



Quality: The Basic Tool Kit

Process Analysis 102

Process Analysis Tools

4 Tools in your Quality Tool Kit

1. F
 2. F
 3. M
 4. S
-

Process Analysis Tools

4 Tools in your Quality Tool Kit

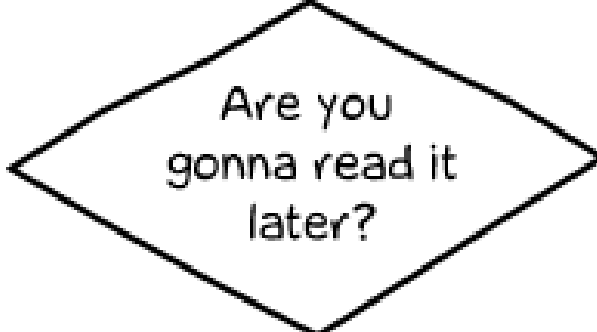
1. Flowchart

2. F

3. M

4. S

Should I forward stuff to my personal account to read later?



No

Don't do it.

Yes

No you won't.

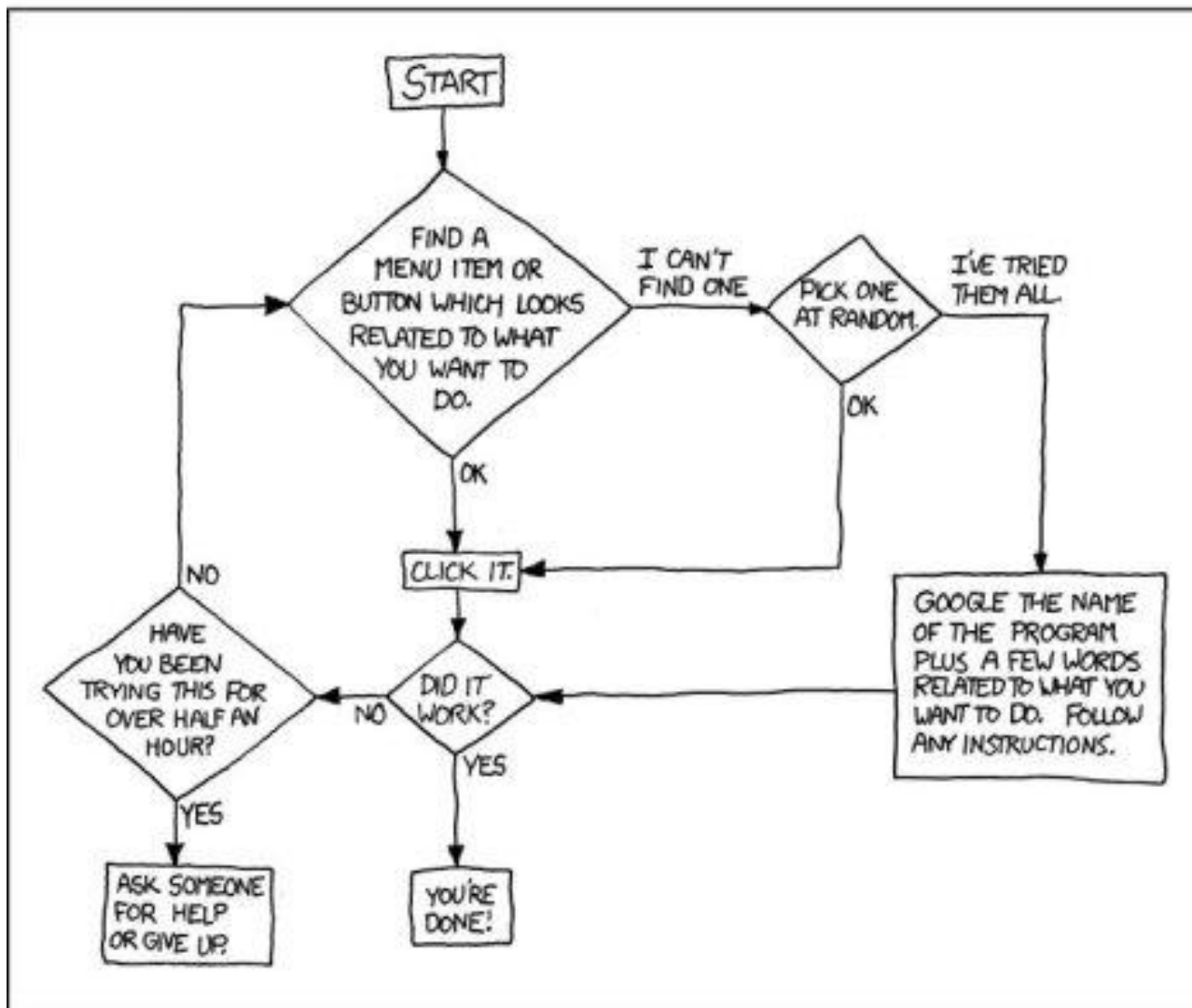
Process Analysis Tools

When you want to understand a work process or some part of a process, these tools can help:

- 1. Flowchart:** a picture of the separate steps of a process in sequential order
 - 2. Failure modes and effects analysis:** a step-by-step approach for identifying all possible design failures
 - 3. Mistake-proofing:** the use of any automatic device or method that makes it impossible for an error.
 - 4. Spaghetti diagram:** a visual representation using a continuous flow line tracing the path of an item or activity through a process.
-

DEAR VARIOUS PARENTS, GRANDPARENTS, CO-WORKERS,
AND OTHER "NOT COMPUTER PEOPLE."

WE DON'T MAGICALLY KNOW HOW TO DO EVERYTHING IN EVERY
PROGRAM. WHEN WE HELP YOU, WE'RE USUALLY JUST DOING THIS:



PLEASE PRINT THIS FLOWCHART OUT AND TAPE IT NEAR YOUR SCREEN.
CONGRATULATIONS; YOU'RE NOW THE LOCAL COMPUTER EXPERT!

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1. Flowchart

2. **Failure Modes and Effects Analysis**

3. M

4. S

潜在的失效模式及后果分析

(过程 FMEA)

项目名称: 左前门/H8HX-000-A②

过程责任部门: 车身工程部/装配部③

FMEA 编号: 1450 ①

页码: 第 1 页 共 1 页

车型年/车辆类型: 199×/狮牌 4 门/旅行车⑤

关键日期: 9×03 01 9×08 26 工位号 1 ⑥

编制: J. 福特-X6521-装配部门④

FMEA 日期(编制): 9×05 17(修订)9×11 06⑦

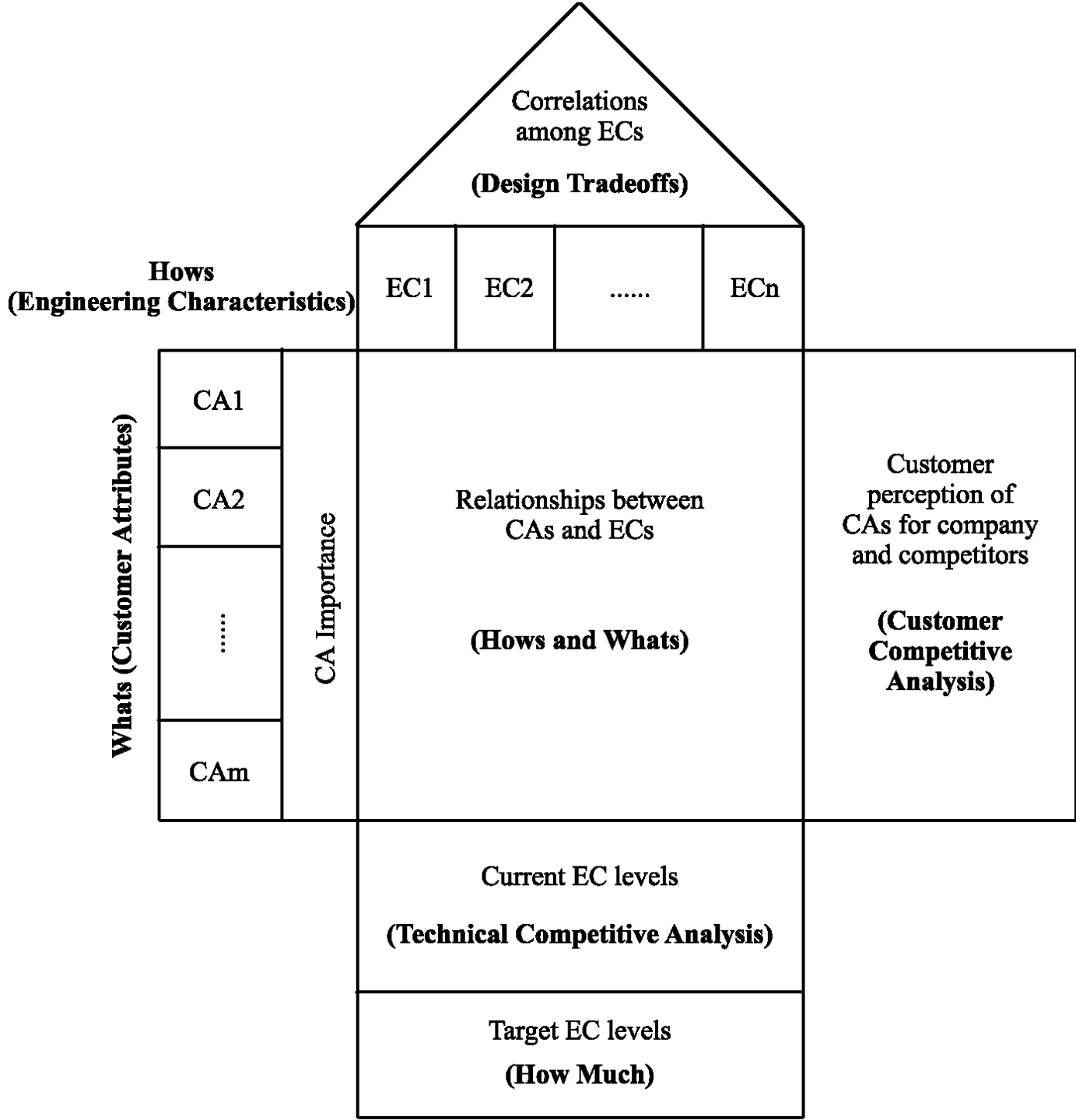
主要参加人: A. 泰特-车身工程 J. 史密斯-操作控制 R. 詹姆斯-生产部 J. 约翰-维修部⑧

过程功能要求 ⑨	潜在的失效模式 ⑩	潜在的失效后果 ⑪	严重程度数 ⑫	级别 ⑬	潜在的失效原因/机理 ⑭	频度数 ⑮	现行过程控制 ⑯	不可探测度数 ⑰	风险顺序数 ⑱	建议的措施 ⑲	责任及目标完成日期 ⑳	措施结果㉑				
												采取的措施 ㉑	严重程度数	频度数	不可探测度数	风险顺序数 RPN
车门内部人工涂蜡 为覆盖车门内侧,车门下层表面涂以最小厚度的蜡,以延缓腐蚀	规定表面涂蜡不足	车门寿命下降导致: · 由于时间长生锈使顾客对外观不满意 · 车内门附件功能下降	7		人工插入喷头不够深入	8	每小时进行目测检查,每班检查一次喷膜厚度(深度仪)和范围	5	280	给喷蜡器加装深度限位器	制造工程 9×10 15	增加限位器,在线上检查喷机	7	2	5	70
					喷头堵塞 · 粘度太高 · 温度太低 · 压力太低	5	在开始和停机后试验喷雾形状,按照预防维护程序清洗喷头	3	105	使用试验设计确定粘度、温度和压力	制造工程 9×1001	确定了温度和压力限值,安装了限值控制器,控制图显示流程受控。 CPK=1.85	7	1	3	21
					因冲击喷头变形	2	按预防维护程序维护喷头	2	28	无						
					喷蜡时间不足	8	按操作规程进行批量抽样(每班 10 个门),检查重要部分喷蜡范围示例	7	392	安装喷蜡定时器	维修部门 9×09 15	安装了自动喷蜡定时器,操作者打开喷头,定时器控制关闭,控制图显示流程受控 CPK=2.05	7	1	7	49

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When you want to understand a work process or some part of a process, these tools can help:

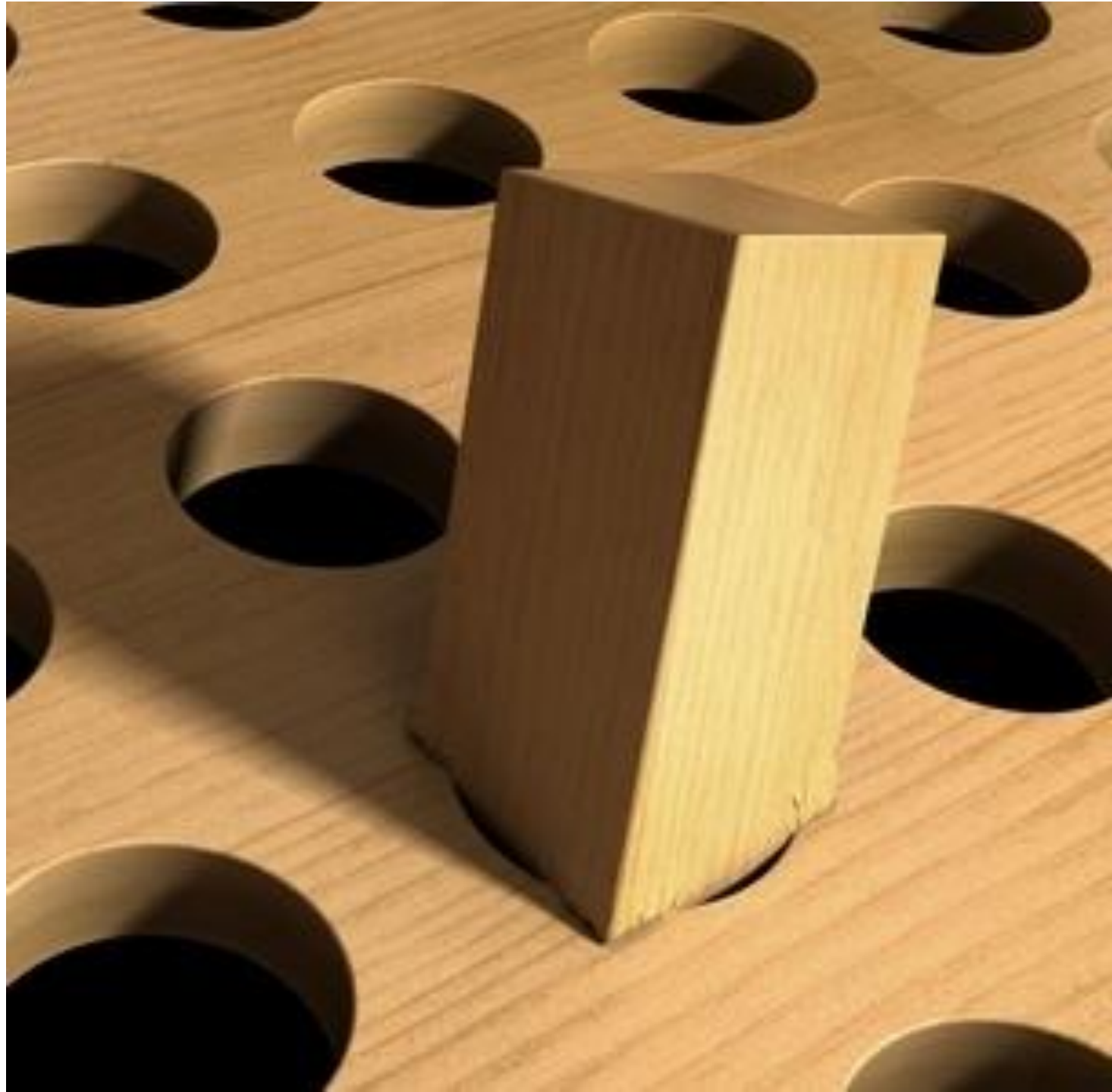
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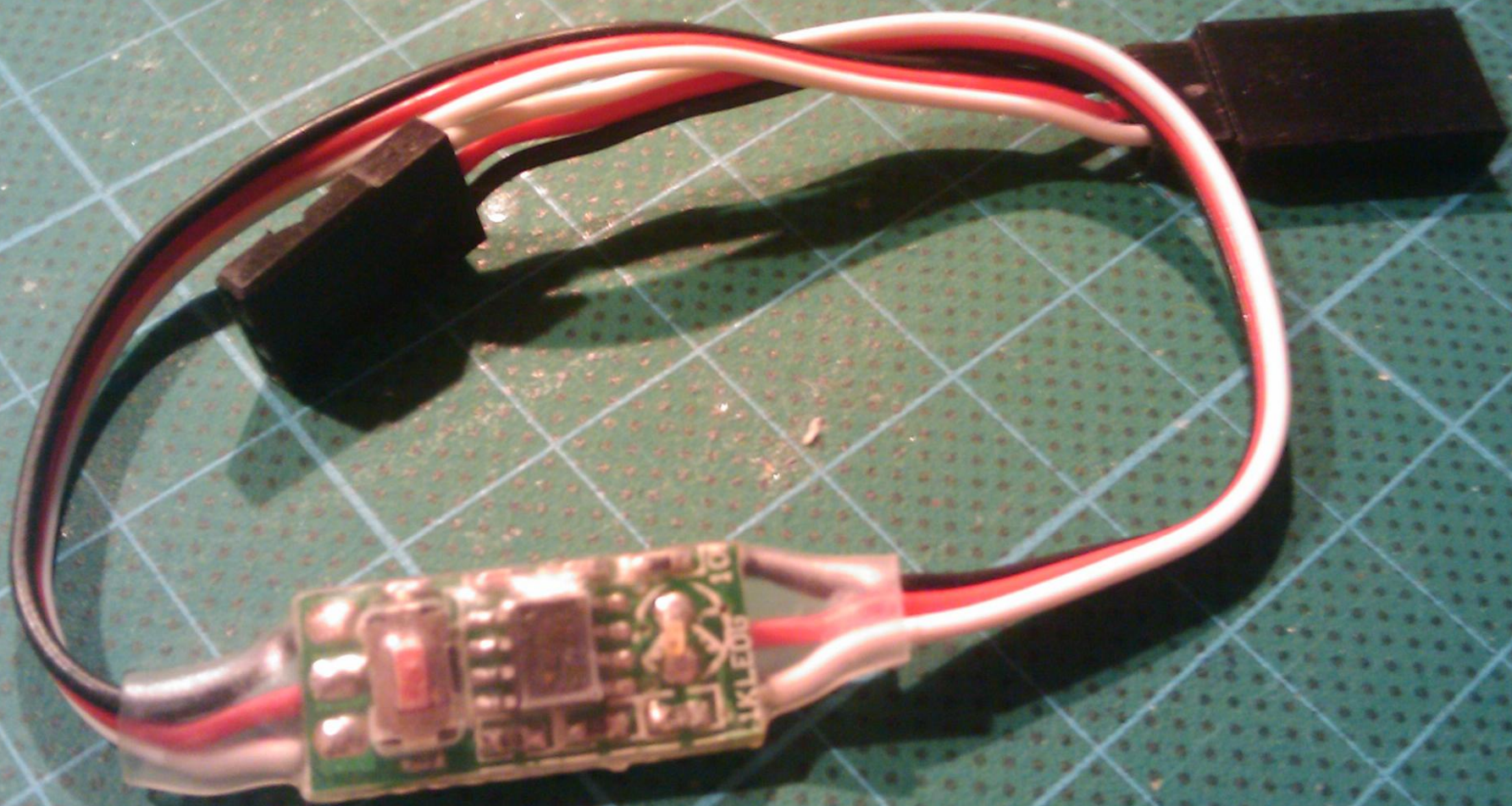
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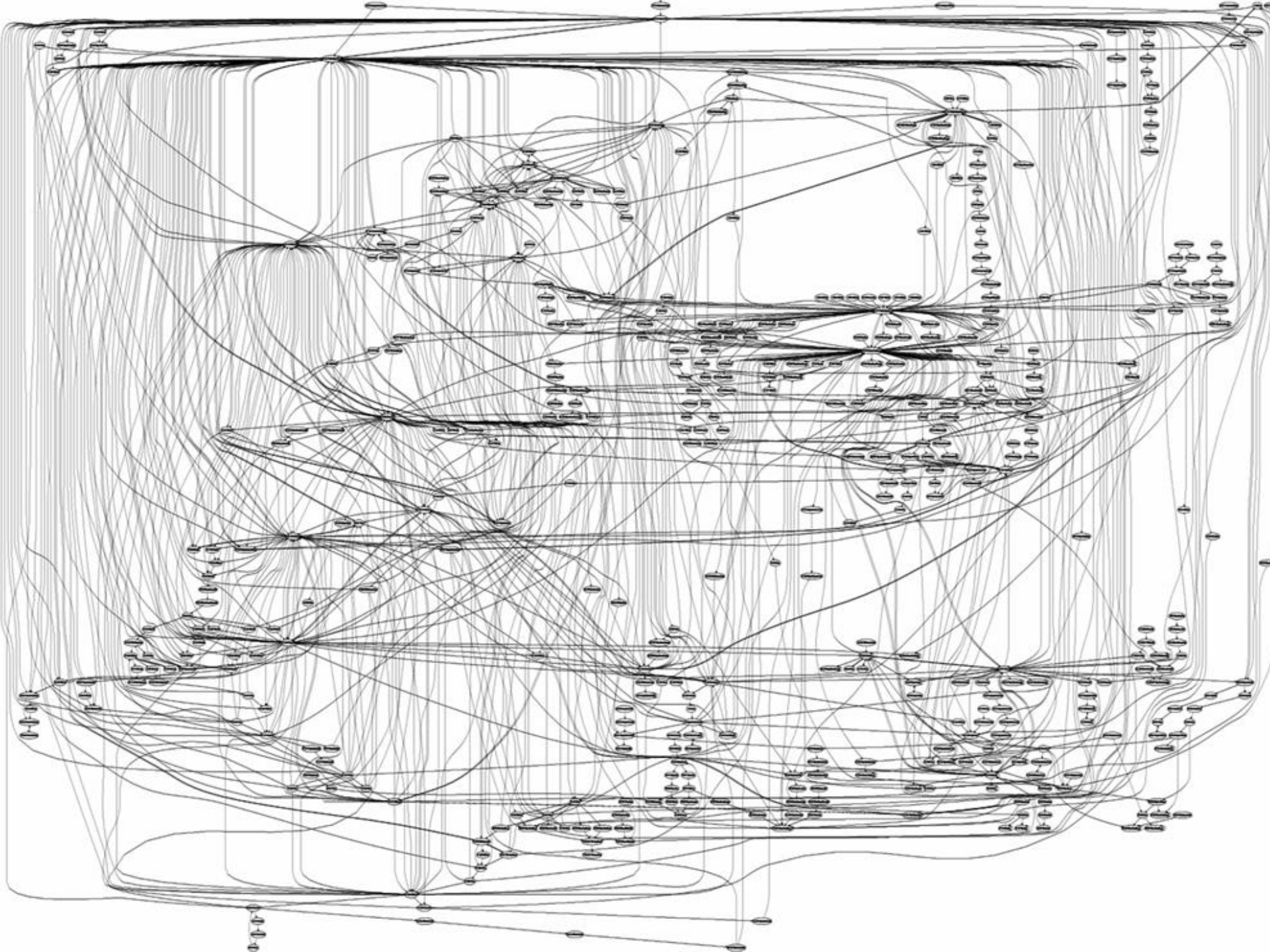
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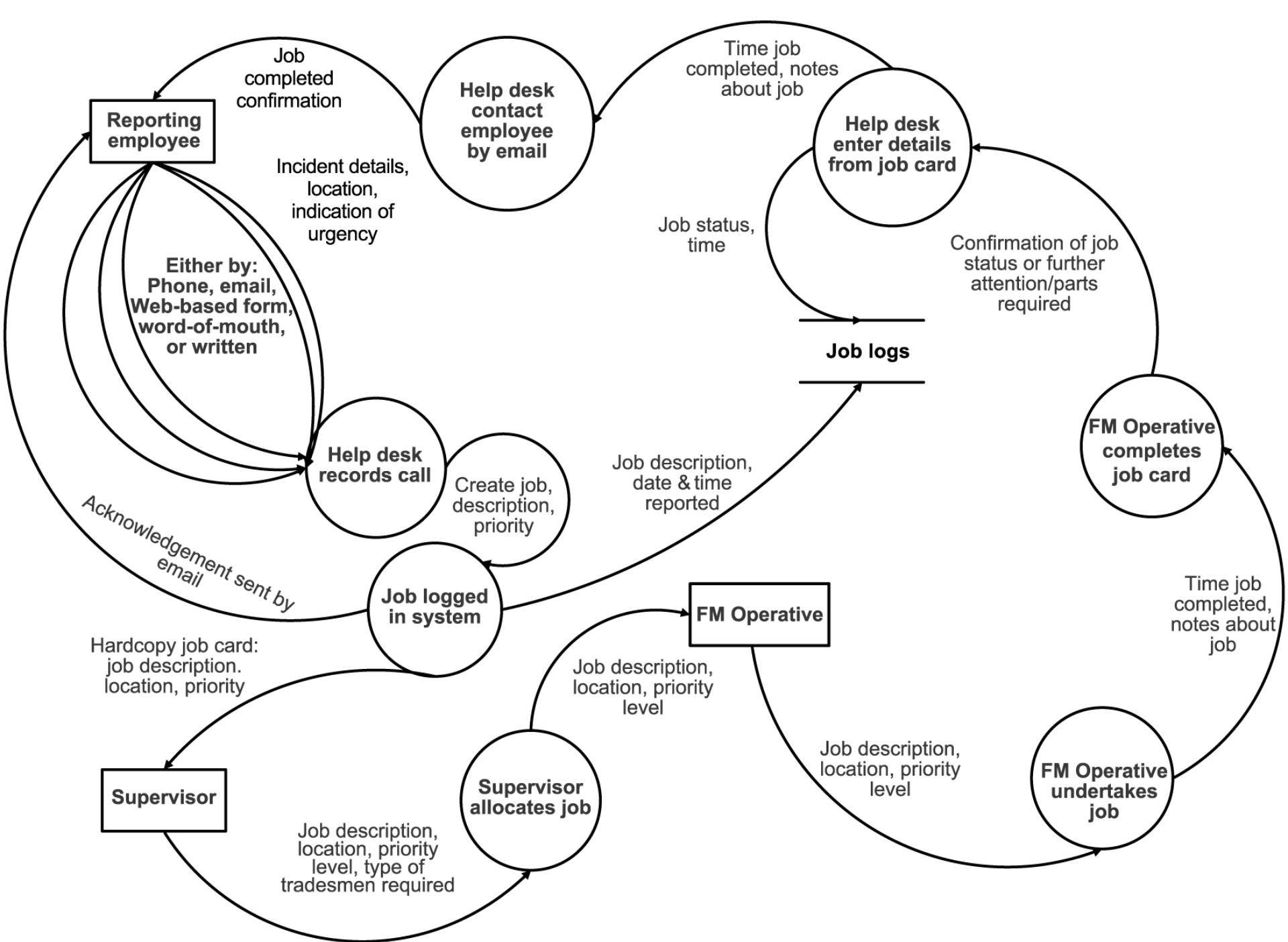
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 4. **Spaghetti Diagram**
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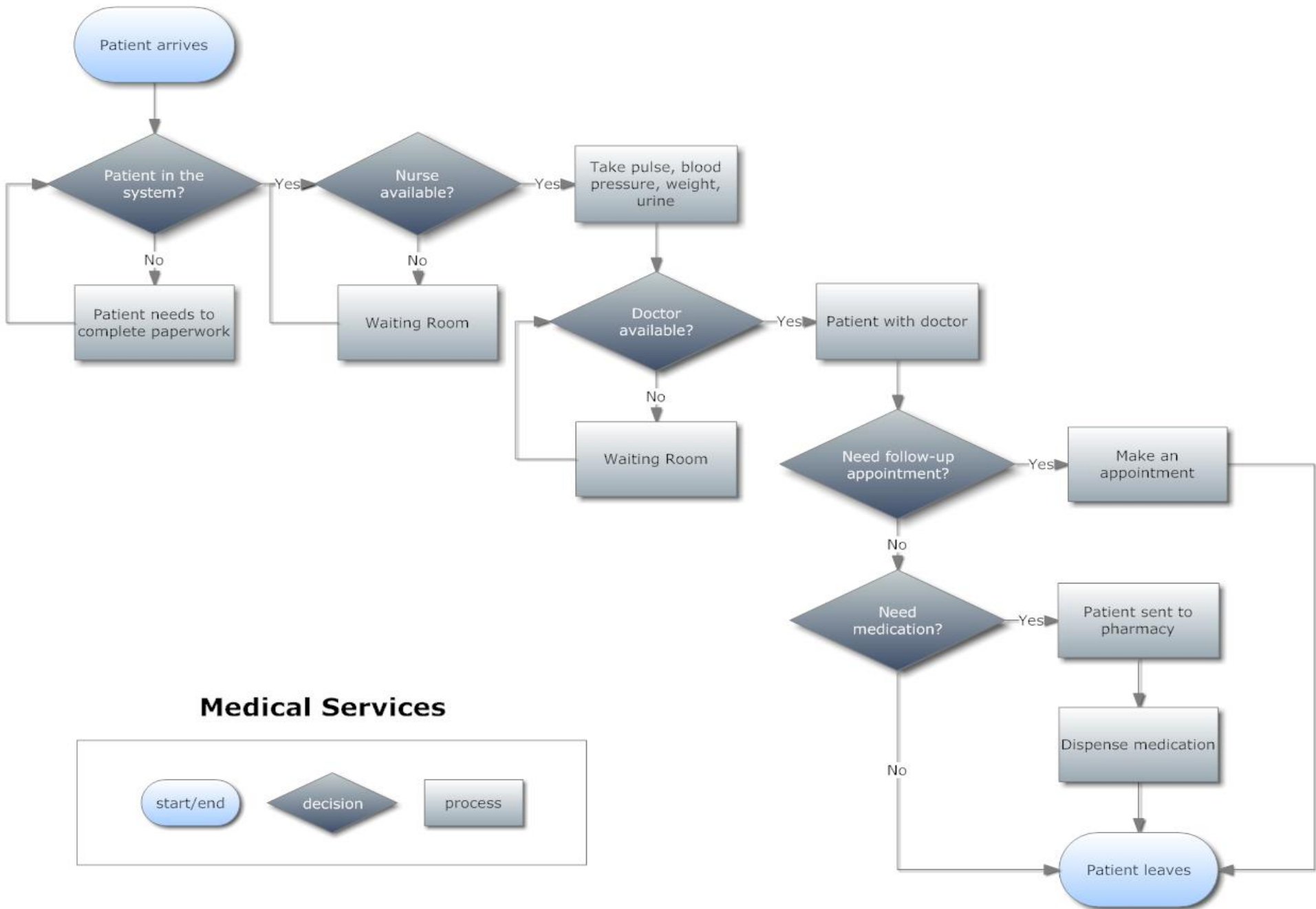


Flowchart

Process flowchart
Process flow diagram

Elements that may be included:

- sequence of actions
 - materials or services entering or leaving the process (inputs and outputs)
 - decisions that must be made
 - people who become involved
 - time involved at each step
 - process measurements
-



Patient arrives

Patient in the system?

No

Patient needs to complete paperwork

Yes

Nurse available?

No

Waiting Room

Yes

Take pulse, blood pressure, weight, urine

Doctor available?

No

Waiting Room

Yes

Patient with doctor

Need follow-up appointment?

Yes

Make an appointment

No

Need medication?

Yes

Patient sent to pharmacy

Dispense medication

No

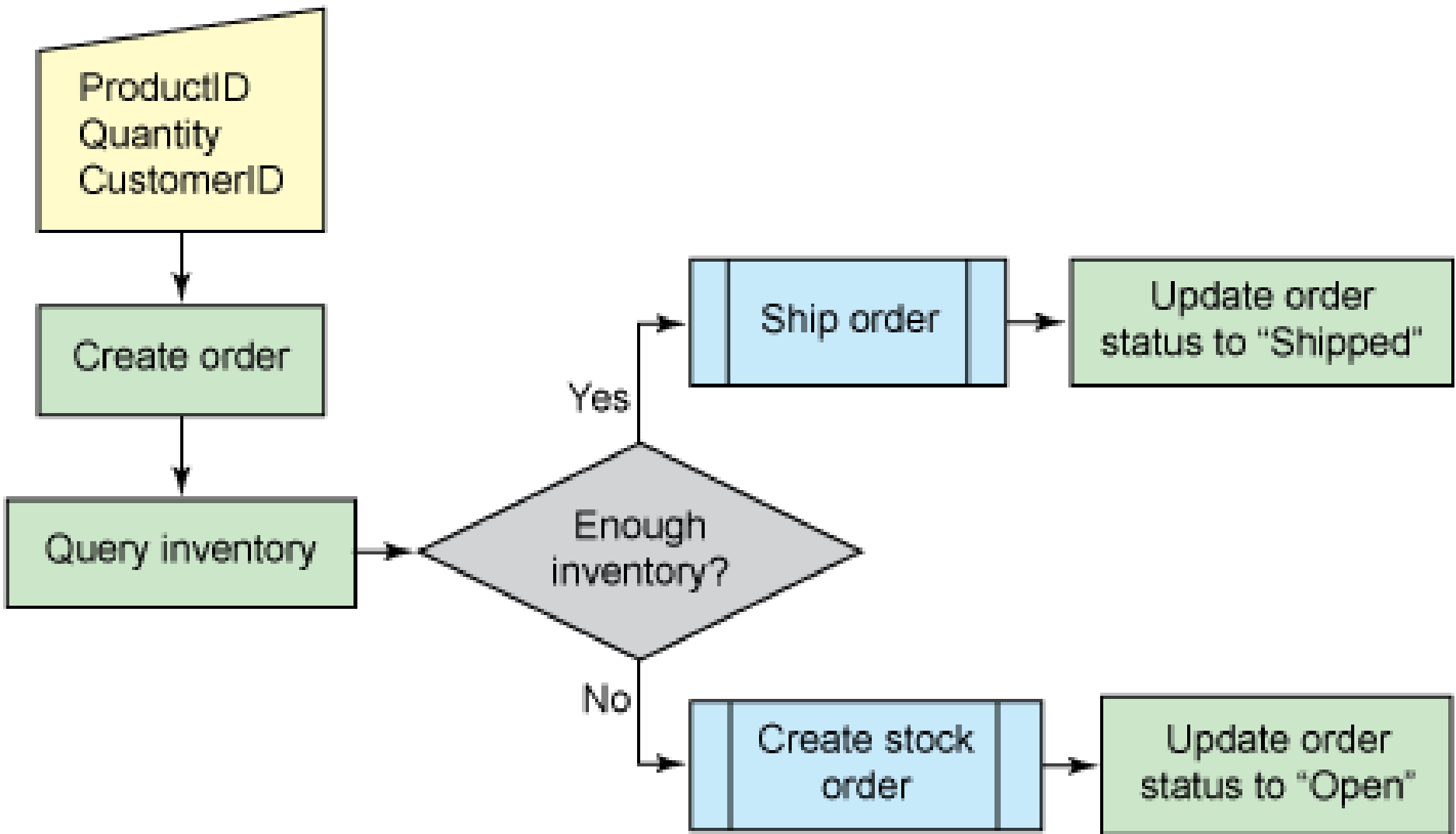
Patient leaves

Medical Services

start/end

decision

process



Flowchart

- Flow charts are simple diagrams
 - To draw a flowchart: brainstorm the tasks and decisions
 - Then map these out in flow chart format
 - Finally, challenge your flow chart
-

Failure Modes and Effects Analysis

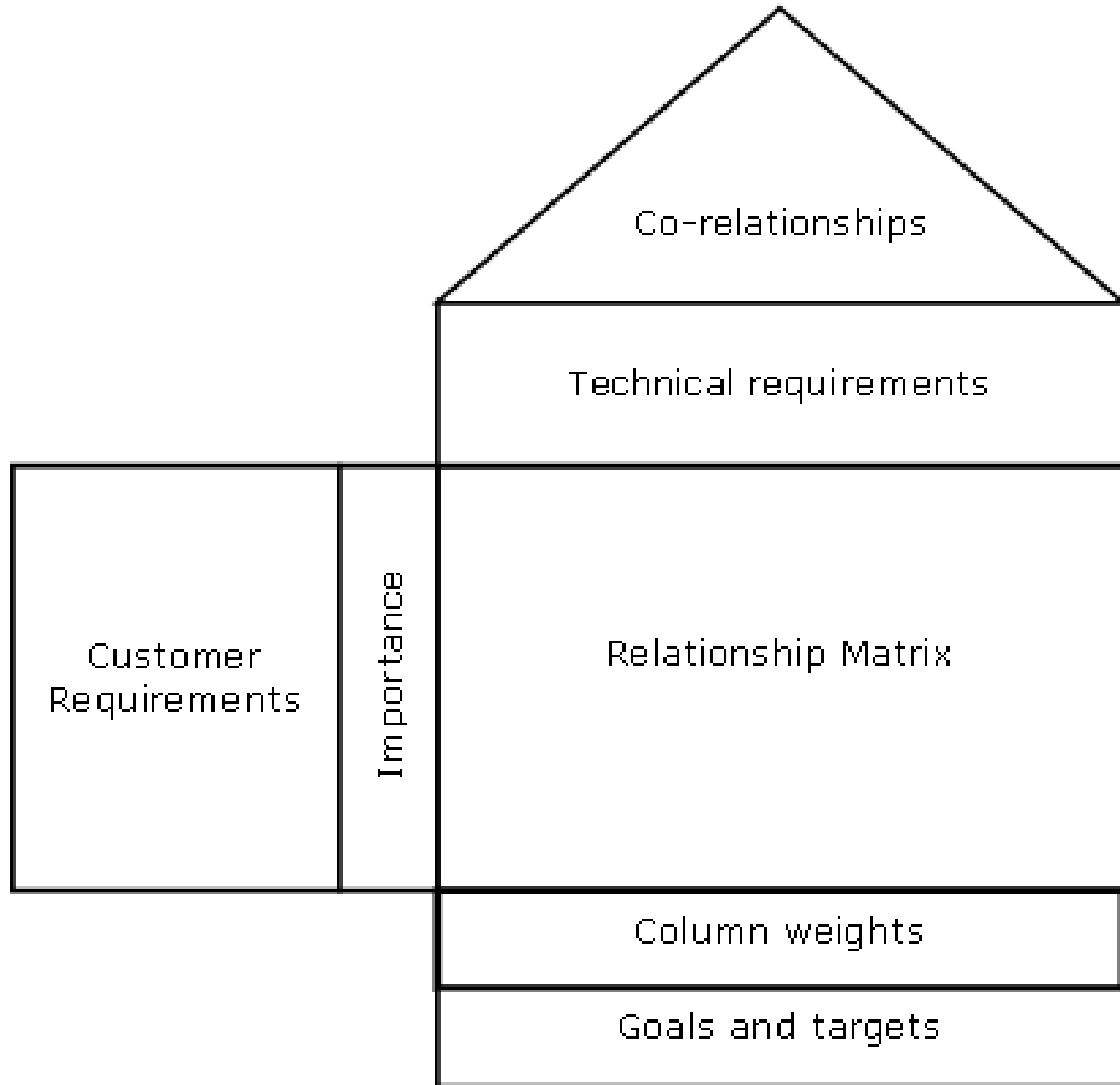
FMEA
House of Quality

FMEA

- A step-by-step approach for identifying all possible failures
 - Design, manufacturing or assembly process or product or service
 - Failure modes = what could go wrong
 - Effects analysis = how would it happen, how likely is it to go wrong and how bad would it be?
-

What is FMEA?

1. What can go wrong?
2. What can be done to keep that from happening?



Refrigerator Product Planning Matrix

Interactions:

- ⊕ Strong Negative
- ⊗ Moderate Negative
- Strong Positive
- Moderate Positive

		Goal	↑	↓	↓	↓	↓	↓	↓	↓	↑	↑	↓	↑	↓	↑	↑	↑	○	↑	↓	↓	↓	○	↓	↑	↓	↑	↑	↓	↑		
		Priority	Compressor energy efficiency rating	Insulation efficiency	Noise measurement-front	Refrig. temp. range (on/off cycle)	Refrig. temperature variation	Refrig. cooling speed (from 30°C to 5°C)	Freezer temp. range (on/off cycle)	Freezer temperature variation	Freezer cooling speed (30°C to -15°C)	Volume efficiency (total/usable)	% Shelf & tray area adjustable	Drawer/shelf pull force	# of visibility features	Dis-assy & re-assy time for cleaning	% of features rated easy to clean	Freezer width	Refrigerator shelf depth & width	Freezer shelf height	Door tray depth	Warranty period (years)	Water filter replacement time & cost	10 year service contract cost	Time to disasb & reasb door	Refrigerator depth	Stainless & trim panel option prices	Focus group rating - appearance	Water temperature	Water filter indicator & life	Ice produced daily	Manufacturing cost	No. of adjustable temp. drawers
Customer Needs		Priority	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
		1	3	5																													
		Competitive Evaluation (1-Low, 5-High)		Sales Points		Improvement Goal		Improvement Factor		Relative Development Effort																							
		U	MG	A	W	1.0	3	1.1	1																								
		MFA		W	U	1.0	5	1.0	0																								
		FA	MW	G	U	1.0	5	1.0	0																								
		MFA		W	U	1.2	5	1.0	0																								
		U	MG	FA	W	1.1	5	1.4	5																								
		A	U	WG	M	1.0	3	1.1	1																								
		U	FA	WG	M	1.0	3	1.2	1																								
		MWGFA		U	1.0	5	1.0	0																									
		U	W	A	M	1.0	3	1.2	1																								

Why do FMEA?

1. When preventing problems is cheaper and easier than cleaning them up
2. Some things are too risky or costly to incur mistakes

PROCESS FMEA											FMEA Number : SY827-01							
Part Name :					Process Responsibility : Production					Page No. : 3 - 5								
Part No :					Key Date :					Prepared By : Mr.Muthusamy								
Core Team : S. Muthuswamy , G. Jayavel , K. Saravanan , S.Chandrasekaran ,										FMEA Date (Orig) : 18/04/08								
Process Function											Rev.No& :00							
Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v s	C l a s s	Potential Cause(s)/ Mechanism (s)of Failure	O c c u r	Current Process Control Detection	Current Process Control Detection	D e t e c t	R P N	Recomended Actions	Responsibility & Target Completion Date	Action Result					
													Action Taken	S e v	O c c	D e t	R P N	
Drilling	Hole dia over size/ under size	Fitment problem at customer place	8		Drill bit wornout	2	Tool life monitoring based onlast off approval	First off inspection & patrol inspection	4	68								
	Dimension variation	Fitment problem in successive operations	8		Location problem	2	Tool life monitoring based on last off approval	First off inspection & patrol inspection	4	68								
	Burr on the component	Customer dissatisfaction cause injurty to operator	8		Drill bit worn out	2	Tool life monitoring based on last off approval	inspection & patrol inspection	4	68								
Co2 Welding	Improper weld penetration	Part failure in usage	8		Process parameter Not maintained	2	Control system of process parameters	Weld Penetration test weekly twice	6	96								
	Dimension variation	fitment problem at customer place	7		improper clamping	3	Work instruction	Periodic inspection in every 2 hrs	3	63								

When to do FMEA?

1. Before there's a problem
2. During a project's lifespan
3. After there's a problem, so it doesn't happen again

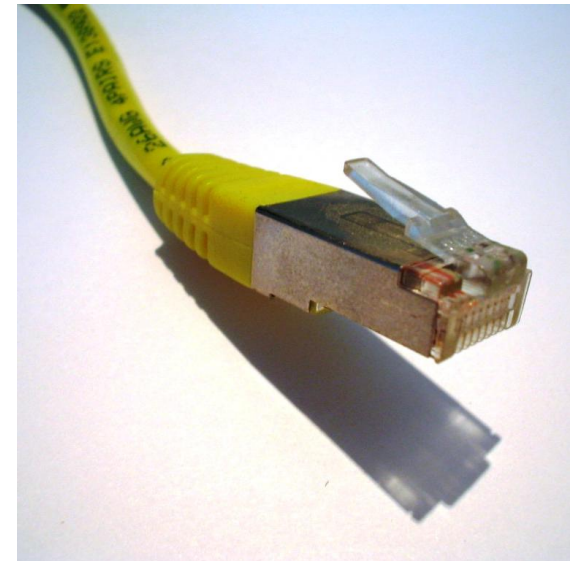
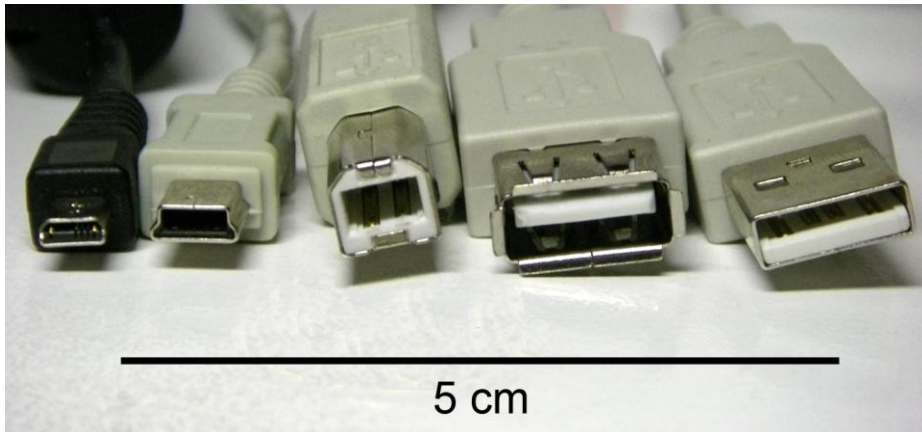
Failure modes and effects analysis

- How to do FMEA
 1. Gather your smart people together
 2. Represent every area where a problem could occur
 3. Use a worksheet to record the information
-

Mistake-proofing

Poka-yoke
Fail safe

The use of any automatic device or method that either makes it impossible for an error to occur or makes the error immediately obvious once it has occurred.



1. Eliminate the process step
2. Replace the step

3. Facilitate the correct action
4. If not, make detection easy





When to do mistake proofing?

1. Where human error exists
2. At a handoff
3. When an error is costly



1. Self inspection 2. Source inspection 3. At the next step

Mistake-proofing

Make errors impossible

- **Elimination** seeks to eliminate the possibility of error
- **Replacement** substitutes a more reliable process
- **Prevention** engineers the product or process
- **Facilitation** makes work easier to perform
- **Detection** involves identifying an error
- **Mitigation** seeks to minimize the effects of errors

Healthcare example

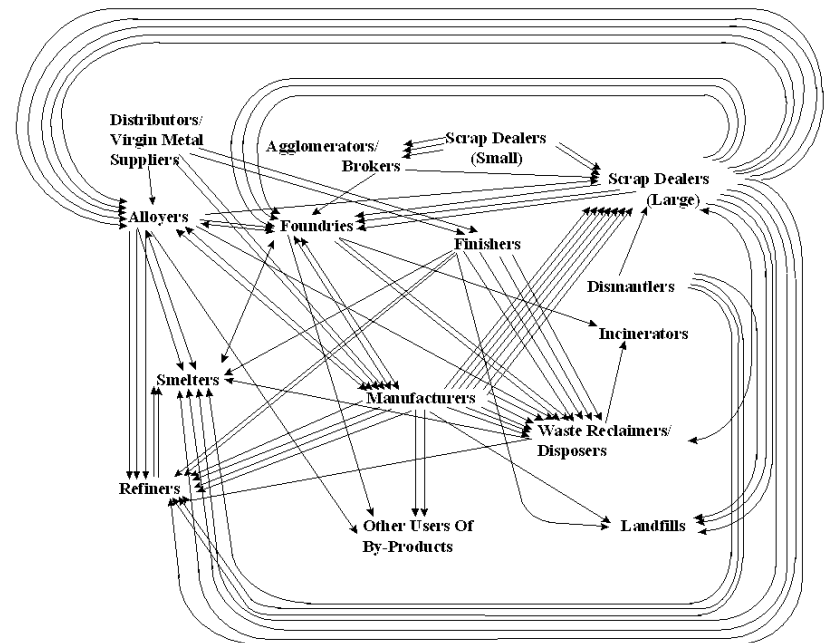


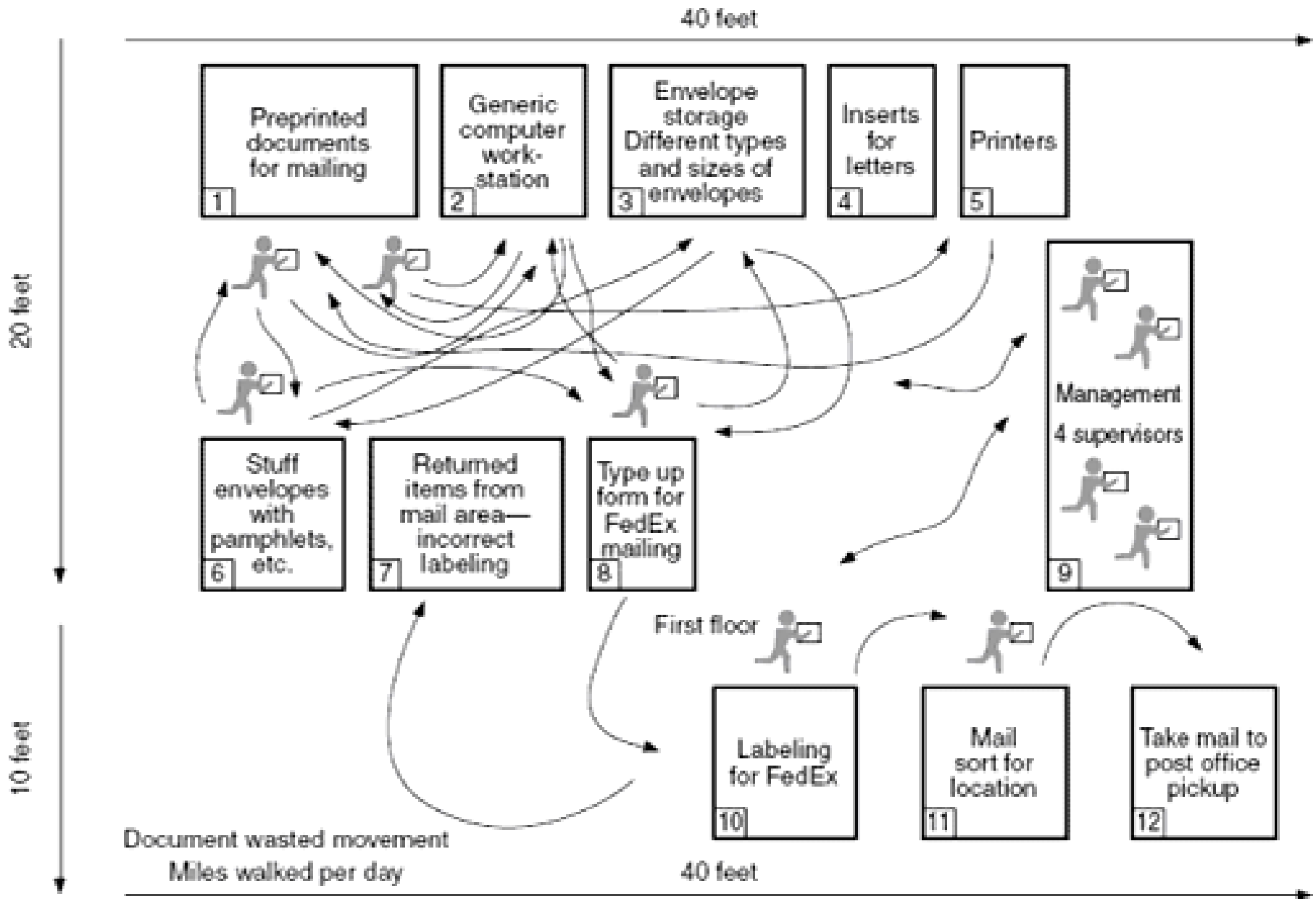
Spaghetti Diagram

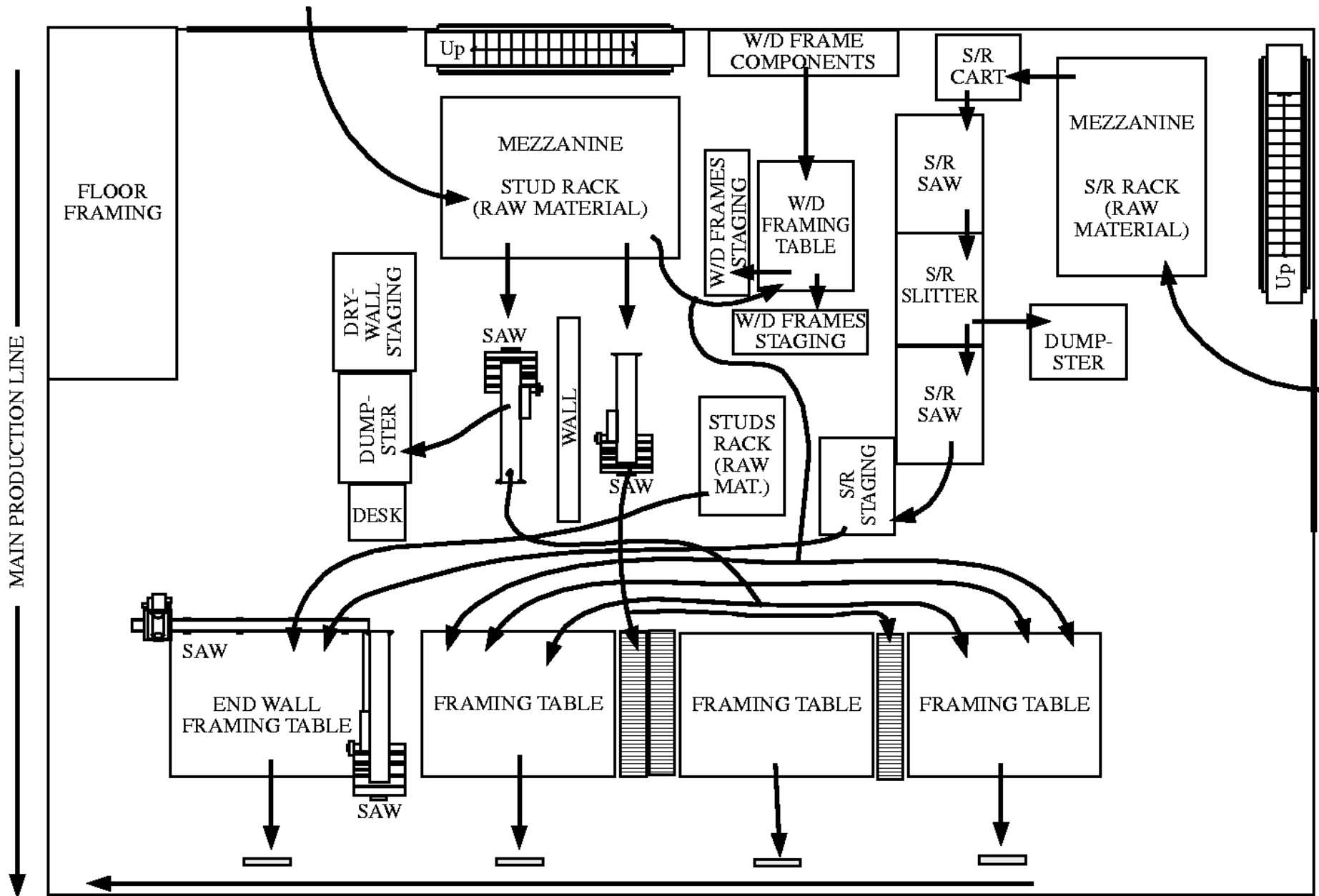
Layout diagram

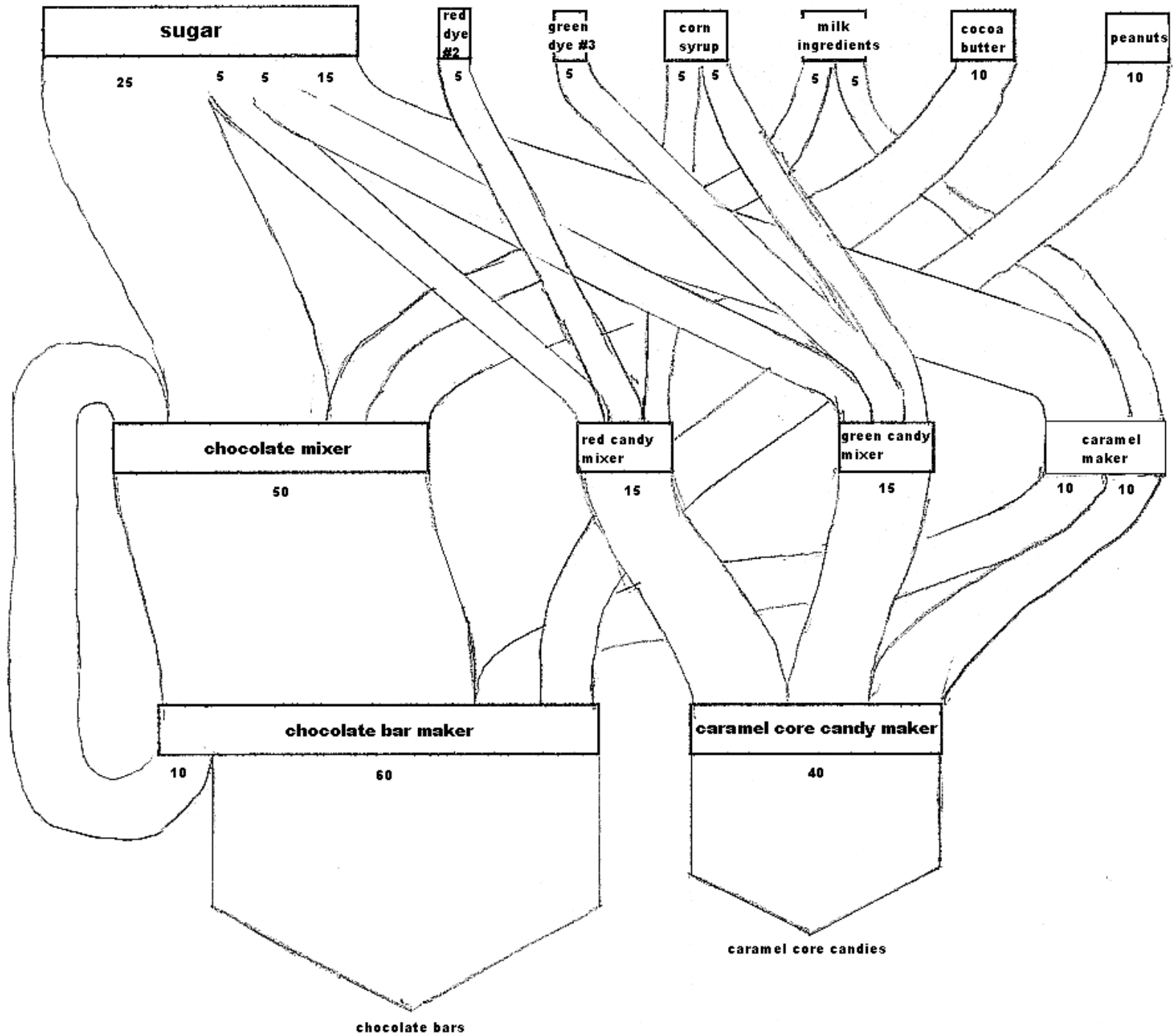
A spaghetti diagram is a visual representation using a continuous flow line tracing the path of an item or activity through a process.

The continuous flow line enables process teams to identify redundancies in the work flow and opportunities to expedite process flow.









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PA Tool	Definition
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