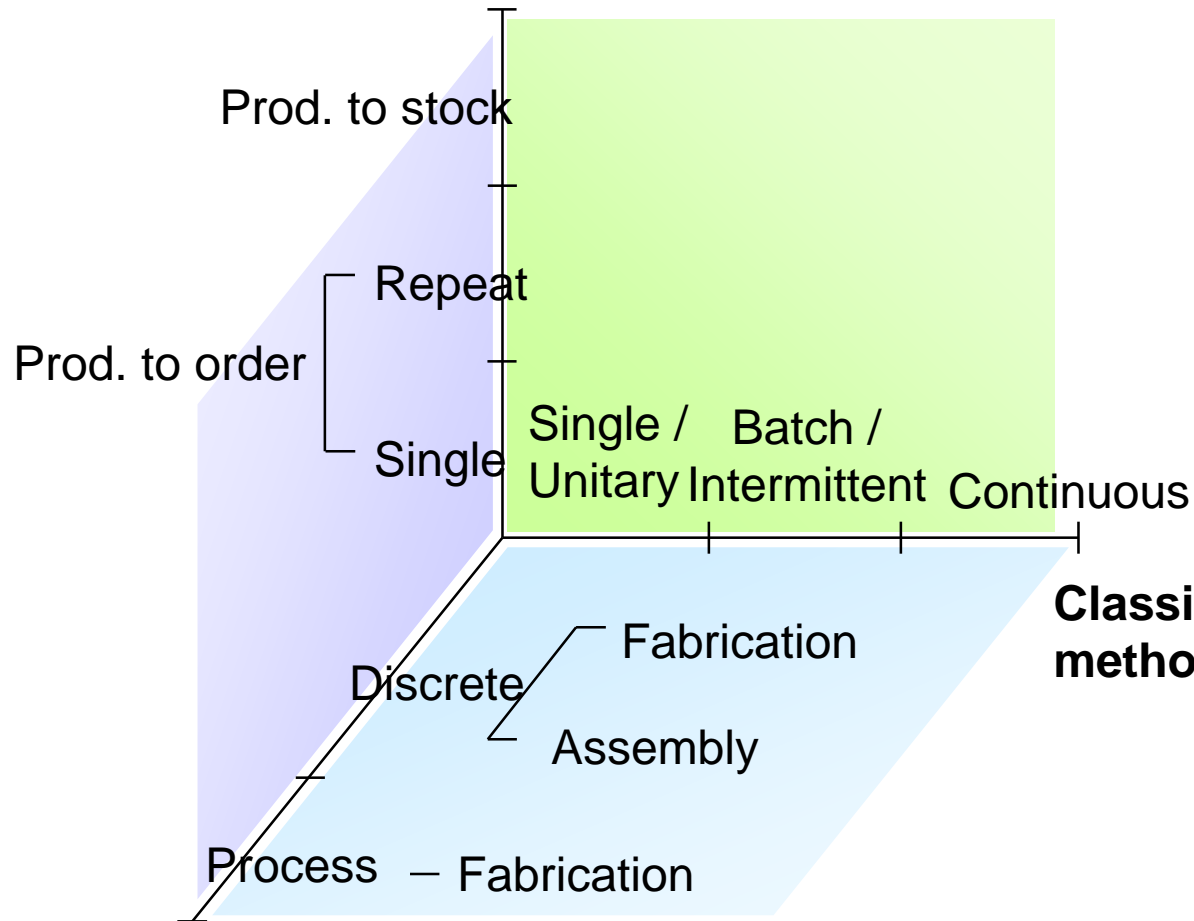


Classification of Production Systems

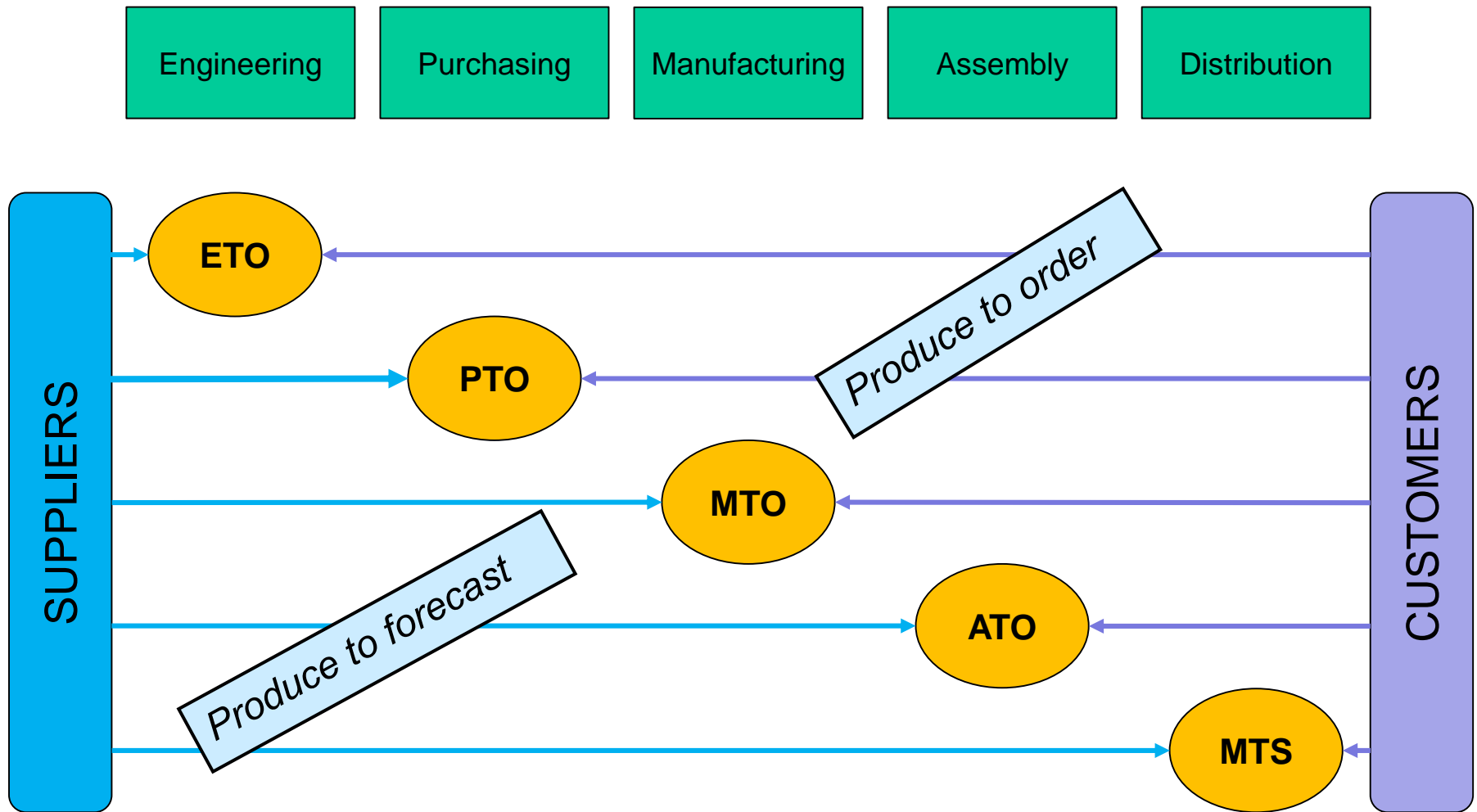
Prof. Tommaso Rossi
School of Industrial Engineering


Classification by market interaction (standardisation of product)



Classification by nature of process (type of production technology)

Wortmann Classification (CODP concept)



 Customer Order Decoupling Point

MTS - Make to stock **ATO - Assemble to order**
MTO - Make to order **PTO - Purchase to order**
ETO - Engineer to order (/ Project)

How these products production systems can be classified in the three axes?



- Single
- To order (repeat)
- Discrete fabrication



- Single
- To order (single)
- Assembly



- Continuous
- To stock
- Process



- Batch
- To stock
- Assembly

Production systems classification

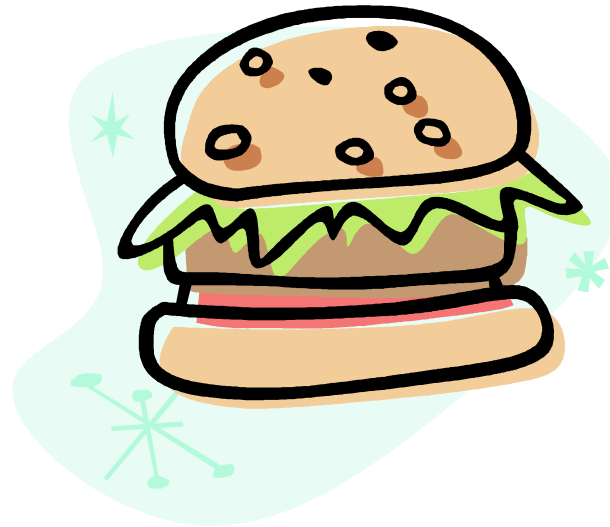
Correlations

	Single	Batch	Continuous
To stock		Commercial clothing	Water bottles replenishment
To order (Repeat)	Pizzeria	Machine tools	
To order (Single)	Tailored clothing		

	Single	Batch	Continuous
Process manufacture		Semiconductors	Cement, paper, plastic, glass
Discrete manufacture	Customized mechanical parts	Glasses frame	Steel or plastic shaping
Assembly	Shipbuilding	Electronical commodities	Car assembly

	Process manufacture	Discrete manufacture	Assembly
To stock	Plastic	Pharmaceutical	Staple
Repeat		Pizzeria	Machine tools
Single			Shipbuilding

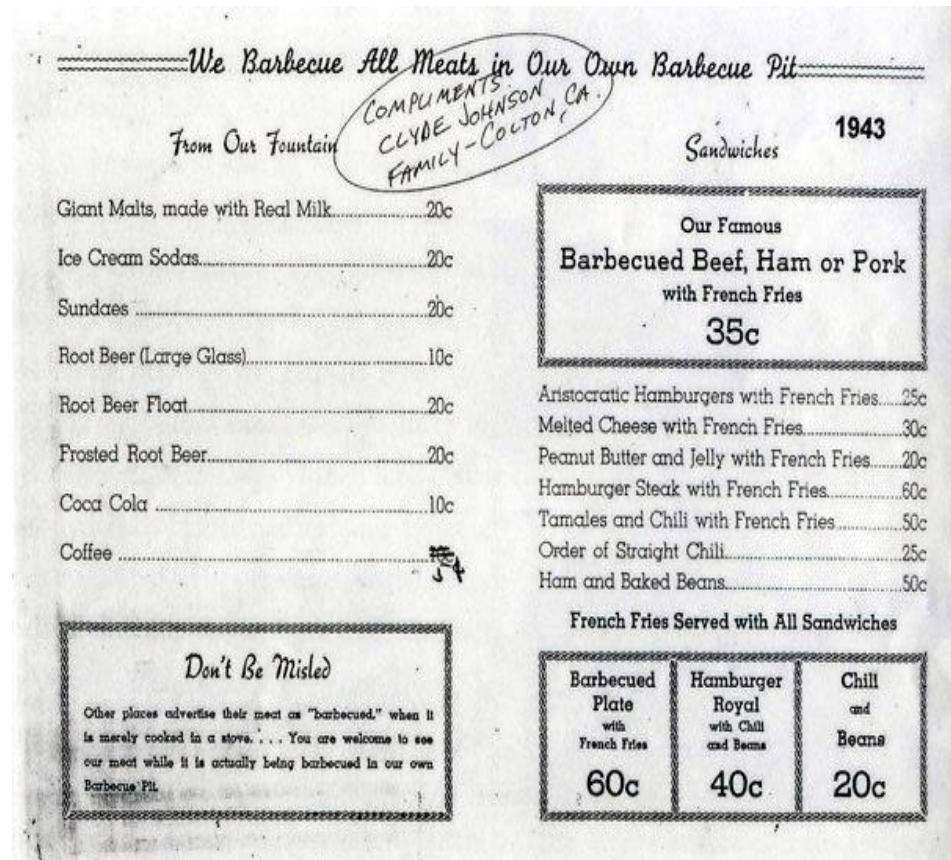
Production systems classification: McDonald's case study

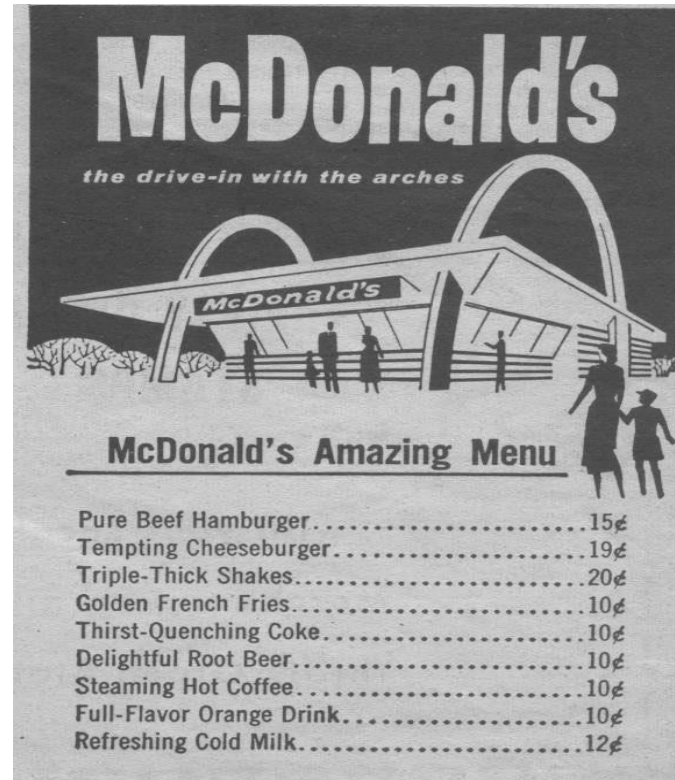


The fast food restaurant chain McDonald's was founded in 1940 in San Bernardino, California, as a barbecue restaurant.



- The initial menu was large, including several items which costed less than 60 cents each.
- It included hamburger, barbecue plates, melted cheese sandwiches, etc.
- Opening hours: lunch and dinner time





- Since the hamburgers were the most sold products among the items proposed in the menu. In 1948 McDonald's was refurbished and became a self-service restaurant, with a business mainly based on the hamburgers.
- Menu slimmed-down: only nine items were included, with six drinks and three food choices.
- High quality, cheap and fast food: only 15 cents for the best hamburger of the region, without waiting times

- Over years McDonald's changed the restaurant culture, focusing on a concept of fast and cheap food.
- This culture reached people of all ages across the globe.
- For this reason, in 1980 the menu increased the variety and included different typologies and sizes of hamburger/cheeseburger, drinks, and snacks, and started to offer also breakfast options.
- But, still the items proposed by the menu were few and standardized, to make the fast and cheap service possible.



Introduction

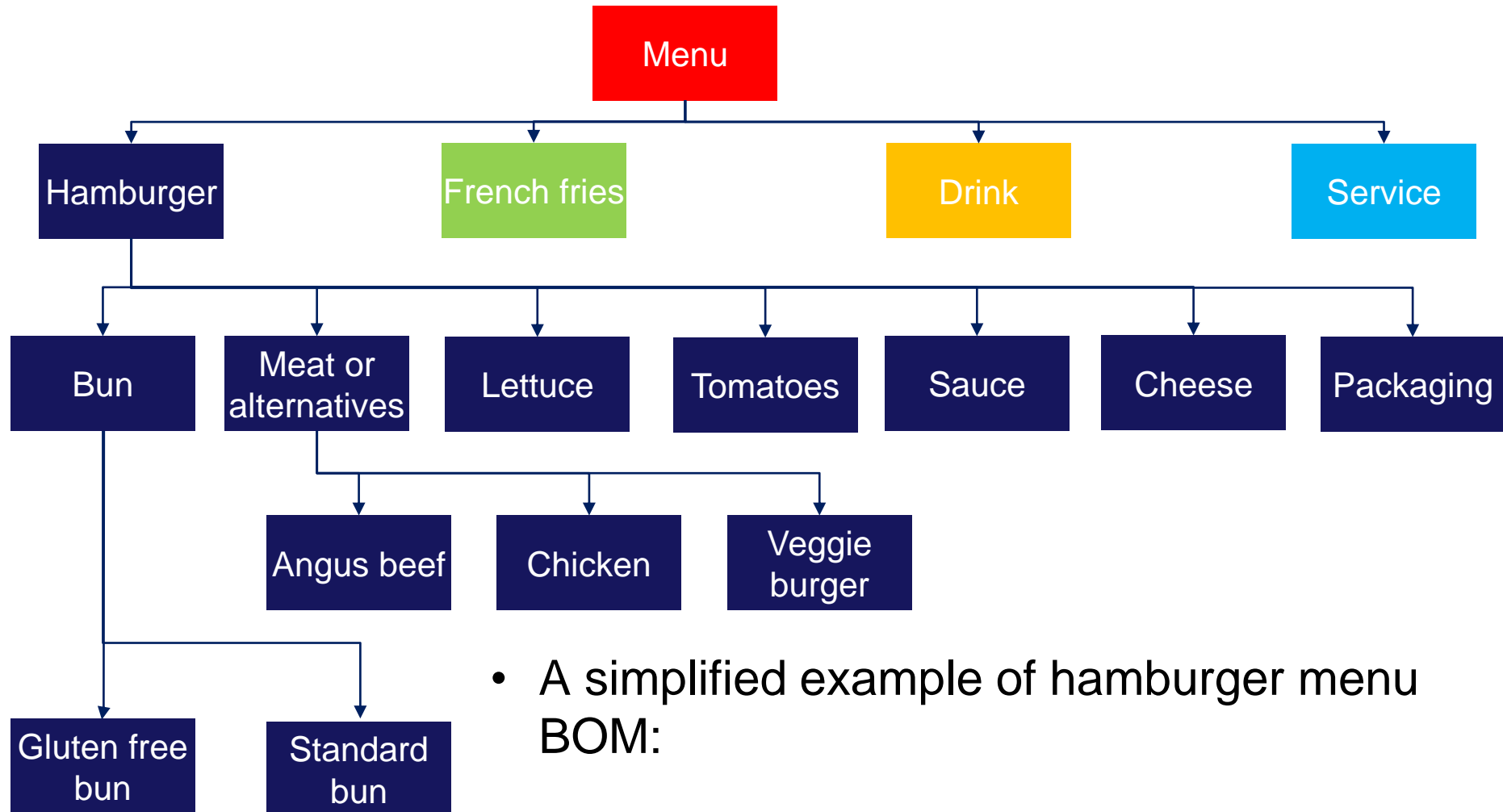
- In 1981 **Burghy** fast food chain has been founded in Milan. It was inspired on US McDonald's restaurants and also the menu were really close to McDonald's concept.
- Burghy became rapidly a trend among young people in Milan that loved the idea of fast and cheap food, so different and new with respect to the Italian culture.
- When McDonald's arrived in Italy, it was hard to succeed in the Italian market, given the strong presence and the power of the Burghy brand.
- In 1996 McDonald's owned a network of 38 restaurants in Italy and decided to acquire Burghy, that owned a network of 88 restaurants in the Northern Italy, in order to increase its presence in the Italian market and acquire the leading position.

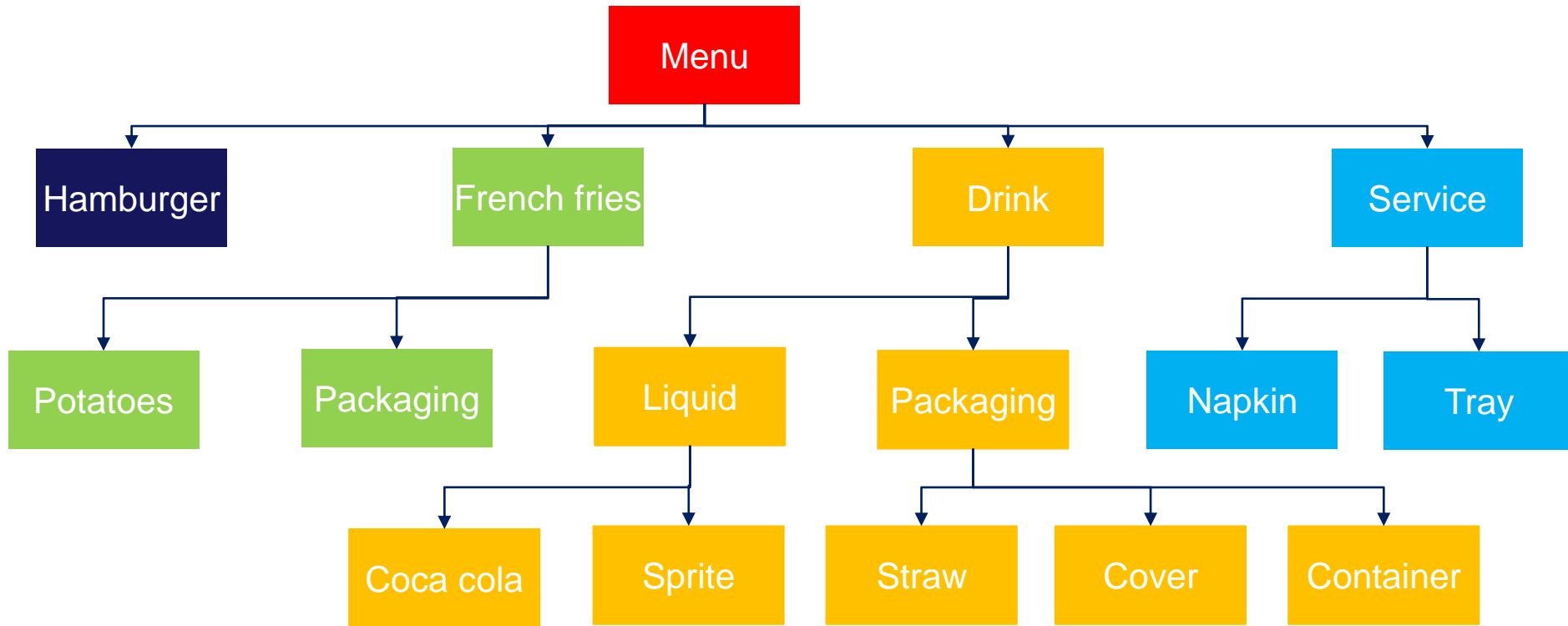


- What is the BOM of a McDonald's finished product?



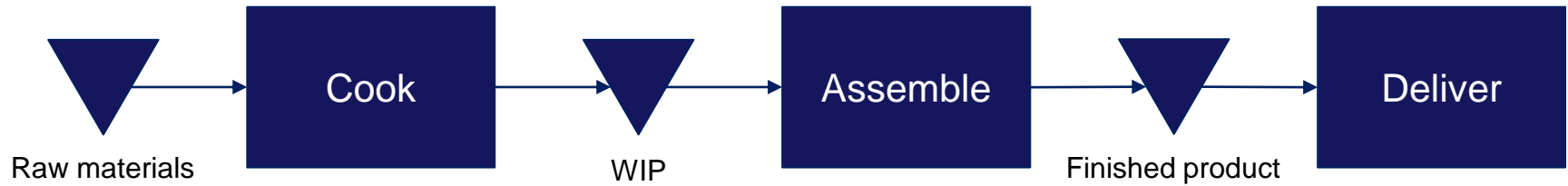
- What is the BOM of a McDonald's finished product?





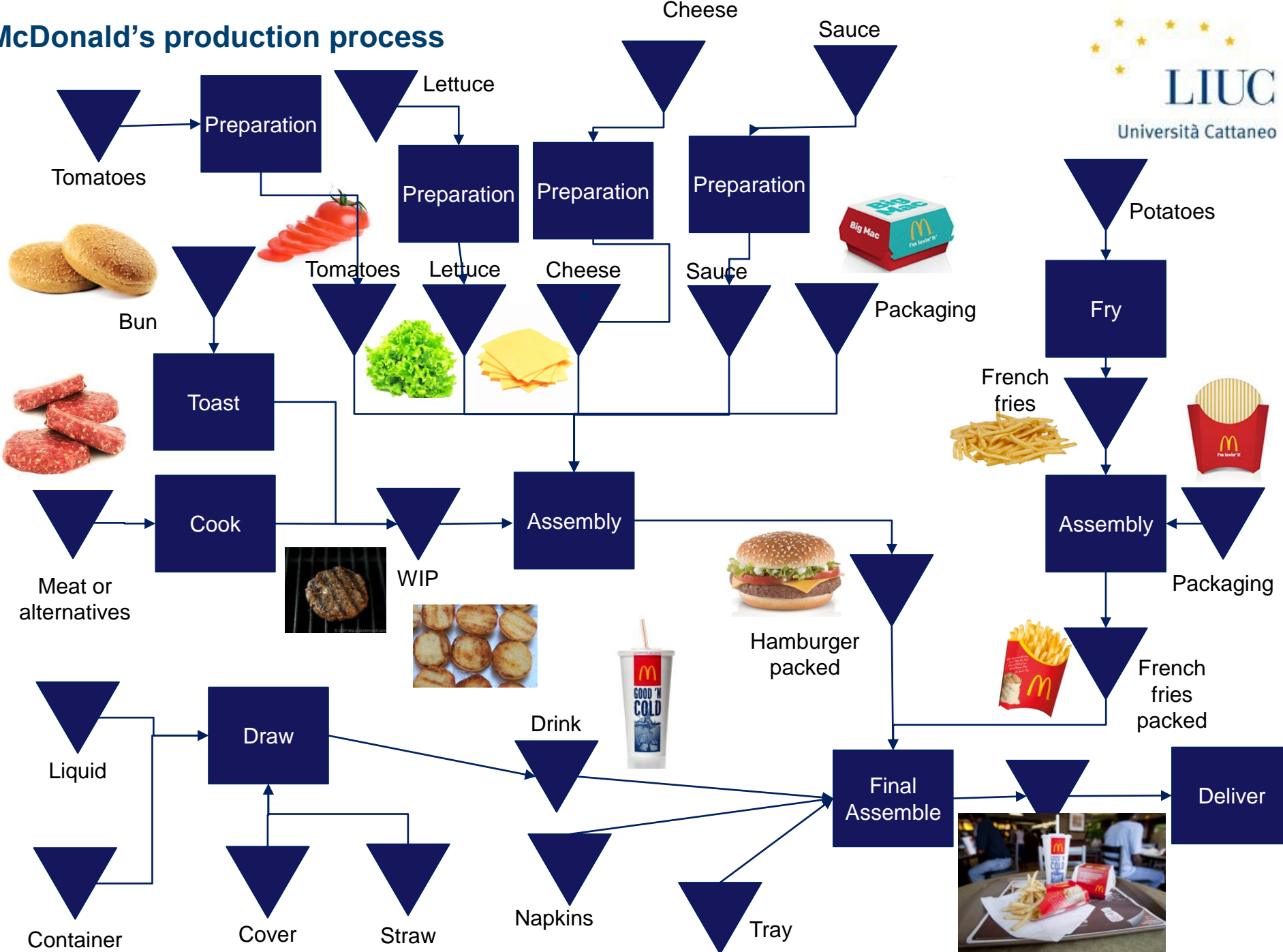
- A simplified example of hamburger menu BOM:

What is McDonald's production process?

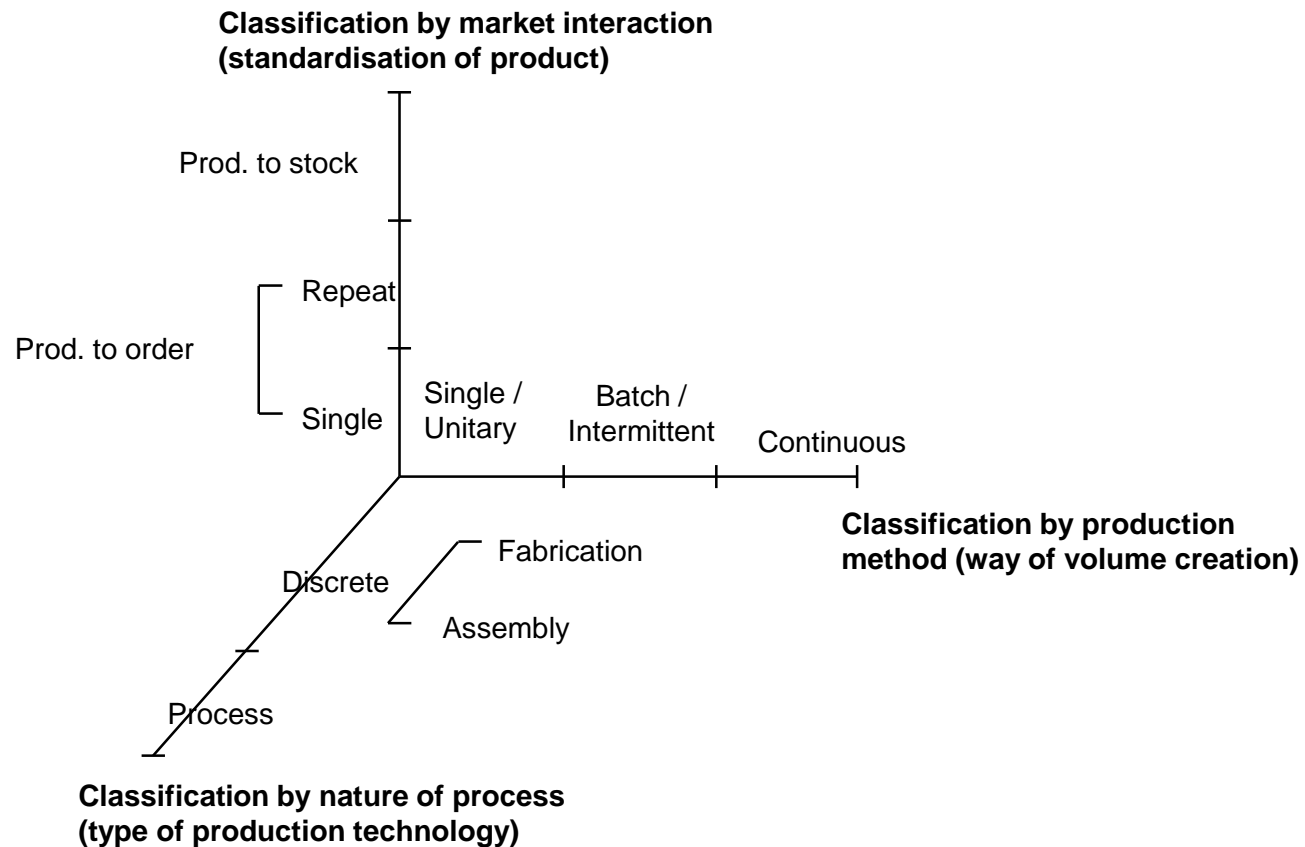


- What are McDonald's raw materials?
- What are McDonald's WIP?
- What is McDonald's finished product?

McDonald's production process



How can you classify this production process?



McDonald's production process - classification

Sub-system	Nature of process	Production method	Market interaction
Standard bun toasting	Process	Single	MTS – high demand MTO – low demand
Gluten free bun toasting	Process	Batch	MTO
Meat cooking (Angus and Chicken)	Process	Batch	MTS – high demand MTO – low demand
Vegan burger cooking	Process	Batch	MTO
Cheese and sauce preparation	Discrete fabrication	Batch	MTS
Vegetables preparation	Discrete fabrication	Batch	MTS – high demand MTO – low demand
Standard hamburger assembly	Assembly	Batch	MTS – high demand ATO – low demand
Special hamburger assembly (gluten free & vegan)	Assembly	Single	MTO
Potatoes frying	Process	Continuous	MTS
French fries packing	Assembly	Single	MTO
Drink drawing	Process	Single	MTO
Final assembling	Assembly	Single	ATO – high demand MTO – low demand or special requirements

- The classification of production processes by market interaction depends on different factors:
 - Demand volumes
 - Demand seasonality
 - Delivery lead time vs total production lead time
 - Customization required
 - Customization offered
 - Demand predictability
 - Customer sensitivity to special offers
 - Product shelf-life
 - ...

McVEGGIE®



GLUTEN FREE BURGER



Quality by
Schär
Gluten Free

CRISPY McBACON®



BIG MAC®



McTOAST®



	MTS	MTO
Service level	high	low
Flexibility	low	high
Inventory costs	high	low
Stock-out costs	low	high
Engineering change order costs	high	low
Resources saturation	high	low

What are the main advantages of MTS/MTO choices?

CHOOSE YOUR OWN INGREDIENTS

Build your own burger by choosing from 30 delicious ingredients!

1. GET BREADY



Bakery Style Bun



Brioche



Bunless

2. MEAT OR PORTOBELLO



Thick-cut Grilled Chicken



100% Angus Beef



Portobello

3. MAKE IT CHEESY?



Pepper Jack Cheese



Mozzarella Cheese



Classic Cheddar Cheese



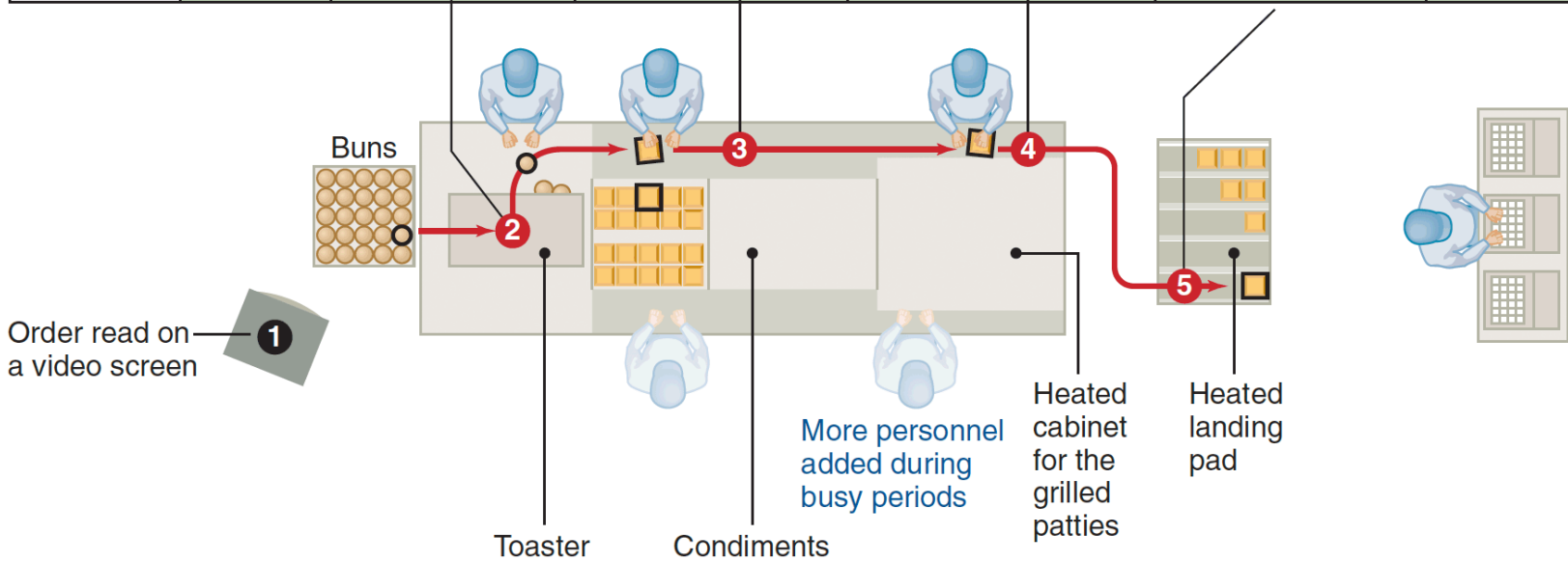
McDonald's in the last years applied a new strategy to be more competitive within the market, by assuring high variety and maintaining at the same time a good service level.

The new strategy is based on:

- Quality (local foods, food safety certifications)
- Innovation (special month burgers, special menu)
- Customization (mass customized menu)
- Service level (just in time production systems)

New McDonald's production process

Elapsed time	0:00	0:11	0:31	0:45		1:30
Task time (seconds)		11	20	14	0	45
Task	1. Order	2. Bun toasting	3. Assembly with condiments	4. Wrapping of patty with bun	5. Order picked up immediately to keep it fresh	6 Customer service (order and payment)



(Heizer & Render)