



QUALITY TIME

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Agenda

- Quality definition
- Quality history
- Japanese model
- Toyota Production System
- 4Q Methodology
- Workplace organization

Definition of quality

- What is quality?
- Ability of a set of characteristics inherent in a product, system, or process to comply with the requirements of customers and other interested parties (ISO 9000 definition)
- Quality = ability of a product to meet customer expectations (informal definition)

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A bit of history (1/3)

- It seems that at the time of the Phoenicians there were inspectors who cut off the hand of artisans who violated the standards set by the customer...
- In the code of Hammurabi, around 2150 BC, it was described how houses should be built and it was prescribed that a bricklayer who had badly built a house, should even be killed!!
- The oldest "guide to quality" dates back to 1450 BC and was discovered in Egypt. Explain how you can check the perpendicularity of a stone block with the help of a rope.

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A bit of history (2/3)

- In the Middle Ages, the affixing of the trademark to the product identified the producer and established his responsibilities in relation to the quality of the product itself.
- With the two Industrial Revolutions and the introduction of the assembly line (1920s), quality control was born in the critical points of the production process aimed at separating compliant products from waste.
- Starting from the 1920s, statistical quality control techniques were developed which allowed to highlight the irregularities of the process from the examination of production samples, and which had the maximum application during the Second World War, when for the war industry it became necessary to use massively unskilled female labor and therefore subject to a greater margin of error

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A bit of history (3/3)

- In the 1950s, the first theories on quality applied to the process and organization (Total Quality) were born in Japan, while in the USA Quality Assurance was born in the aerospace, nuclear, petrochemical, etc. sectors, and the quality standards of the Department of Defense.
- In the 1970s, the culture of Company-Wide Quality Control established itself in Japan; Western markets are invaded by Japanese products (cars, household appliances, consumer electronics) which in many cases become the best sellers in their categories because they are synonymous with technological innovation, reliability, quality at affordable prices.
- In the 1980s / 1990s the Japanese model began to establish itself in the West; since 1987 the International Organization for Standardization begins to publish a series of standards known as ISO 9000.

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The Japanese model (1/2)

- The absolute priority of the company, that is the essential condition to ensure its survival, is the customer, without whom the company cannot exist.
- The most important customer is the **consolidated customer**, that is, the customer who buys back from our company. A turnover achieved with established customers is much safer (for survival) than that achieved with occasional customers.
- An established customer repurchases if they are satisfied with the previous purchase; **customer satisfaction** thus becomes the real operational priority of the company.
- Customer satisfaction is achieved by providing him with a high-quality product; the quality of what he has already purchased is the factor that will most affect him at the time of his next purchase.

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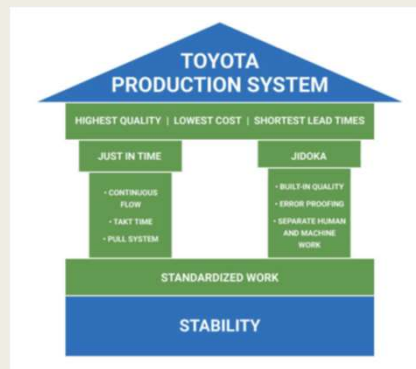
The Japanese model (2/2)

- To guarantee the consolidation of the customer, it is necessary to ensure his continuous satisfaction (with each subsequent purchase). This result presupposes the continuous improvement of the product supplied to the customer, who will be satisfied and positively conditioned for the next purchase.
- The quality of the product is the result of the quality of the **company's processes** implemented to produce it.
- Therefore, to **continuously improve the product**, it is necessary to continuously improve the company's processes.
- To continuously improve processes, it is necessary to **involve** the maximum amount of company resources, training them in the skills required for improvement.

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Toyota Production System

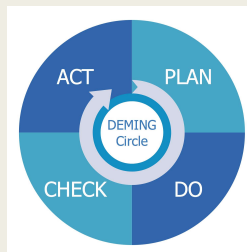
- The Toyota production system brings together all the characteristics of the Japanese model of quality referred to both the product and the process; is based on the "Just in Time" technique that arose from the need to be able to build small quantities of many different types of cars, to meet the growing product diversification required by the market, allowing to reduce production times, waste and costs.



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TPS - Kaizen

- The philosophy of **continuous improvement** (kaizen) is implemented with the creation of quality circles, made up of groups of workers who meet regularly to identify, analyze and solve problems concerning their work area.
- It takes place through the Deming cycle :
 1. Plan: identify the problem to be addressed
 2. Do: implement the necessary actions for improvement
 3. Check: verify the effectiveness
 4. Act: implement the corrective action and possibly extend it



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UNI EN ISO 9001

ISO 9001:2015 standard must be read and interpreted on the basis of eight principles of quality management

- ✓ *Customer oriented organization*
- ✓ *Leadership*
- ✓ *Involvement of people*
- ✓ *Process approach*
- ✓ *Systemic approach to management*
- ✓ *Continuous improvement*
- ✓ *Decisions based on facts*
- ✓ *Mutually beneficial relationship with suppliers*

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TPS – Quality circle

- The Quality Circles are working groups, whose composition involves the participation of all employees, from the manager to the worker.
- During these work sessions a sort of brainstorming takes place in which each participant uses problem solving techniques to solve quality everyday problems. For Quality Circles to work, the involvement and support of Top management, the voluntary participation of all and the sharing of information and knowledge are required.



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TPS - Kanban

- Production is regulated by means of the kanban, which is a tag associated with the semi-finished product (or a group of products) that describes the department of origin and destination, and other information.



- Management through kanban establishes a customer-supplier relationship within the individual departments of the company, and therefore the responsibilities of those who produce and those who pick up individual products (or groups of products) in the production chain.

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TPS - Jidoka

- Workers have the right / duty to stop production if they identify a product defect or process problem; the goal is to prevent a defect, whatever it is, from reaching the downstream process, even at the cost of temporarily slowing down production efficiency.
- Give machines and operators the ability to detect when an abnormal condition has occurred and stop work immediately.
- Jidoka highlights the causes of problems because work stops immediately when a problem first occurs. This leads to improvements in processes that build quality by eliminating the root causes of defects.
- The jidoka concept originated in the early 1900s when Sakichi Toyoda, founder of the Toyota Group, invented a textile loom that stopped automatically when a thread broke. Previously, if a thread broke, the loom produced piles of defective fabric, so each machine had to be checked by an operator.

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TPS - Jidoka

Under what conditions can the process be interrupted?

- Quality issues: if a defective part continues to be machined, materials and labor are added that will be wasted if the part is then discarded or reworked
- Process issues: they may not lead to an immediate quality problem, but the process should still be stopped (for example, if a machine is overheating, it should be stopped and checked even if the quality of the parts is still good, to avoid failure or subsequent defects, or operator safety problems.
- Raw material supply problems

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TPS - Andon

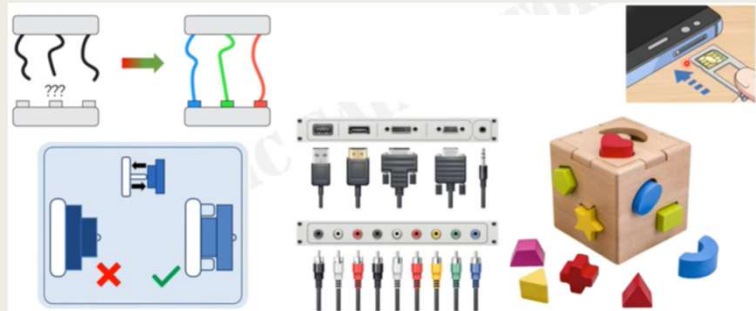
- Process management must be visual (**andon**); everyone must have visibility of the situation of the production process and be aware of the problems connected to it.
- It thus allows to identify and intervene on a process problem, for example a too long production stop, or on a quality problem, such as the production of products that do not comply with predefined standards.



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TPS – Poka Yoke

- It describes a principle consisting of several elements, which includes technical precautions and devices for the prevention of errors and for the immediate detection of errors.
- It is particularly geared towards the unintended mistakes people can make when involved in manufacturing processes and is intended to prevent an error from turning into a product error.
- They can be visually supported, visually controlled or "fail safe"



TPS and lean production

The Toyota Production System inspired the **lean production** philosophy, which has as its objectives:

- elimination of all waste: anything that does not add value to the product must be reduced to a minimum
- minimization of WIP and stocks: financial waste is the worst of all waste
- lead time minimization: to have a high response capacity to the market
- absolute flexibility on mixes: to be able to catch all commercial opportunities through a high diversification of products

The minimum energy model

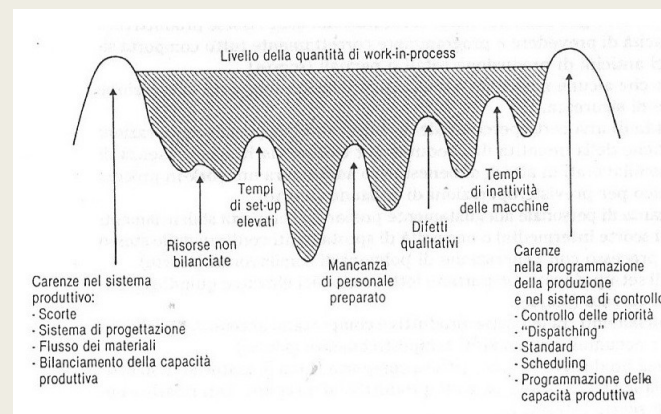
The objectives of lean production are pursued with an organizational model called **minimum energy**:

- the production system is represented as the bottom of a lake and the management of production as navigation in the waters of the lake itself
- the rocks present on the bottom of the lake represent the production problems that prevent the bottom itself from being perfectly flat
- stocks (of raw materials, semi-finished and finished products) represent the water that covers the rocks, keeping them hidden from view

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The minimum energy model

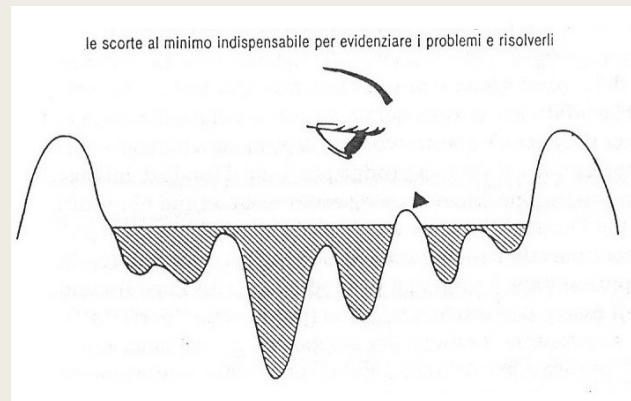
The objectives of lean production are pursued with an organizational model called minimum energy



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The minimum energy model

lowering the level of all stocks allows you to highlight problems and solve them







































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Toyota Sales



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Reliability of Toyota cars

 Lexus 97 89		● Affidabilità		● Soddisfazione	
 Porsche 96 94					
 Toyota 95 84	 Daihatsu 95 83				
 Honda 94 86	 Subaru 94 86	 Audi 94 85			
 BMW 93 86	 Infiniti 93 85	 Ssangyong 93 84	 Kia 93 82	 Mitsubishi 93 82	 Suzuki 93 81
 Mazda 92 85	 Mini 92 84	 Skoda 92 84	 Jeep 92 83	 Hyundai 92 82	
 Jaguar 91 87	 DS Automobiles 91 86	 Mercedes-Benz 91 85	 Volkswagen 91 82	 Ford 91 81	 Dacia 91 80
 Volvo 90 86	 Nissan 90 81	 Citroën 90 80	 Peugeot 90 80	 Renault 90 80	
 Opel 89 79	 Seat 89 79	 Chevrolet 89 78	 Lancia 89 78	 Fiat 89 77	
 Tesla 88 93	 Land Rover 88 84	 Alfa Romeo 88 83			

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4Q METHODOLOGY

- 4Q is the data-driven problem-solving process
- 4Q stands for per 4 Quadrants
 - *Measure, Analyze, Improve and Maintain*
- Continuous improvement comes from the constant use of 4Q

4Q Process	
Q1 - Measure	Q2 - Analyze
Define the opportunities. Investigate to understand the current state	Identify and define the root causes of problems
Q4 - Maintain	Q3 - Improve
Maintain improvements by standardizing your process or method of work	Develop, test and implement solutions that eliminate root causes

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The objectives of the 4Q method

- Make continuous improvement an integral part of the work activity
- Introduce methodology and systematicity in solving problems
- Use a scientific approach to problem solving

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4Q Q1 Measure

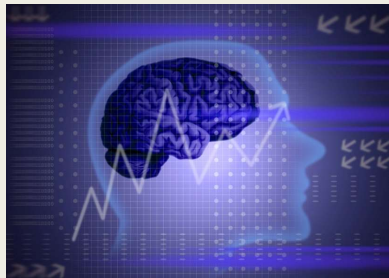
- In Q1, Measure, the goal is to identify and use those process outputs and metrics that can help understand when a problem occurs.
- What extra measures need to be taken to identify the causes of the problem? How to view the data?



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4Q Q2 Analyze

- In Q2, Analyze, the goal is to find the real causes of the problem.
- Eliminating the causes prevents the problem from returning.
- A good root cause analysis is the key to success in any 4Q process.



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4Q Q3 Improve

- In Q3, Improve, the goal is to create and implement a list of possible solutions / pilot actions for the causes.
- Test the results of the pilot actions and decide if the results are satisfactory enough to move on to the next quadrant, make the changes permanent, or return to Q2 for a deeper understanding of the causes.

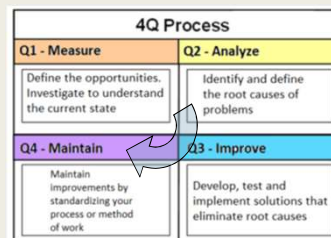


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4Q

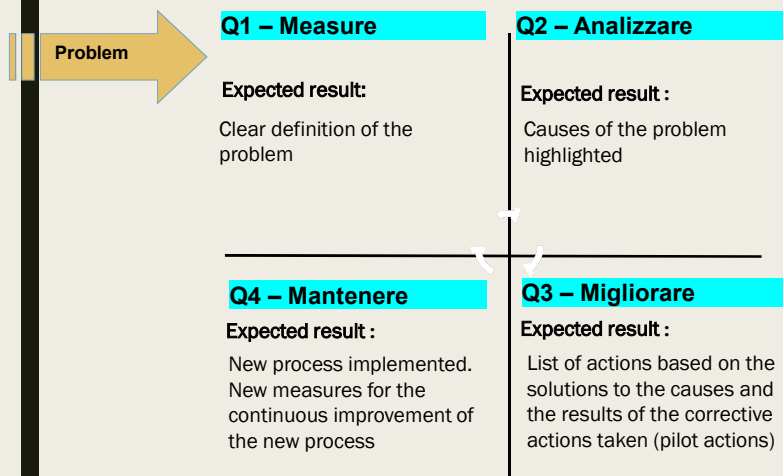
Q4 Maintain

- In Q4, Maintains, the goal is to make permanent the new solutions found in Q3.
- The good results obtained in Q3 will be maintained by the people working on the new process. This change can be the most difficult challenge.
- It may be necessary to introduce new metrics to monitor again in Q1 and continue the circle of continuous improvement.



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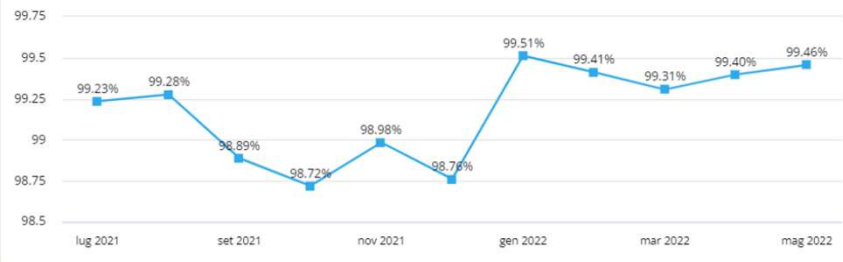
How does the 4Q process work?



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ESEMPIO 4Q Q1 MEASURE

FPY per linea %



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ESEMPIO 4Q Q2 ANALYZE

- Ishikawa diagram: graphically represents all the possible causes of a problem



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ESEMPIO 4Q

Q3 IMPROVE

- Actions for improvement

Objective	Proposed solution
Measurement method	Creation of a control gauge to filter non-compliant pieces at the end of the process
Welding quality	Resumption and validation of all welding positions and bending of the winding
Process standardization	Processing of work and control instructions
Status of the tools	Development of maintenance procedure for molds and tools

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ESEMPIO 4Q

Q4 MAINTAIN

- Actions for maintain

Objective	Proposed solution
Quality rate	FPY monitoring
Process waste	Process waste analysis
Status of the tools	Monitoring of the status of the tools

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The 5S phylosophy

- 5S is a workplace organization strategy to minimize the waste of time = MUDA
- Having everything clean, organized, and placed in the right place increases quality and productivity because it makes things easy to find and problems more visible.
- A place for everything, everything in its place, clean and ready for use

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What is 5S ?

- A process and a method to create and maintain an organized, clean, high-performance workplace
- A rigorous discipline for continuous improvement
- The basis for Lean manufacturing

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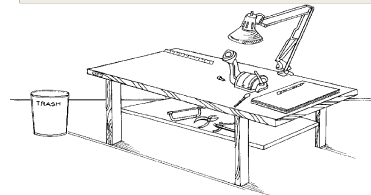
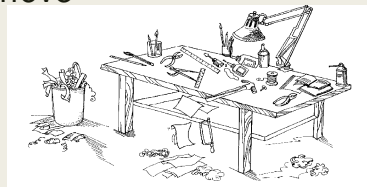
What does 5S mean?

- **Seiri:** Choose and separate= get rid of unnecessary items
- **Seiton:** Simplify (organize) = put in order
- **Seison:** Shine (clean) = clean daily to immediately identify anomalies and non-conformities
- **Seiketsu:** Standardize = establish rules for maintaining the first 3S and inspect often
- **Shitsuke:** Sustain over time = Ensure the maintenance of the 4S, preparing the workstation for other improvements

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First S = Separate

Get rid of unnecessary or useless objects for the proper implementation of the activity → “if in doubt, remove”

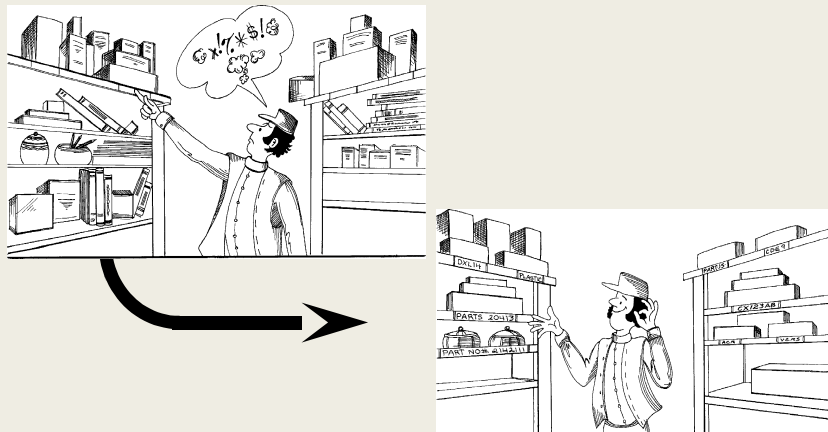


Eliminate waste and create a safe workstation

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Second S = Simplify

Organize and identify to facilitate use: everything has its place and is in its place



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Third S = Shine

- Use cleaning to immediately identify anomalies and operating irregularities
- Cleaning is a form of inspection
- The purpose of the inspection is to find problems and solve them so that they do not recur in the future
- A clean workplace creates a sense of pride

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Forth S = Standardize

- Establish rules and inspect often
- Make work activities convenient and efficient
- Maintain organization, clarity and cleanliness
- The 5S are easy to do for one time only. What is difficult is consistency and repetition
- Once the standard procedures for the 5S are established, the operational staff must be encouraged to modify them, introducing continuous improvements

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Fifth S = Sustain

- Guarantee the conservation of all activities and improvements made
- Discipline is how you continually act to make your staff do the right things naturally
- Getting collaboration means getting new suggestions and ideas
- Involve everyone on respecting the tasks and rules

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First S = Separate



Red label to identify unnecessary items at the factory



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Second S = Simplify



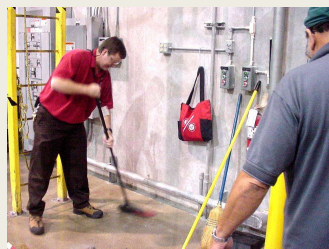
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Second S = Simplify



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Third S = Shine

**Before****After**

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Third S = Shine



The anomalies were marked with a red label

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THANK YOU

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