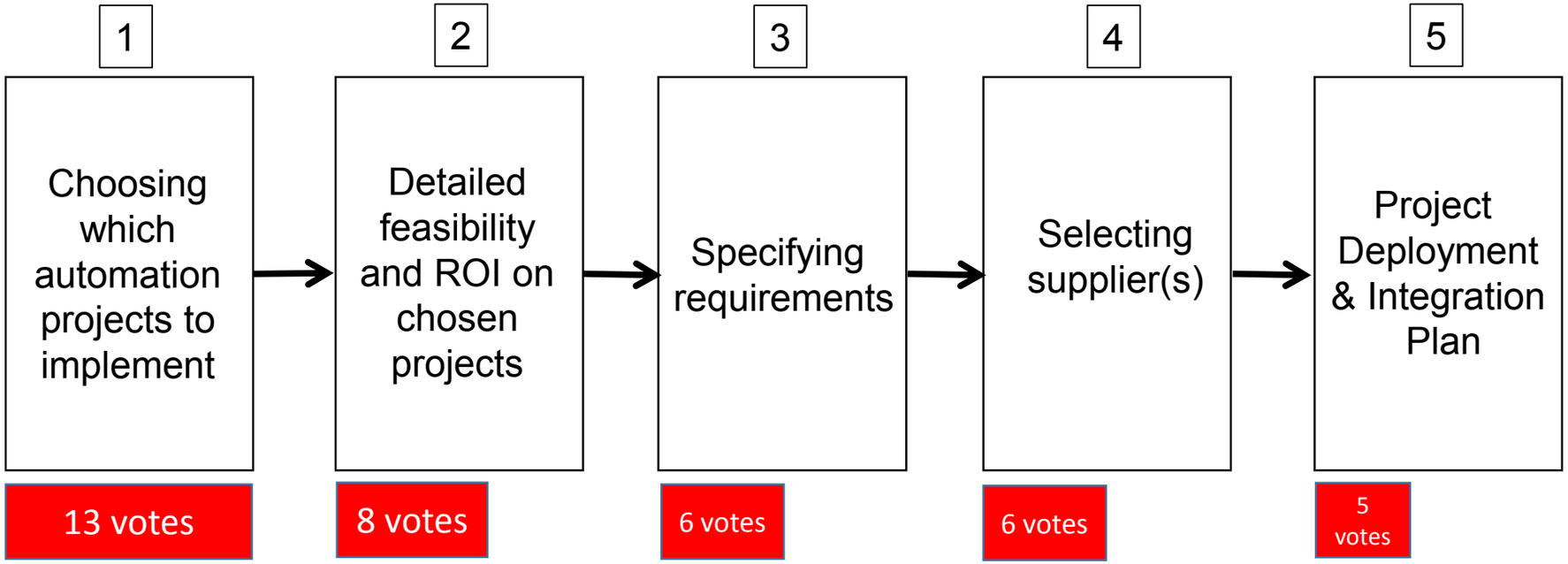
Top Level Business Aim:

To identify, develop and successfully implement appropriate automation solutions across the business.



Workshop exercise
Poster and dot voting

Red dots = we find this difficult



“reduce headcount + improve operations”

External support sought to apply a structured approach and to stimulate higher level discussions around pros and cons

Multi-site manufacture
Flexible and changing footprint
Limited design input
Demanding customers

Foxconn

“modernise manufacturing + identify automation opportunities”

Seeking a method to categorise and prioritise multiple opportunities

Acquisition built growth
Geographical expansion
Cost reduction
Mobility of manufacturing and of refurbishment

Schlumberger

Experienced +
expert automation team

multiple projects, multiple solutions
“which one should we do?”

Jaguar Land Rover
Rolls-Royce

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Automation Assessment Tool Overview

Top Level Business Aim:

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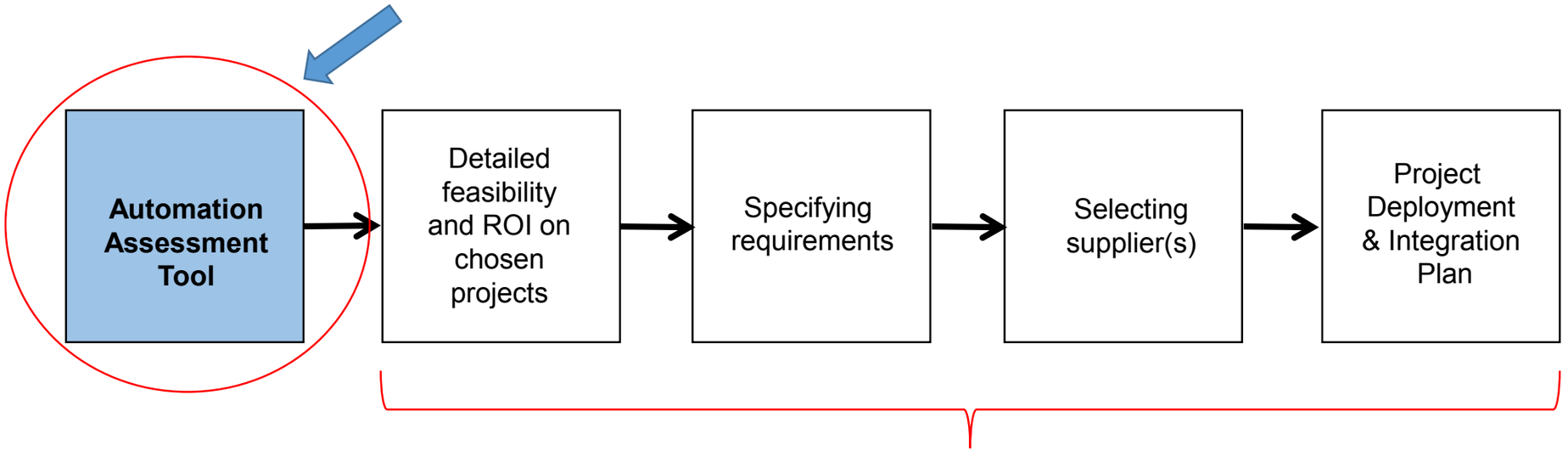


Use of the tool supports these later stages

Motivation

- Labour costs keep
- Jack is off with stra
- Keep get product r
  quality issues
- Bill & Fred retire at
  year!
- Industry 4.0 ? Data

d

me

IfM ECS Automation Assessment Tool

Designed to:

- Support decision making around automation
- Help develop an automation strategy
- Identify benefits, potential downsides and feasibility challenges
- Support a structured and prioritised implementation pathway

Focus on enhancing existing production capabilities

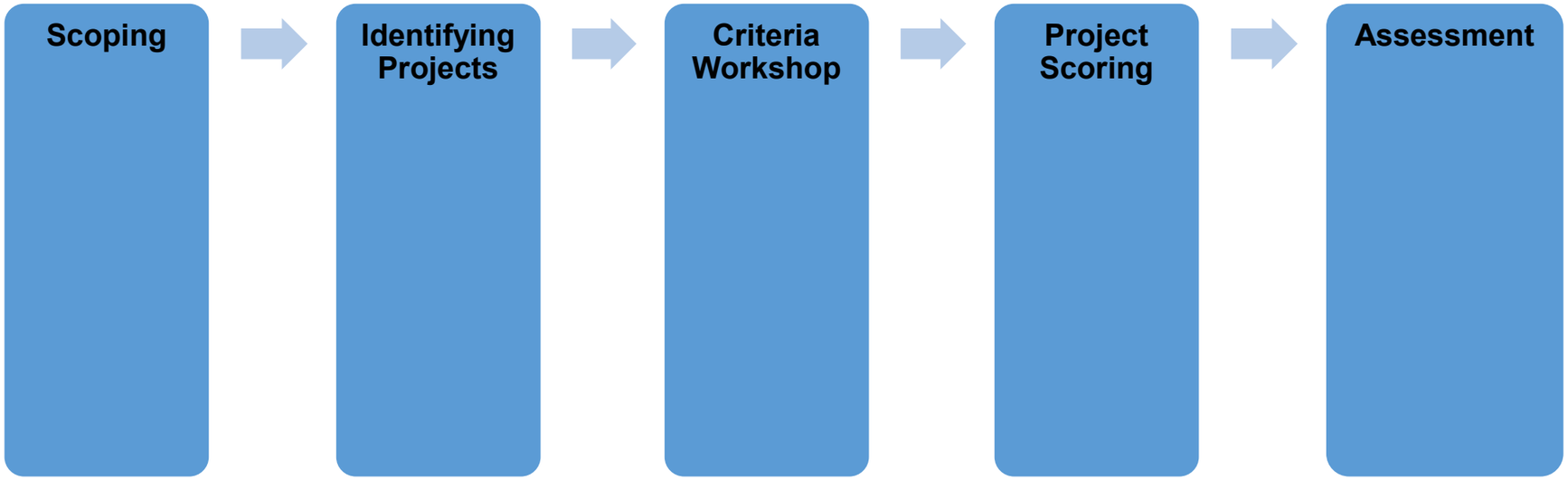
Collaborative approach with in-house production engineers

Automation Assessment

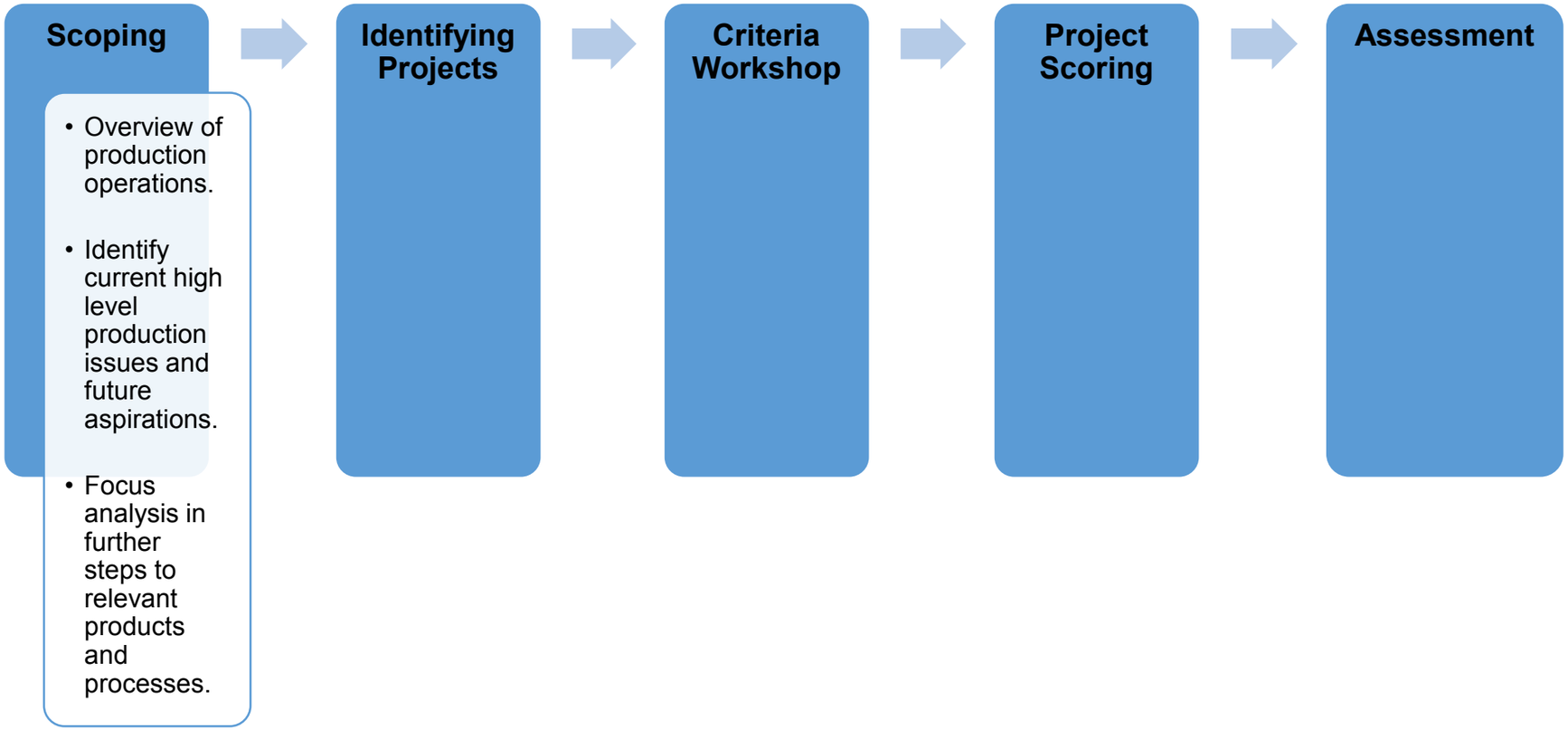
- Building a model so that projects can be plotted and compared

Decision Support Tool

Automation Assessment Overview



Automation Assessment Overview



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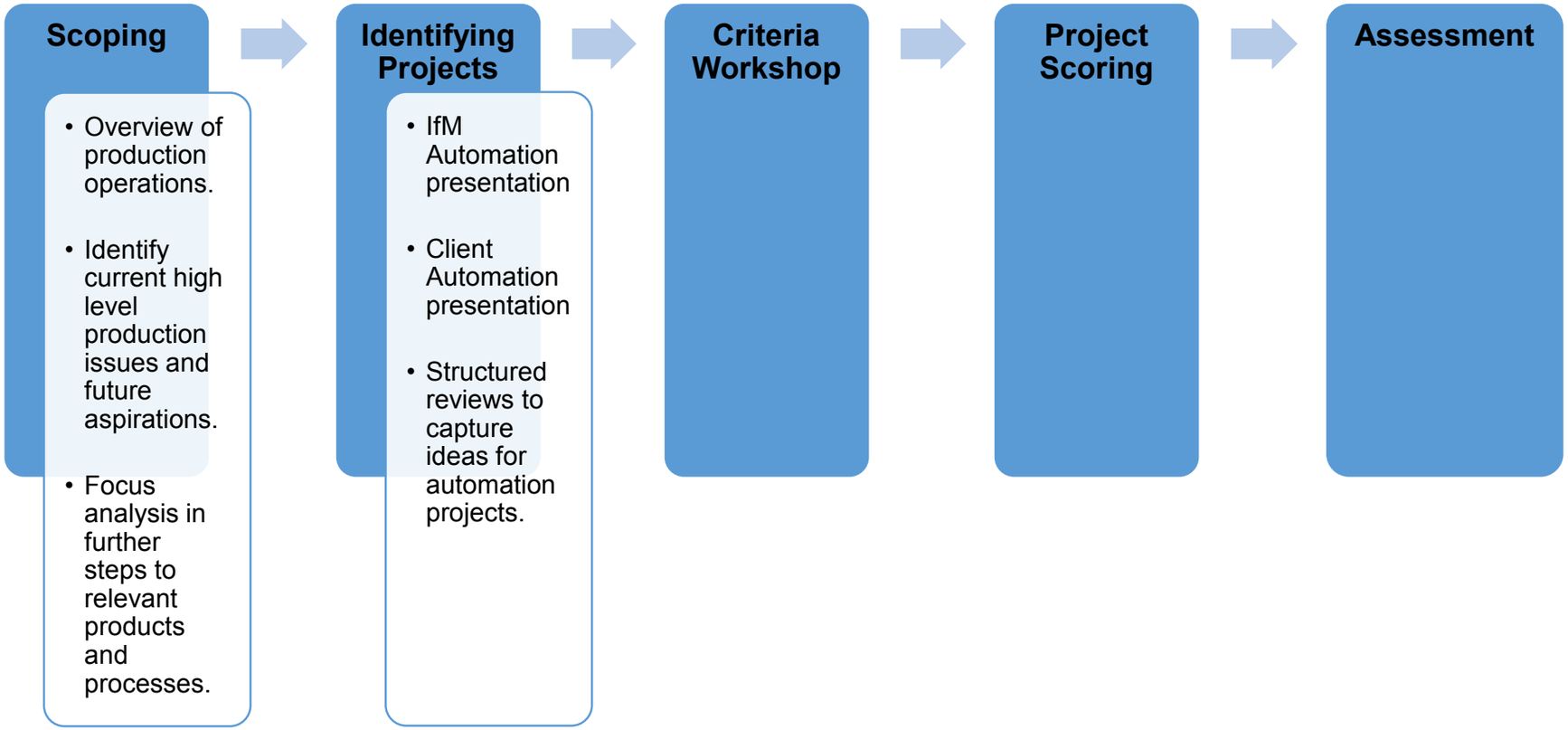

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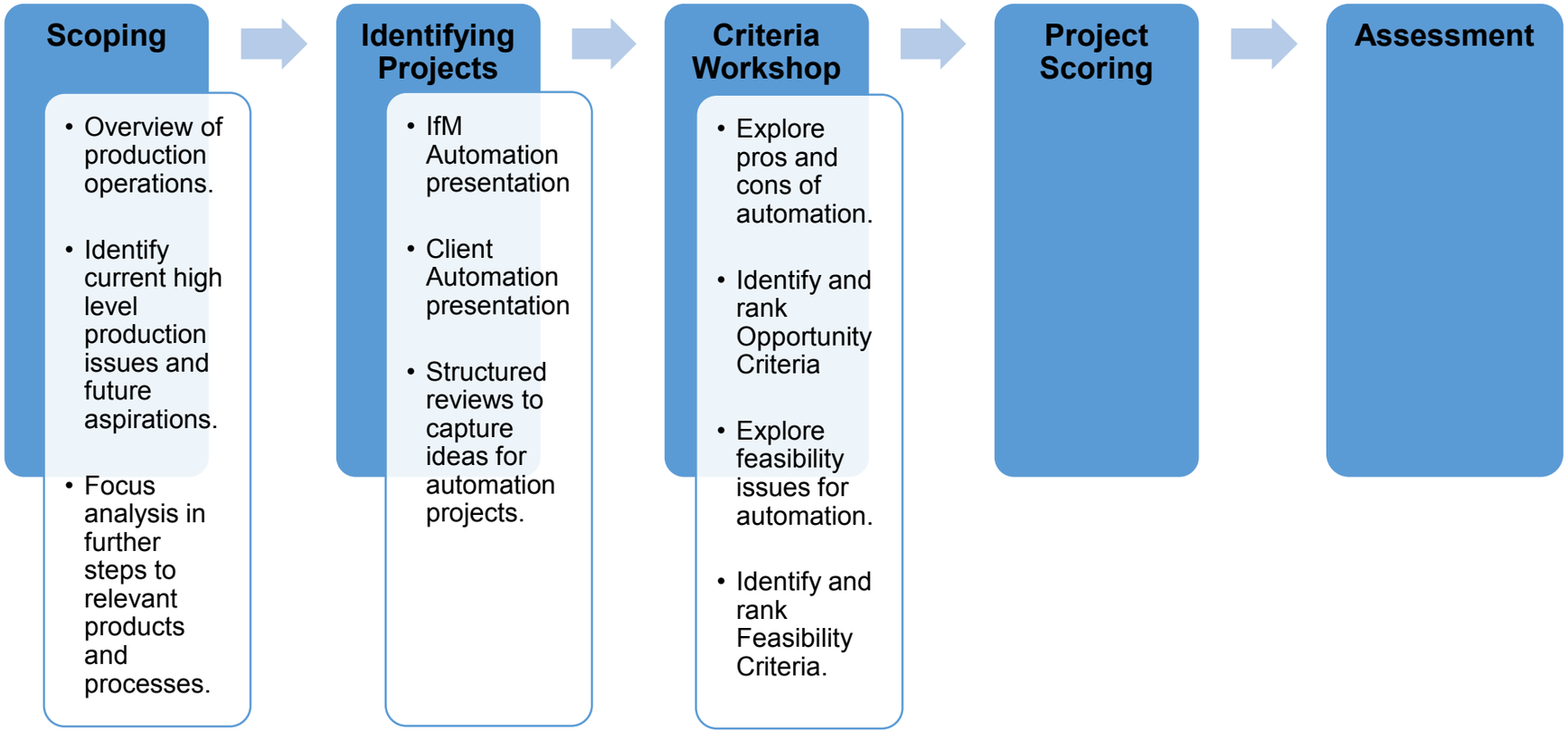

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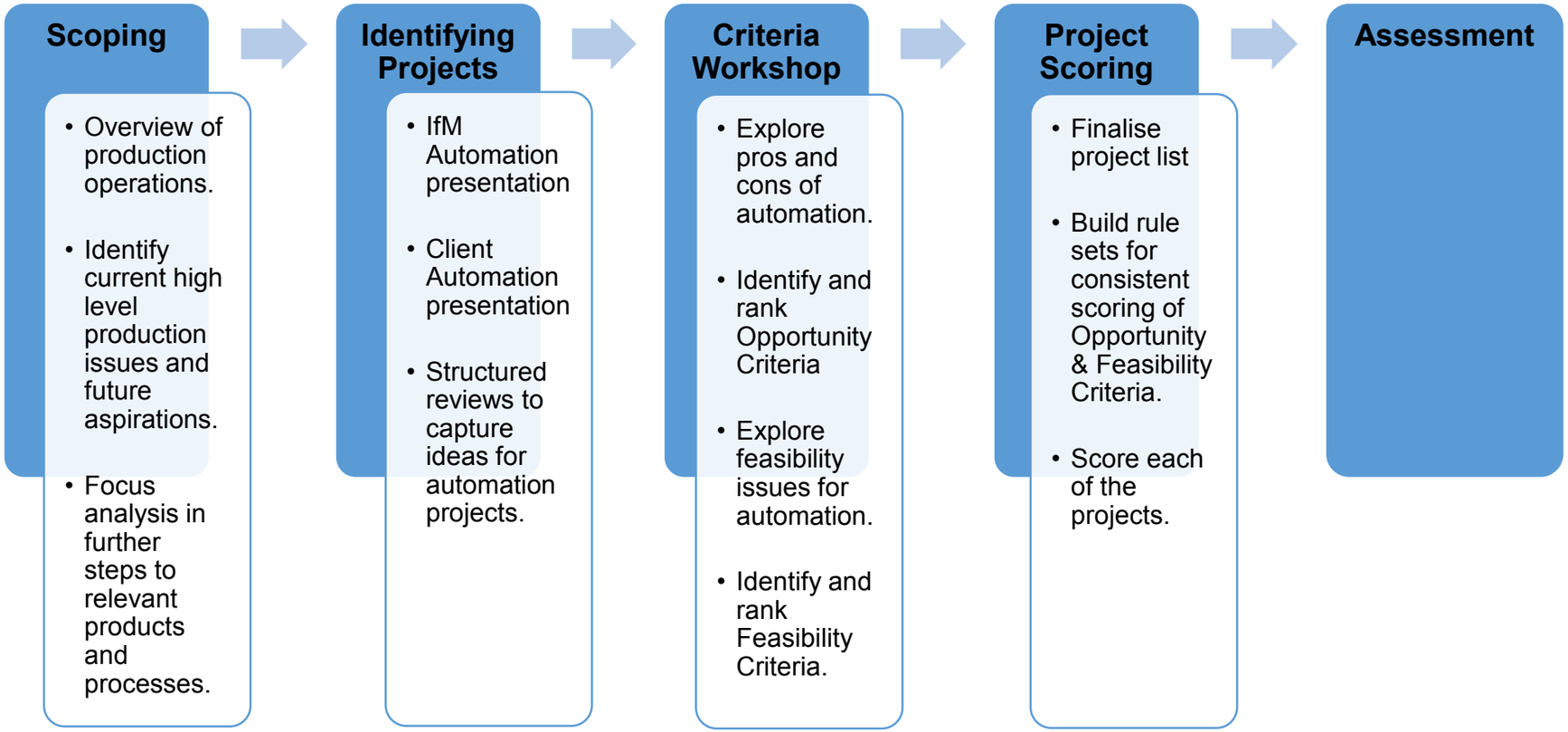

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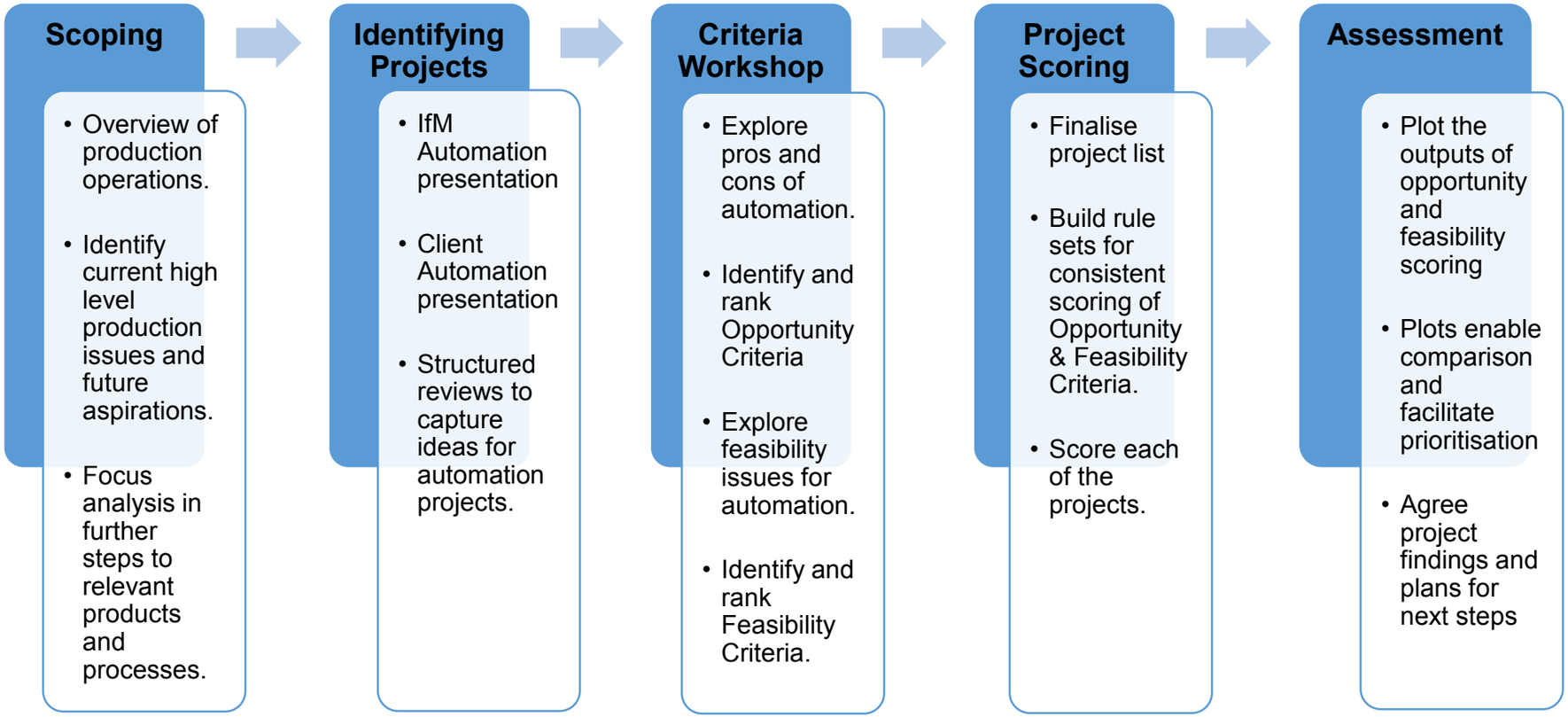

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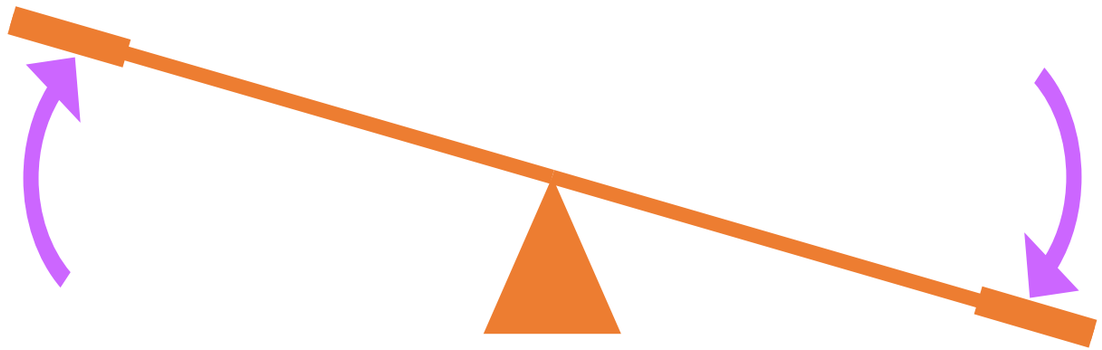
The Automation Challenge Opportunity Balance



Automation Opportunities

Many benefits of automation

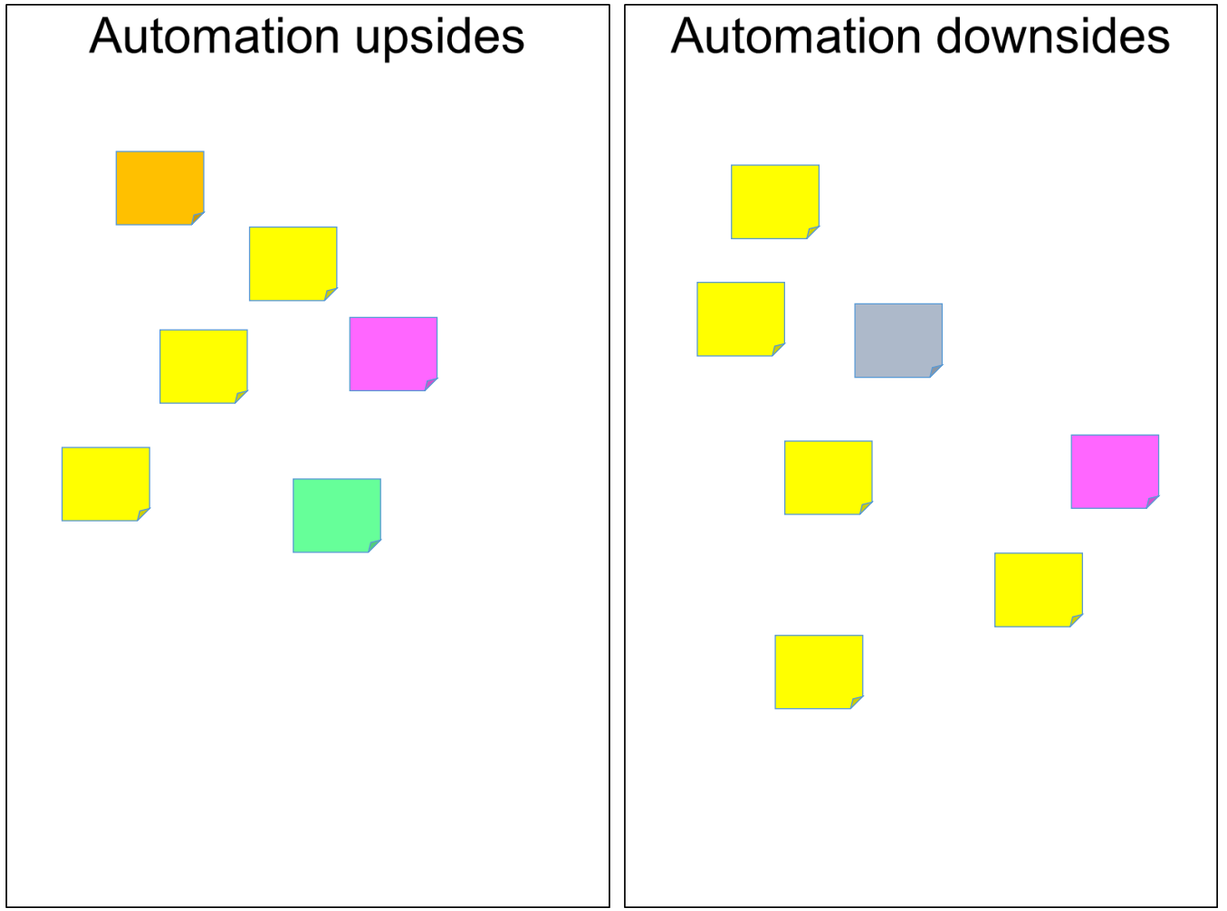
Automation downsides

But constraints may be introduced…

Considering opportunity

- What benefits would you hope to see from automation?
- What benefits have you seen from previous automation activities?

- What downsides would you anticipate with automation?
- What downsides have you seen from previous automation activities?



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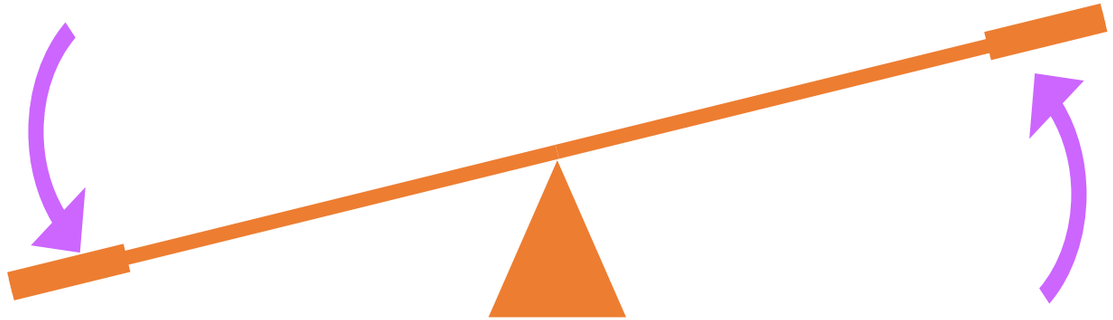
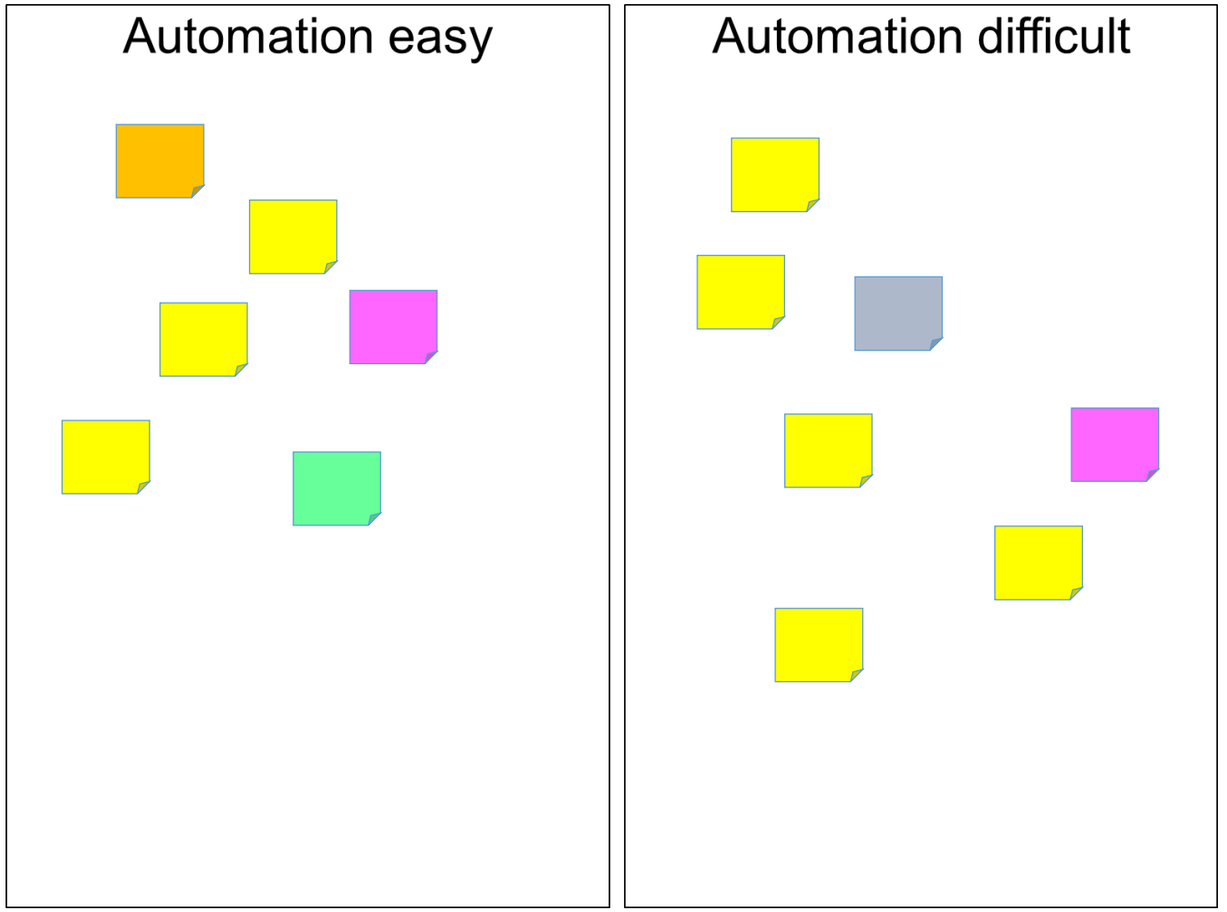
The Automation Challenge Feasibility Balance



Implementation Issues	**Feasibility high / Easy**
Space	Solutions exist
Services	
Expertise	Processes are “automatable”

Considering opportunity

- What makes automation easy?
  - Based on experience?
  - What has worked best for you?
- What makes automation hard?
  - Based on experience?
  - When have things not worked out as hoped?



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Automation Assessment

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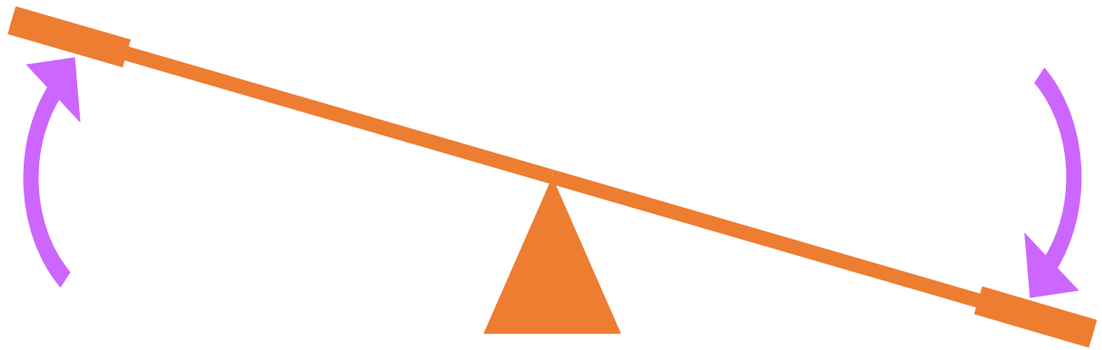
Decision Support Tool

The Automation Challenge
Opportunity / Feasibility Balance



~20 Opportunity Criteria

Improve operator safety
Reduce labour cost
Increase production rate
Reduce floor space requirement
Improve product quality
…

~12 Feasibility Criteria

Number of assembly operations
Complexity of assembly operations
Material delivery (logistics)
Ease of integration
…

Automation Workshop
Designing the model

Criteria fit	• Do they apply here?
	• Do they align with current KPIs?
	• Should we adjust the wording?
Criteria ranking	• What is the relative importance of the criteria?
	• Agree rankings – High, Medium, Low
Criteria coverage	• Are there any new criteria?

"Shared understanding and agreement on what to look for when automating"

"Very good discussion to kick off a project"

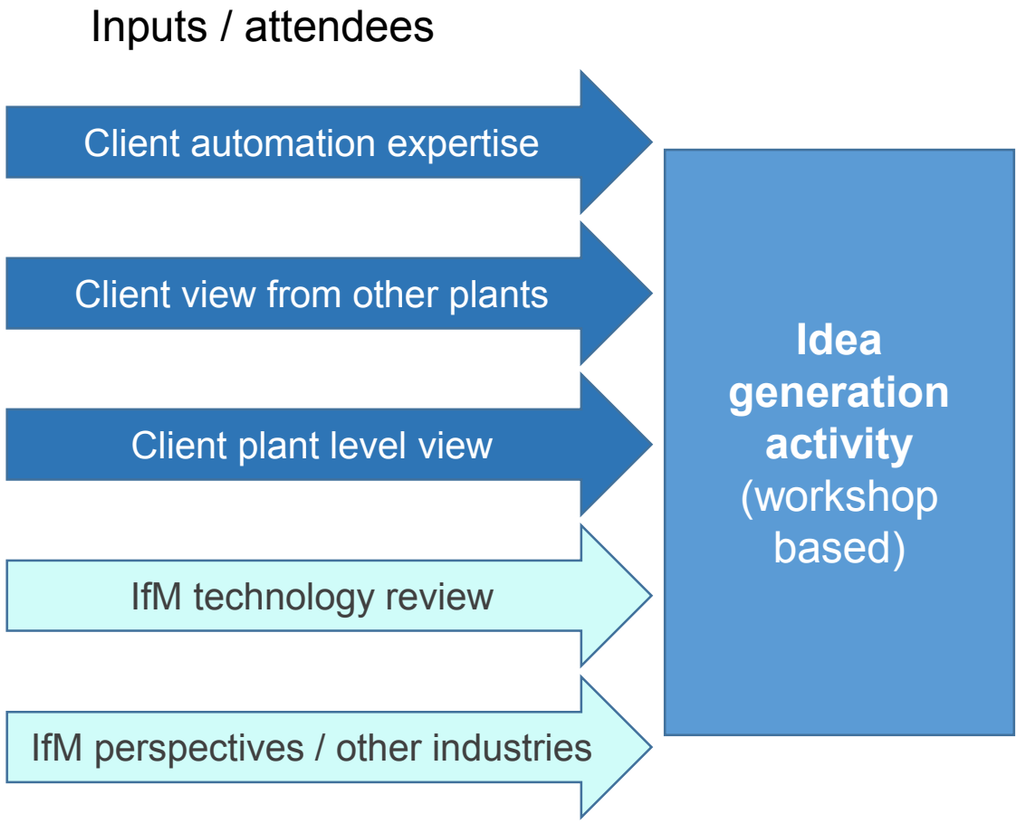
"Good interactions"

"Definitely got a better appreciation of the factors to consider when implementing automation"

"Collaboration was very good"

"A lot of information was shared"

Automation Workshop Idea Generation



Capture individual ideas in workshop

Initial list typically 40-60 ideas

After workshop: Refine list, tighten definitions, clarify scope

Projects for scoring

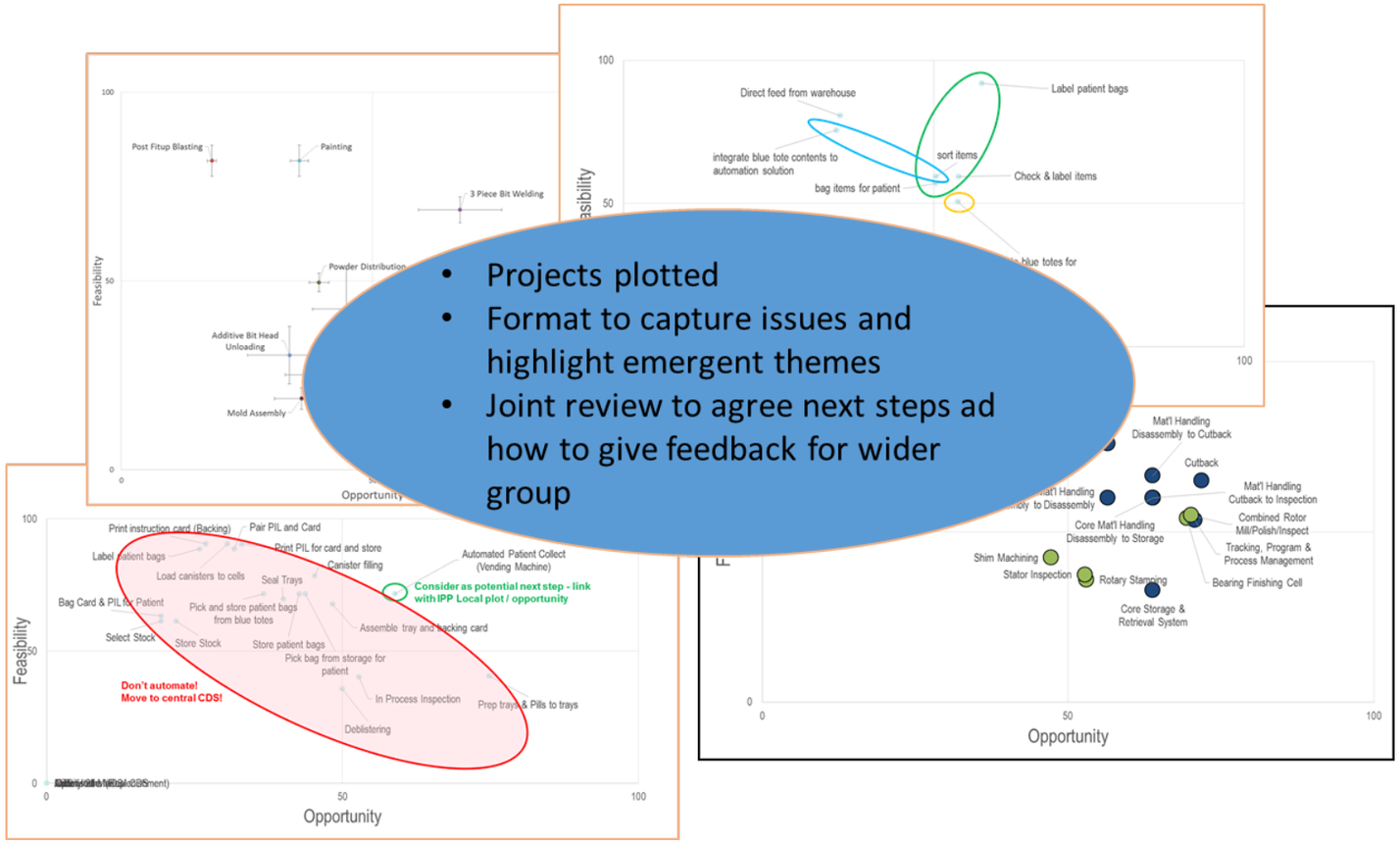
After the Workshop
Developing a Scoring Model

- Rule sets are used for scoring Opportunity Criteria and Feasibility Criteria
- After the workshop IfM and client work together to:
    1. Confirm the project list
    2. Refine the rule set for consistent scoring

Opportunity Criteria	High very good to automate confident of improvement here	Medium some potential benefit may improve this criteria	Low no benefit anticipate no impact on this criteria	Negative bad to automate
Right first time	Enhancement in capability will increase yield and reduce scrap and rework costs. May generate IP advantage.	May improve manufacturing capability in non-critical areas.	No enhancement in capability likely.	Automation solution likely to degrade manufacturing capability.
Ergonomics				
Manual tracking				

Feasibility Criteria	Easy easy to automate	Medium neutral	Difficult hard to automate	Zero impossible / insane
Number of operations	Low number of discrete operations within a production station (<3). Repeated or duplicated operations.	Medium number of operations within a production station (3 to 5).	High number of operations within a production station (>5).	Very high and variable number of different and changing operations.
Solution difficulty / need for innovation	Solution is readily available (has been used to carry out the same task in house or in same industry sector).	Solution is readily available (has been used to carry out similar task but in different industry sector).	Solution not readily available (fundamental technologies exist but solution requires research and development).	Solution not readily available (fundamental technologies do not exist, long term research).
Operation difficulty	Current operators will be easily capable of working with new solution with minimal training required.	Current operators will require some in-house training, or suitably skilled people could be easily recruited.	Appropriate skills not available in house or locally. Recruitment and training will be required.	Global skills shortage

Using the outputs



- Projects plotted
- Format to capture issues and highlight emergent themes
- Joint review to agree next steps ad how to give feedback for wider group

IfM ECS Automation Assessment Tool

Key characteristics:

- Developed with, and applied in, a wide range of manufacturing businesses
  - Different industries
  - Different levels of automation expertise
- Structured approach
- Identify, rank and score - the pros and cons of automation
- Identify, rank and score – the likely ease of implementation

Opportunity + Feasibility

Deliverables:

- Clear view of the relative attractiveness for a range of different automation options
- Detailed understanding of what underpins the scores
- Provides the basis for recommendations “Decision support”

"set up an effective platform among Foxconn facilities to evaluate automation potential"

- Clarified automation objectives
- Gave focus and direction to the international automation team
- Stimulated higher level discussion of automation benefits and issues
- Structured assessment approach adopted across global operations
- Highlighted important differences between sites and products
- Company-wide picture enabling consistent analysis for multi-site manufacture

Foxconn

- Highlights plant level priorities
- Captures project interdependencies & benefits of combining projects
- Compares different centers
- Provides company-wide picture and consistent approach
- Method to share knowledge and experience
- Global roll out

Schlumberger

- Useful resource for JLR
- First step when considering the implementation of automation
- Logical and structured way of considering automation opportunities
- Highlights benefits and drawbacks that were previously unconsidered

"a good visual method of summarising the findings of the study"

Jaguar Land Rover

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Working with IfM

- Scoping is key

- Work with operations team
- Tailor the tool / approach
- Work with available data
- Run workshops

- Equip team for deployment

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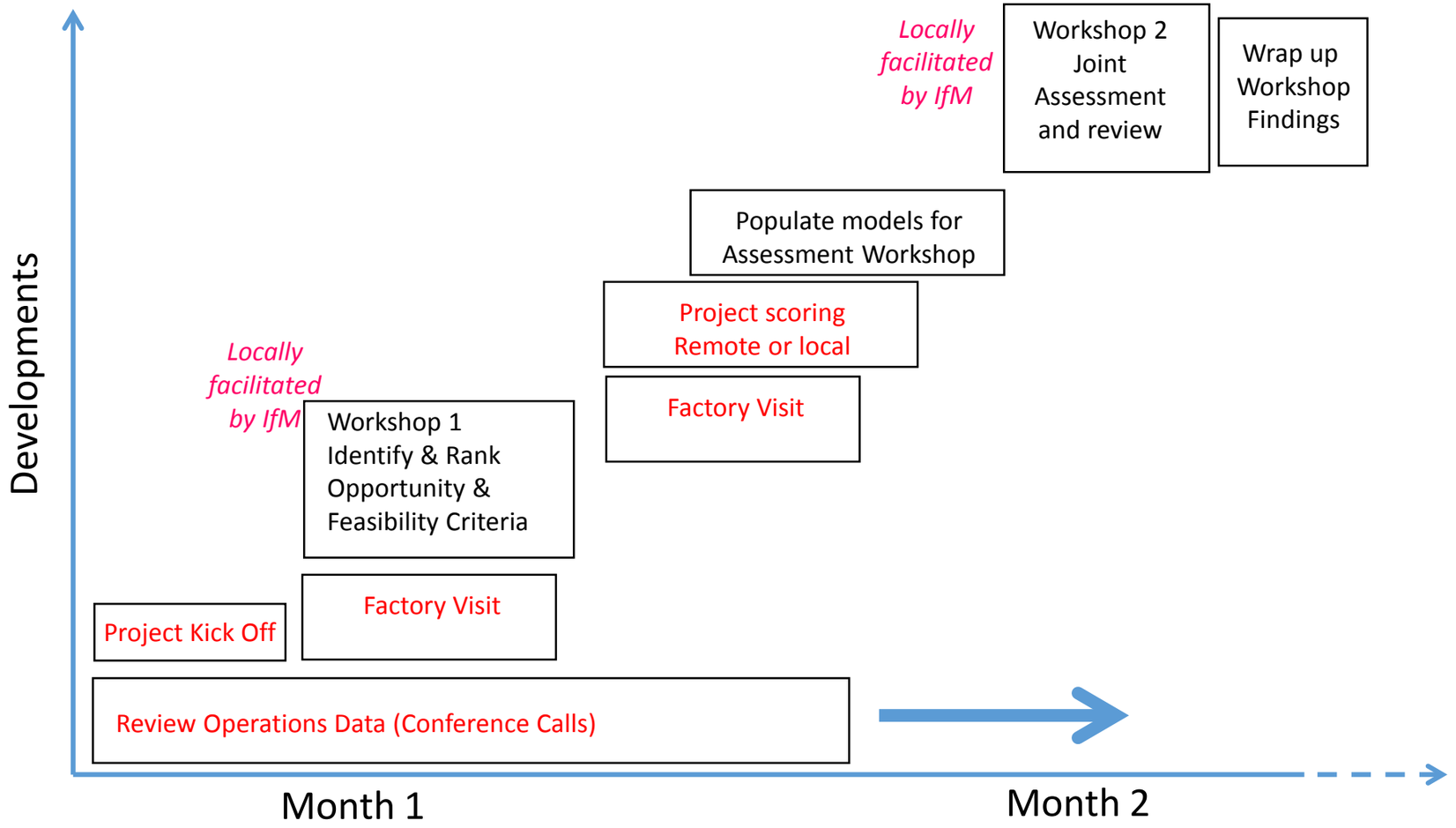
Typical Project Flow



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