

# “Spot-Welding Technology and the Development of Robotics at Fiat, 1972-87: A Case of Managerial Discontinuity?”



Today we are going to talk about the following:

- Background on FIAT and Giuliano.
- Five performance objectives and Product Life Cycle.
- FIAT's production process and flexibility.
- Capital utilization.
- Innovation at FIAT and innovative features of Robogate technology.
- Comparing FIAT's flexibility 1970s vs. 1980s.
- Discontinuity.

# Who is Dr Giuliano Maielli?



- Received PhD in Economic History from the London School of Economics
- Senior lecturer in Operations Management at QMUL.
- Director of the Business and Management Undergraduate Programme.

# Who is Dr Giuliano Maielli?



- Specific focus on the car industry and flexible manufacturing systems.
- Has written numerous articles and a book chapter relating to Fiat.
- In 2003 received a Coleman Prize for the best PhD thesis for the optimisation at Fiat.

# Who is FIAT?

- FIAT was founded by Giovanni Agnelli in 1899 in a city called Turin in Italy.
- They are mainly producing autos, trucks and auto parts.
- Also involved in construction, agricultural machinery, financing, newspaper publishing and advert sales.
- Total equity of 10.3 billion Euros and 67.24 billion worth of fixed assets (2009).



# Who is FIAT?

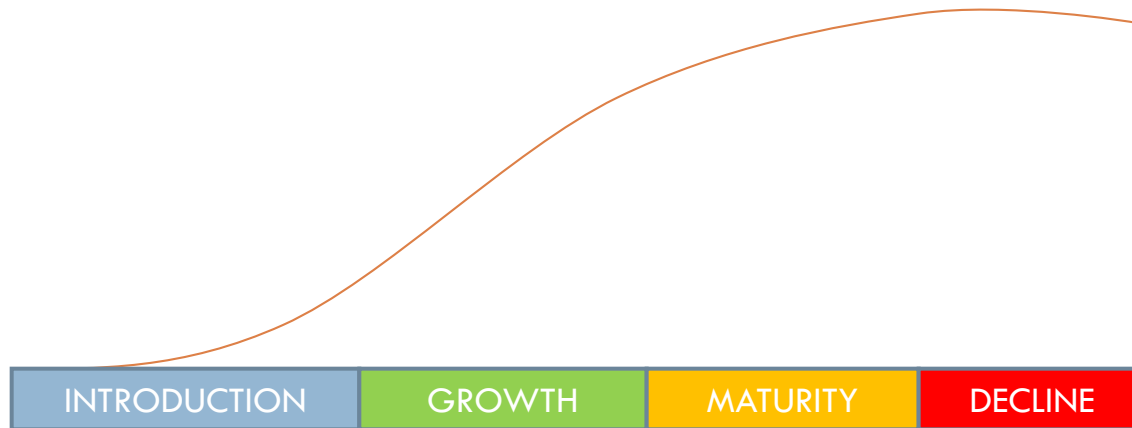
- Lancia, Alfa Romeo, Maseratti, Ferrari, Ducato and Iveco as well as Abarth – an Italian racing car maker, which is basically producing sporty versions of some well known FIAT models.



# Five Performance Objectives

Speed	<ul style="list-style-type: none"><li>•Fast production</li><li>•Capacity utilization</li><li>•Specialization</li></ul>
Cost	<ul style="list-style-type: none"><li>• Aiming at the lower end market</li><li>• Lower unit cost</li><li>• Affordable</li></ul>
Flexibility	<ul style="list-style-type: none"><li>•Judged flexibility on the basis of speed</li><li>• one model, one assembly line</li></ul>
Dependability	Keeping to production schedule (meeting promises)
Quality	Safe, minimum quality requirements,

# Product Life Cycle



Stable position selling small inexpensive cars

Mass production techniques

Fiats low cost acts as competitive edge

Resistance to change in the workplace



# Fiat's Production Process

- Fiat has a Mass production process (long and thin).
- They tried to turn their production into short and fat.
  
- Advantages of Mass production:
  - Low unit costs
  - Higher speed increasing dependability
  - Specialization
  
- Disadvantages of mass production:
  - Inflexibility
  - Boredom/Less variety

# Flexibility

- Flexibility means being able to change the operation in some way. This may mean changing what the operation does or how it is doing it.

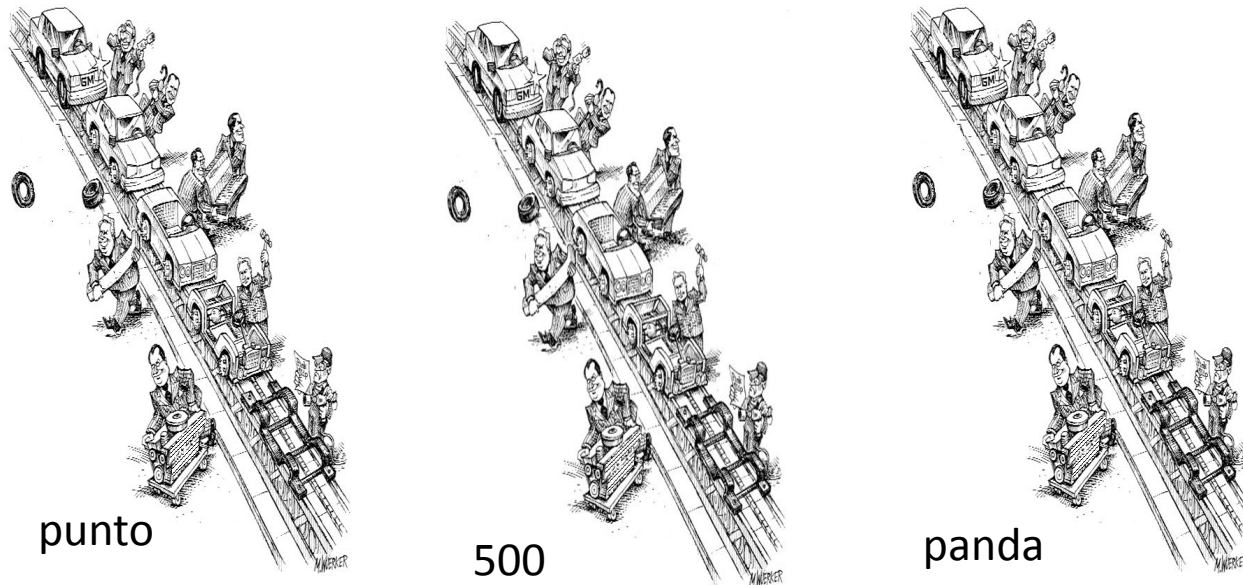
## It has three features

1. Plant flexibility
2. Process flexibility
3. Product mix flexibility



# Product Mix Flexibility

- Product mix flexibility is achieved when a range of cars is produced in the same line in a random sequence. Product mix changes according to demand.
- Fordist Mass Manufacturing Framework



# Fordist Flexibility

- ❑ Fordist system assumed constant and increasing demand.
- ❑ Efficiency was measured in terms of cycle time minimisation.
- ❑ Maximised through the standardisation of the process and the product.
- ❑ In turn generated inflexibility.



# Flexible Mass Production

- Assumes erratic demand for specific products.
- Efficiency is understood as stabilisation of the utilisation rate of production lines.
- The minimisation of the cycle time is less important than the stabilisation of the utilisation rate at the optimal level.
- Fiat believes that they have shifted to flexible mass production in the late 1970s and early 1980s when they developed FMS based on robotics. The system was based on processing two or more different cars in a random sequence.

# Capital Utilisation

Capital utilisation refers to the ratio of actual output to some measure of potential output and is a central feature of the efficient organisation of resources within a firm and an industry.

- How much can we produce and how much are we producing.
- Capacity and how much that capacity is fulfilled.
- Flexibilities main aim is not to utilize capital, but it is to keep this production stable by producing variety to meet demand.
- They clash

# Wrong aim

- Fiat implemented robotics to resolve bottlenecks .
- Which lead to selective and localised implementation of the robotics which in turn hampered the flexibility of the system.
- Fiat to minimise they cycle time rather than maximisation of flexibility.
- As a consequence some lines were underutilized while others were often, or even consistently saturated by implementing overtime.
- This is exactly what flexible manufacturing systems are supposed to avoid or minimise.

# Innovation in Fiat

What is innovation



What are robots



# Innovative Features of Robotics

- Flexible operation
- Process innovation
- Flexibility of production system , a shift from inflexible to flexible mass production
- Shift from fordism to post-fordism
- Development in basting and finishing
- Safety and security
- A life time investment
- Terminated model specificity
- Gained the market share ( people believe, what literature say)
- First mover in robotics in Europe (fiat created a new market for robots)

# Disadvantages of New Technology



- Robots breaks down
- Need human intervention
- Cannot think for themselves



# 1970's vs 1980's Flexibility

- Definition
- Scientific evidence of
  - ❖ Loke and Negrelli
  - ❖ Bonazzi
- Production flexibility vs. capacity utilization
  - ❖ Introduction of robotics at Fiat during the late 1970s to the late 1980s was localised and path-dependent → limited flexibility of production line.
- Robogate was very effective in minimising the cycle-time of finishing ~~not effective in stabilising the capacity utilisation at around the optimal rate~~



# 1970's vs 1980's Flexibility

- Training and education was not provided to management.
- Robotics was deployed only in those stages where traditional technologies did not allow for the minimisation of the cycle time.
- Trade-off between cycle-time minimisation and flexibility maximisation
- Flexibility → Introduction stage
- Dependability → Maturity



# Did Fiat maximise speed by deploying Robogate?



- Deployment of robotics was one of the most important features of the restructuring of the Fiat



- Fiat increased speed in the production process

# Cycle times at FIAT

TABLE 1  
EFFICIENCY EXPRESSED AS DURATION OF THE CYCLE TIME IN WELDING (SECONDS),  
VARIOUS YEARS, VARIOUS PLANTS

Year	Plant	Number of Lines	Model	Efficiency Factor	Technology		Cycle Time Minutes and Seconds
					Basting	Finishing	
1975	Cassino (1)	4	126	0.80	Automated	Automated	6.10
1975	Mirafiori (1)	1	126	0.93	Automated	Manual	2.04
1980	Termini- Imerese	1	Panda	0.85	Robotics	Robotics	1.32
1980	Desio	1	Panda	0.93	Automated	Manual	2.51
1984	Chivasso	1	Lancia Delta	0.90	Automated	Manual	2.01
1984	Chivasso	1	Lancia Prisma	0.90	Automated	Manual	2.01
1984	Mirafiori	3	Uno	0.85	Robogate	Robogate	0.54
1984	Casino	1	Ritmo + Regata	0.83	Robogate	Robogate	0.32
1984	Rivalta	1	Ritmo + Uno	0.83	Robogate	Robogate	0.32

# Did Fiat maximise speed by deploying Robogate?



## BUT

- ❑ Robogate technology did not have positive impact on the stabilisation of the capacity utilization rate.
- ❑ High variety of models however effectively produce only one model
- ❑ Side - Effects

# Discontinuity

- “Before shifting from inflexible to flexible mass production, managers had to change the parameters by which they measured efficiency and their ranking of performance objectives”**
- Fiat management didn't change the way, they were ranking performance objectives.
  - No discontinuity in management. Performance objectives is ranked in same order as they were in 1960's.
  - The ranking of speed has not changed although robotics was implemented under the title of flexibility.
  - There were two arguments in the article, if fiat were flexible they would have shift production to cassino because the cassino were underutilized, the second is, they could not do that because they choose to put robotics in the spot welding process because that process was suboptimal in terms of speed.





Any Questions?



Thank you for listening!

