KIM

Knowledge and
innovation management

Universidade Vigo

SESSION 2

"THE ROLE OF INNOVATION IN ECONOMIC GROWTH: WHAT CAN WE EXPECT FROM ARTIFICIAL INTELLIGENCE?"

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XVIII and XIX centuries: technology as an exogenous variable: **Adam Smith**

- Technology and productivity.
  - "The greatest improvement in the productive powers of labour, and the greater part of the skill, dexterity, and judgment with which it is any where directed, or applied, seem to have been the effects of the **division of labour**."
  - **Example: "the pinmaker**; a workman not educated to this business (…) could (…) make one pin in a day, and certainly could not make twenty. But (…) divided into about eighteen distinct operations, (…) ten men (…) make among them about twelve pounds of pins in a day. There are in a pound upwards of four thousand pins of a middling size."
  - Reasons:
    - "the division of labour, by reducing every man's business to some one simple operation, and by making this operation the sole employment of his life, necessarily increases very much the **dexterity of the workman**."
    - "the advantage which is gained by **saving the time** commonly lost in passing from one sort of work to another, is much greater than we should at first view be apt to imagine it."
    - "Men are much more likely to **discover easier and readier methods** of attaining any object, when the whole attention of their minds is directed towards that single object, than when it is dissipated among a great variety of things. (…) A great part of the machines made use of in those manufactures in which labour is most subdivided, were originally the inventions of common workmen, who, being each of them employed in some very simple operation, naturally turned their thoughts towards finding out easier and readier methods of performing it".

XVIII and XIX centuries: technology as an exogenous variable: **Karl Marx**

- Technology and **domination**
  - "the **workman sells his labour power to capital**, because the material means of producing a commodity fail him".
  - "Its **functions** can be exercised only in an environment that exists in the workshop of the capitalist after the sale."
  - "The **knowledge, the judgement**, and the will, which (…) are practised by the independent peasant or handicraftsman, (…) are now required only for the workshop as a whole."
  - "In manufacture, in order to make the collective labourer, and through him capital, rich in social productive power, **each labourer must be made poor in individual productive powers**.
  - "manufacture (…) **converts the labourer into a crippled monstrosity**, by forcing his detail dexterity at the expense of a world of productive capabilities and instincts".

First half of the 20th century: J. **Schumpeter**

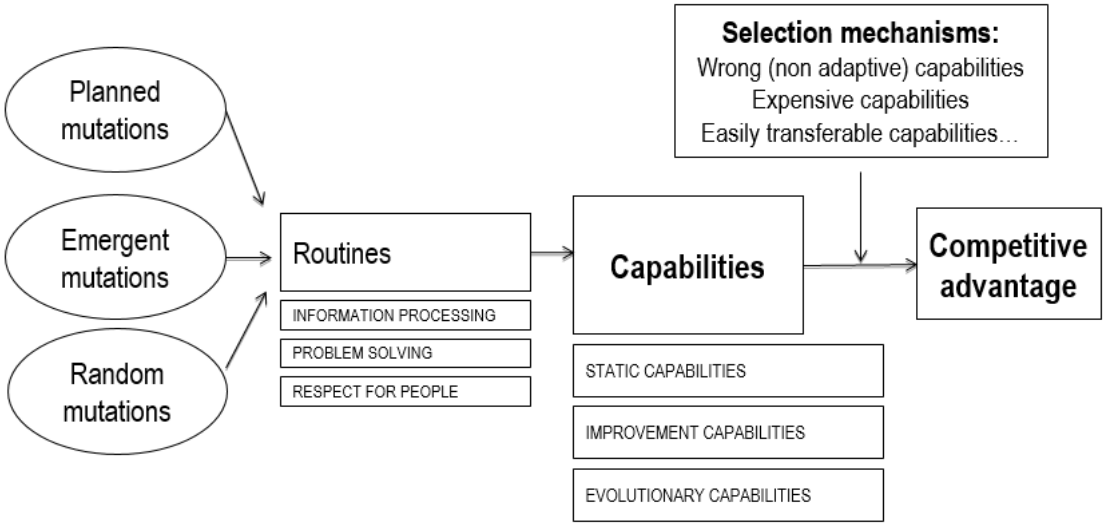
- Innovation: the what, **more tan products and processes**.
- **Entrepreneur**: the who. “The pure new idea is not adequate by itself to lead to implementation ... . It must be taken up by a strong character (entrepreneur) and implemented through his influence”. It is not the power of ideas but the power that gets things done.
- Capitalism: the where. A **process of creative destruction**.
  - Strength: **it induces wealth creation** through the incentives it generates. Weakness: it provokes **social inequalites**.
    - **Industries in crisis**: should we support them or terminate them?
    - **Low skilled workers**: solidarity or awareness of their past decisions? (incentives for others behind)
    - Pressure to new entrants in regulated industries: **statu quo or liberalization**?

Mid-1950s: **Moses Abramovitz, Robert Solow**

- **Conventional wisdom until then**:
  - –Growth dependeds only on capital accumulation (investment, savings, credit…) and labor.
  - –Market liberalization = convergence.
- Both measured the **growth in the output** of the American economy between 1870 and 1950. Then measured the **growth in inputs** (capital and labor) over the same period. Then made reasonable assumptions about how much a growth in a unit of labour and capital should add to the output of the economy. It turned out that (…) the **unexplained residual was no less than 85%**.
- The large residual told economists that they had to **look elsewhere** (not to growth in inputs) in order to account for economic growth.
- Conclusion: **technological innovation** must have been a major force in the growth of output in highly industrialized economies.

Endogenizing technical change: an evolutionary theory of the firm

- The evolutionary theory of the firm provides an alternative explanation of the firm based on **routines** (as genes for humans).
- Routines are the result of past learning efforts and constitute the **organizational memory of a firm**; more important than individual skills.
- Learning and adaptation (innovation) at the base of **ORGANIZATIONAL EVOLUTION**. The role of **mutations, variety and selection mechanisms**.



- **Primary vs. secondary routines within organizations:** why productive specialization and technological diversification?

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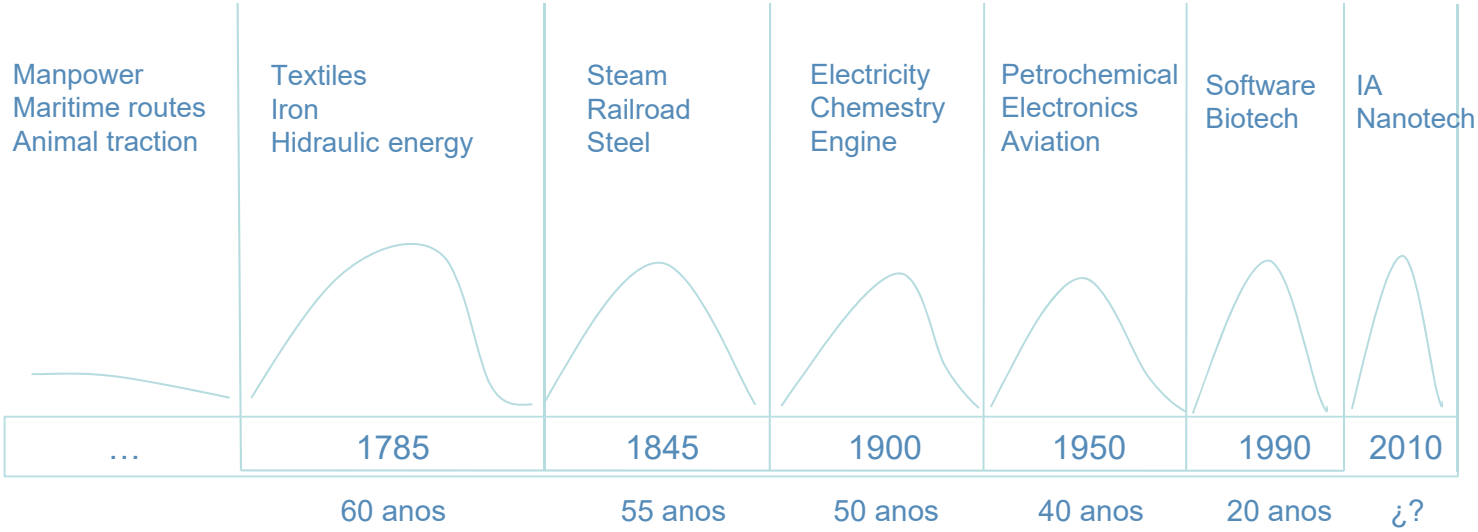
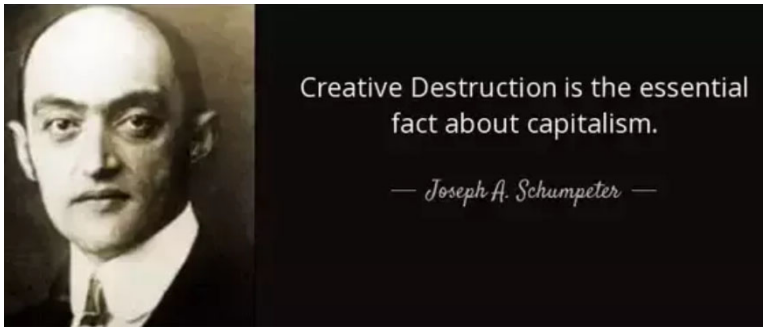
Taking stock… on Technological Systems



What has actually happened with technological change and employment?

- Since it substitutes labor for capital, technological change reduces the level of employment and average salaries in automatized occupations. But:
  - It increases the productivity of other workers.
  - It creates new jobs in other occupations.
  - and thus makes the level of income increase.

So income brings about more demand for other goods and services, creates new jobs in other industries, and simultaneously rises the demand for leisure while decreasing the number of working hours.

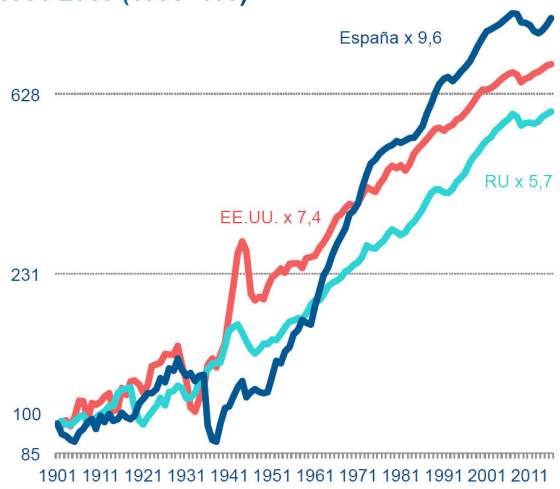


What has actually happened with technological change and employment?

- In the short term, many “workers suffer a transition” to find a new occupation. The length of this transition and the problems inherent to it depend basically on labor institutions:
  - Protection for employed and unemployed
  - Collective bargaining
  - Labor intermediation

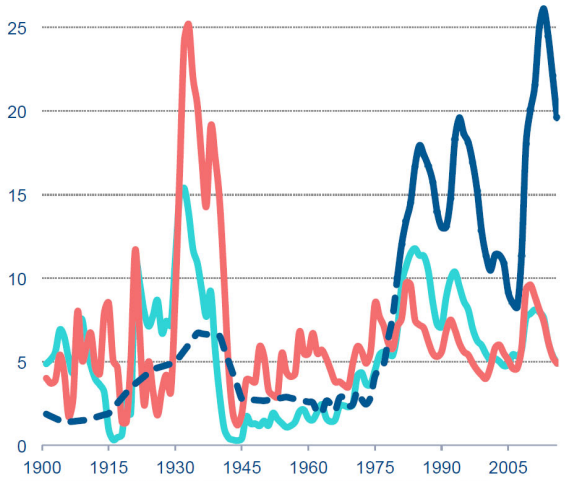
- The economy has re-adapted so far in the long term with a higher level of income.

PIB per cápita en EE.UU. Reino Unido y España 1901-2016 (1901=100)



Fuente: Andrés y Doménech (2018) a partir de Prados de la Escosura (2017), The Maddison Project y OCDE. Datos en logaritmos.

Tasa de paro en EE.UU. y Reino Unido, 1901-2016

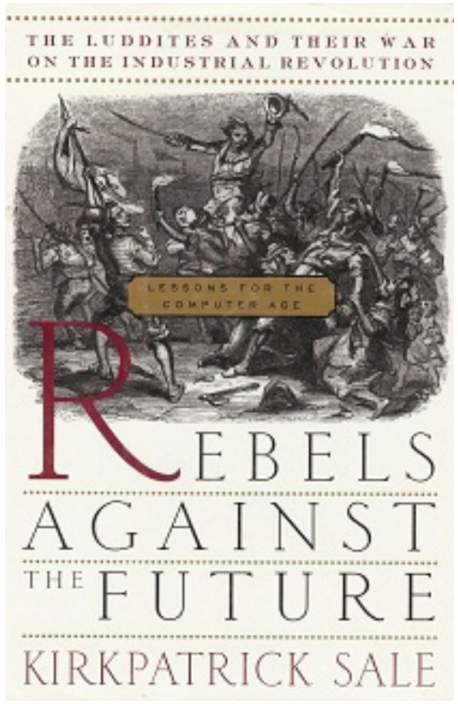


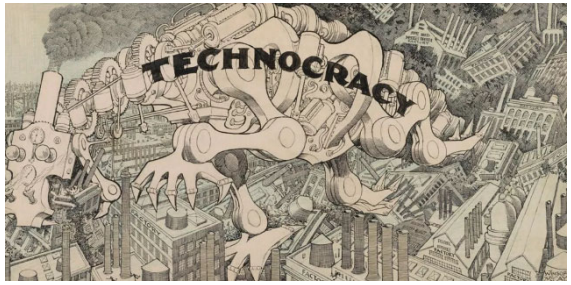
Fuente: Andrés y Doménech (2018) a partir de Lebergott (1957), BLS, BoE, OCDE. INE, Alcaide (2007) y de la Fuente (2017)

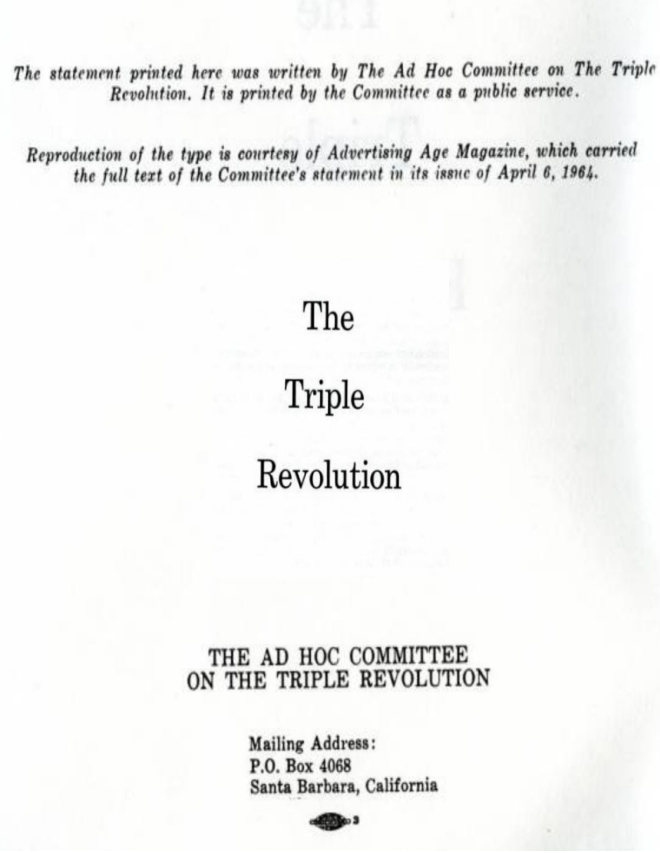
What has actually happened with technological change and employment?

Doomed to a future without employment?

False alarm so far.







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The

Triple

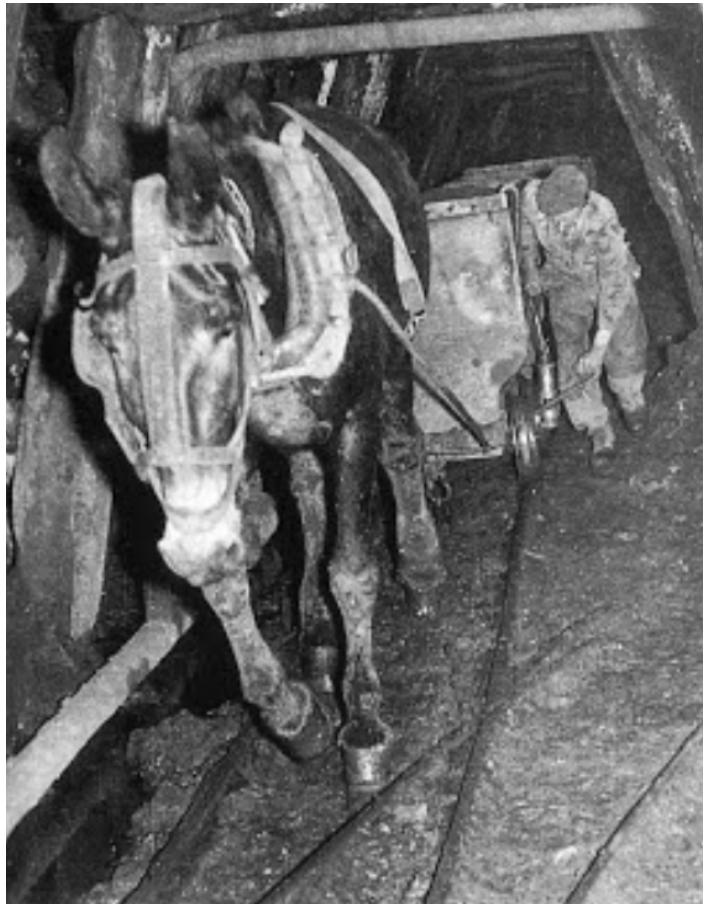
Revolution

THE AD HOC COMMITTEE
ON THE TRIPLE REVOLUTION

Mailing Address:
P.O. Box 4068
Santa Barbara, California

Where does the present concern with AI come from?

False alarm for every type of workers?



Where does the present concern with AI come from?

Elon Musk
Co-founder of Tesla,
PayPal, etc.

"We need to be super careful with AI. Potentially more dangerous than nukes [nuclear weapons]"

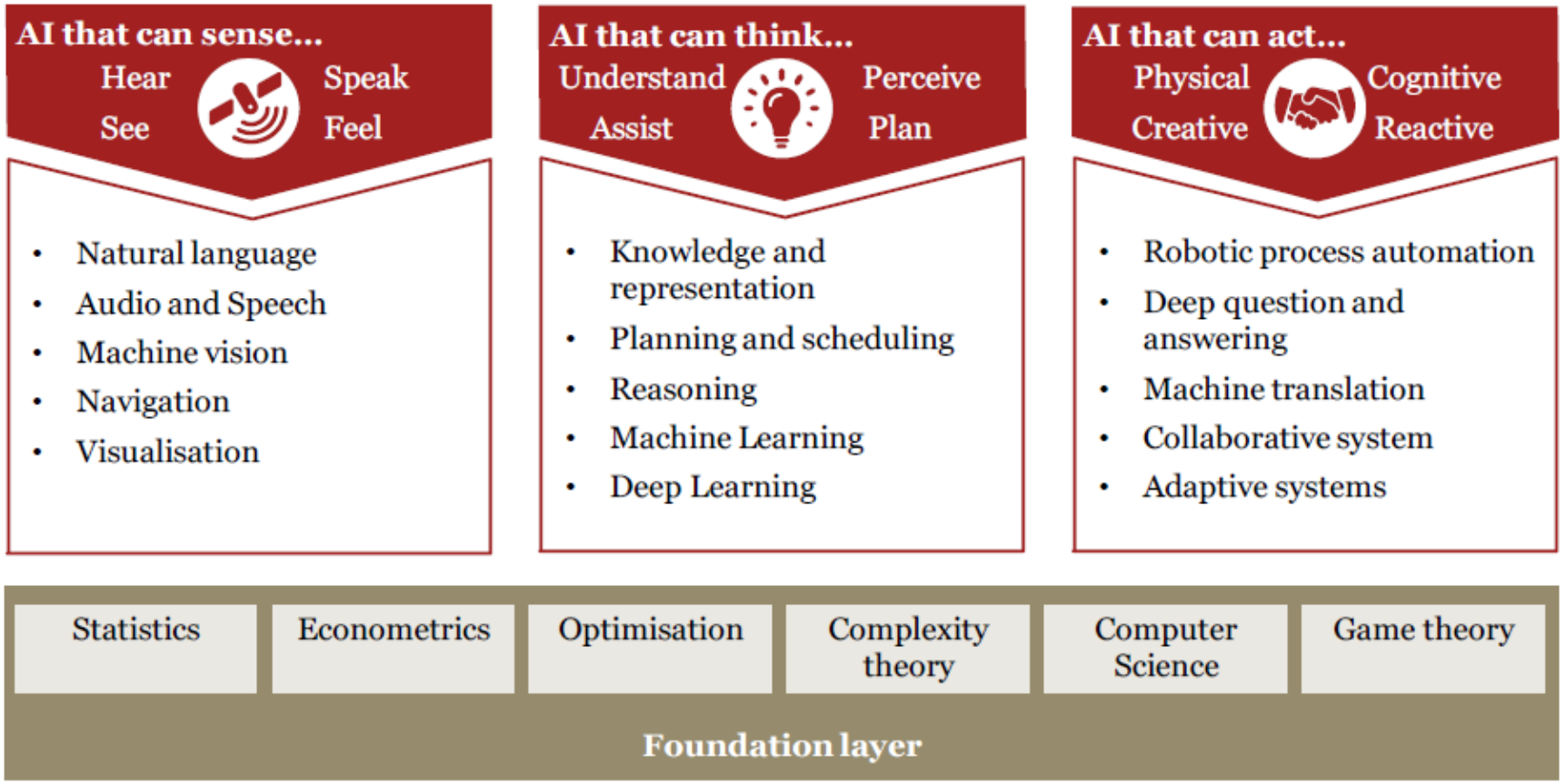
Steve Wozniak
Co-founder of Apple

"the future is scary and very bad for people."

'I don't understand why some people are not concerned'

Bill Gates
Co-founder of Microsoft

What is coming for sure?



What is already happening?

Carl Benedikt Frey and Michael A. Osborne	Citibank with Frey and Osborne	OECD	World Economic Forum	McKinsey Global Institute
Date				
September 2013	January 2016	June 2016	January 2016	January 2017
Key relevant findings				
▪ About 47% of total US occupations are at high risk of automation perhaps over the next decade or two ▪ Wages and educational attainment show a strong negative relationship with probability of computerization	▪ Building on Frey and Osborne's original work, data from the World Bank suggests the risks are higher in many other countries; in the OECD, on average 57% of jobs are susceptible to automation. This number rises to 69% in India and 77% in China	▪ On average, 9% of jobs across the 21 OECD countries are automatable ▪ There are notable differences across OECD countries when it comes to automation (e.g., the share of automatable jobs is 6% in Korea vs. 12% in Austria)	▪ Automation and technological advancements could lead to a net employment impact of more than 5.1 million jobs lost to disruptive labor market changes between 2015–20, with a total loss of 7.1 million jobs—two-thirds of which are concentrated in the office and administrative job family—and a total gain of 2 million jobs in several smaller job families	▪ Almost half of work activities globally have the potential to be automated using current technology. <5% of occupations can be automated entirely; about 60% have at least 30% of automatable activities ▪ Technically automatable activities touch 1.1 billion workers and $15.8 trillion in wages. China, India, Japan, and the United States constitute over half ▪ Automation's boost to global productivity could be 0.8–1.4% annually over decades

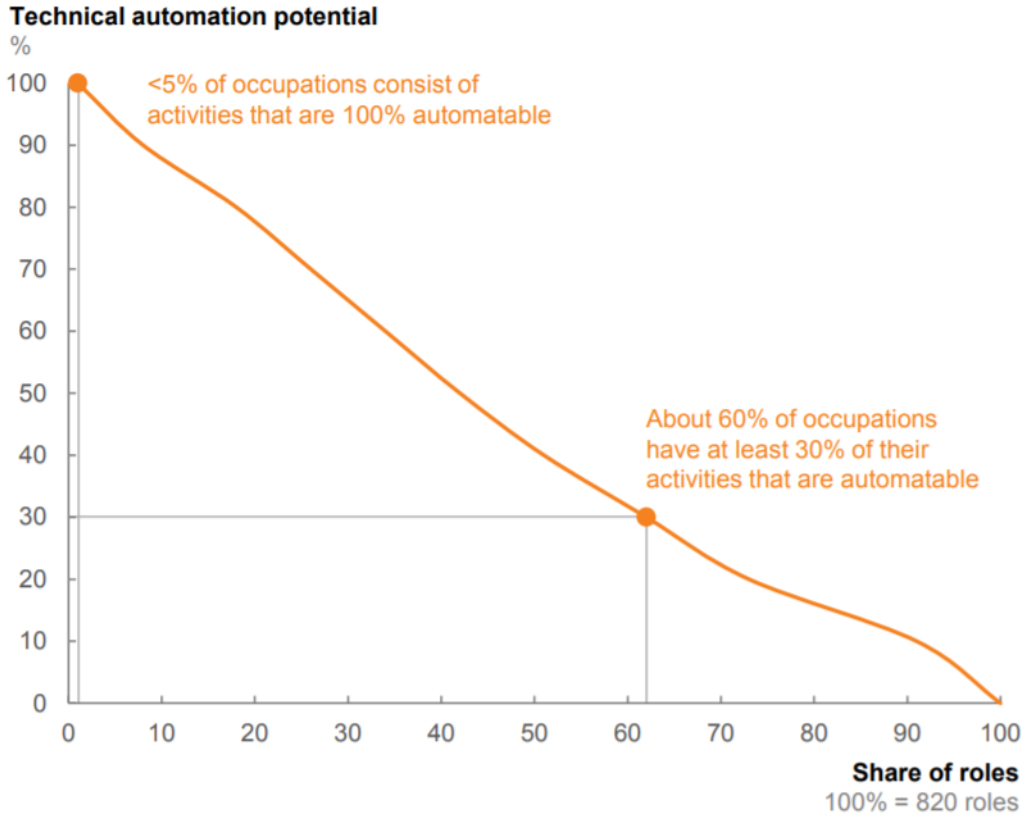
What is already happening?

While few occupations are fully automatable, 60 percent of all occupations have at least 30 percent technically automatable activities

Automation potential based on demonstrated technology of occupation titles in the United States (cumulative)[1]

Example occupations

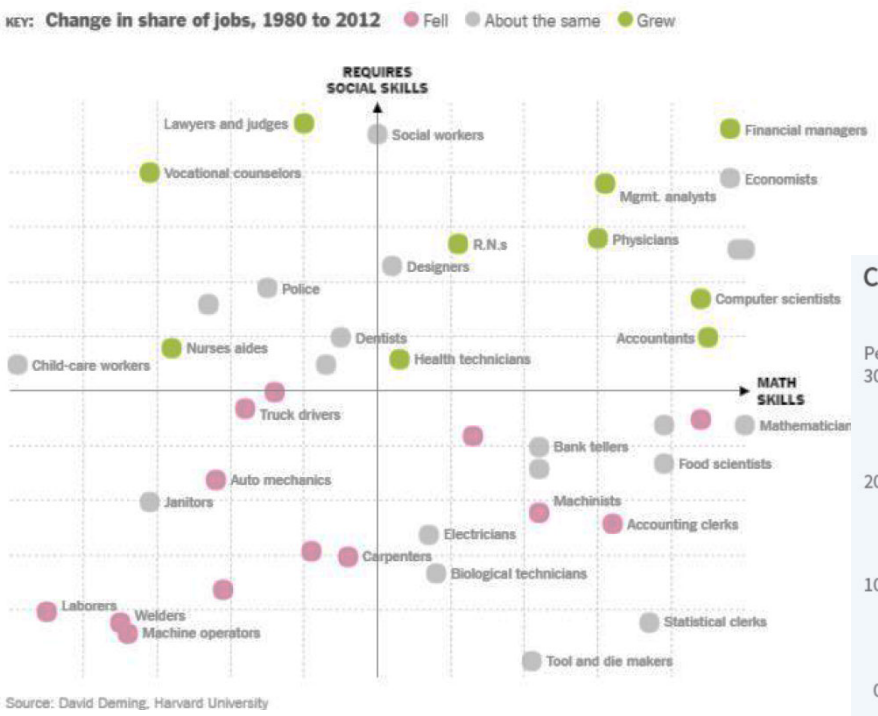
- Sewing machine operators, graders and sorters of agricultural products
- Stock clerks, travel agents, watch repairers
- Chemical technicians, nursing assistants, Web developers
- Fashion designers, chief executives, statisticians
- Psychiatrists, legislators



1 We define automation potential according to the work activities that can be automated by adapting currently demonstrated technology.

SOURCE: US Bureau of Labor Statistics; McKinsey Global Institute analysis

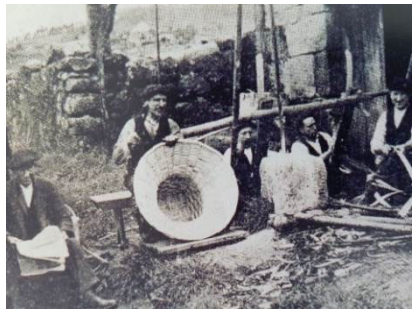
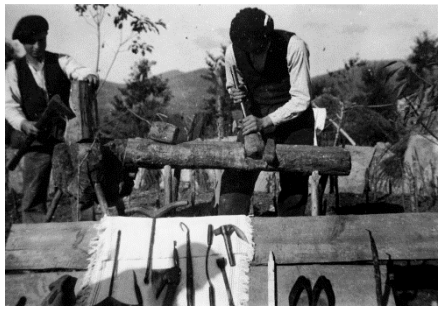
What is already happening?



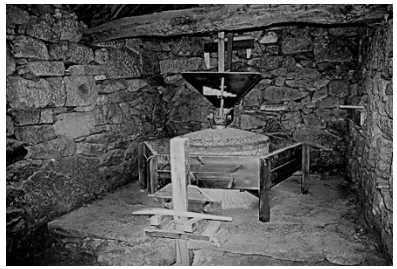
CONTENTS

MESSAGE 1: HISTORICAL EFFECTS OF TECHNOLOGICAL CHANGE ON EMPLOYMENT WERE POSITIVE.

There were never so many people working in history as nowadays, although most of today's occupations would be unthinkable for a citizen anywhere in the world… just 100 years ago.

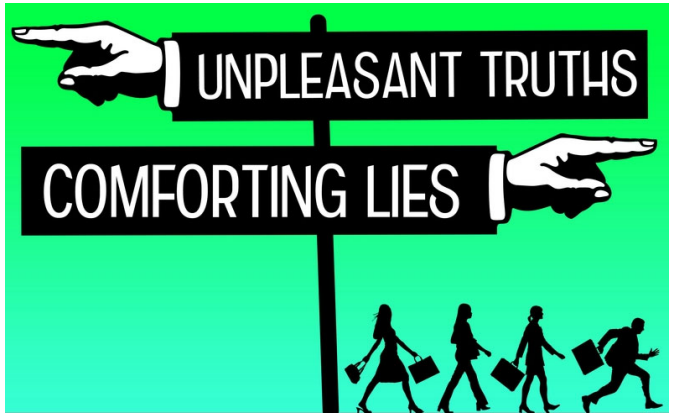





MESSAGE 2: AI REQUIRES INITIATIVE AND ADAPTABILITY

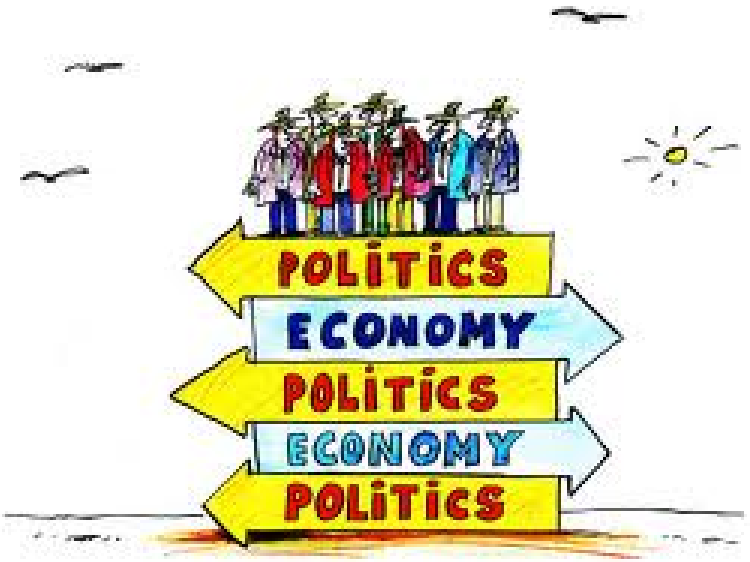
The most innovative and entrepreneurial people / countries are better positioned to survive the transition :

- We do not know which opportunities we will have, but we do know they will not appear in repetitive tasks.
- Having a cognitively-flexible population is critical to address the transition.



MESSAGE 3: NOT ONLY A TECHNOLOGICAL CHALLENGE, BUT ALSO A CHALLENGE TO ORGANIZE SOCIAL COEXISTANCE.

AI will have negative consequences in employment and wages for a period of time that will be shorter or lengthier depending on the institutional context each country develops.



MESSAGE 4: THE GOVERNMENT AND BUSINESS CAN FACE CONFRONTED GOALS.

Little AI entails lack of business competitiveness; too much AI will provoke many job loses with more difficult employment transitions.

MESSAGE 5: WE NEED FORMAL AND INFORMAL INCLUSIVE RULES

We need institutions guaranteeing:

- The convertion of productivity increases into higher salaries or more leisure time.
- The protection of “temporal losers” derived from AI implementation so that they also benefit from it.

	Inclusive political institutions	**Exclusive political institutions**
Inclusive economic institutions	Succesful nations	?
Exclusive economic institutions		Unsuccessful nations

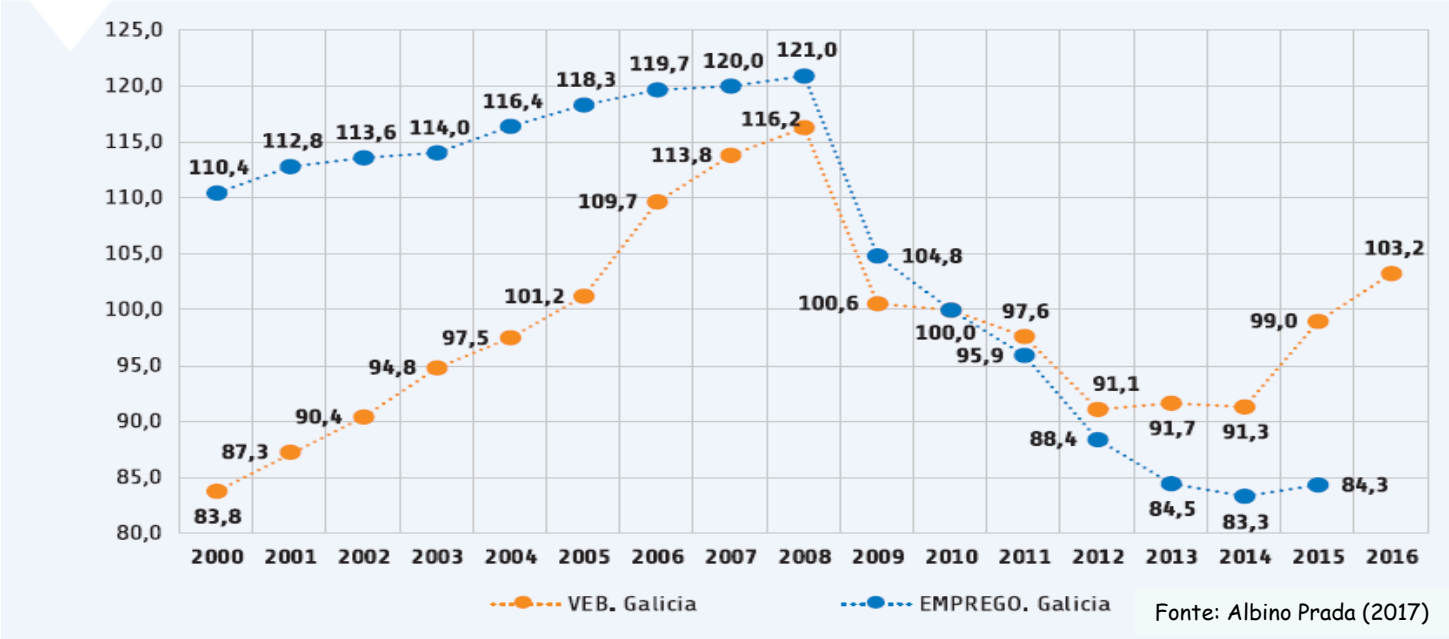
- Appendix just for Galician students

What is already happening?

Some evidence for Galicia

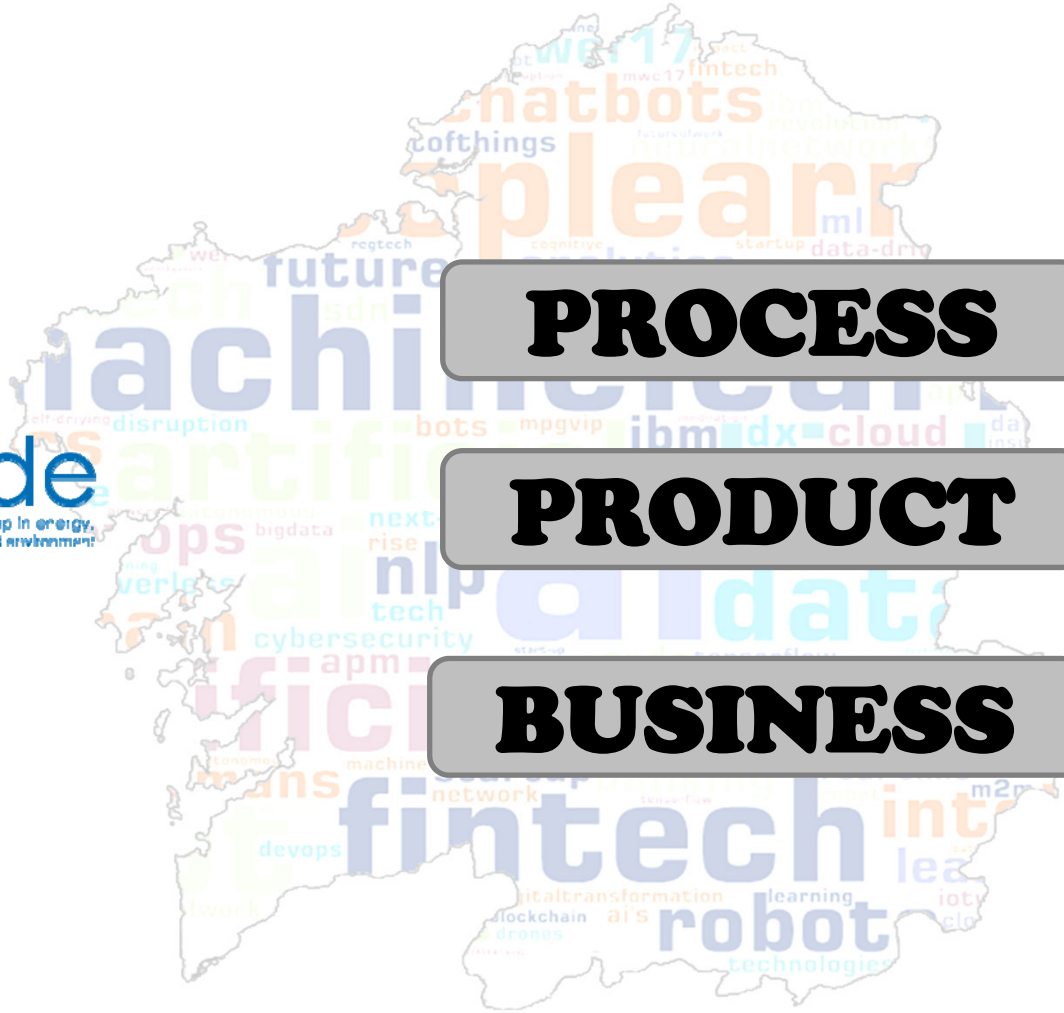
FIGURA 26.

EVOLUCIÓN DA INDUSTRIA MANUFACTUREIRA EN GALICIA 2000-2016. VALOR ENGADIDO BRUTO E EMPREGO (BASE 2010 = 100).



Fonte: Albino Prada (2017)


NETFLIX
Cortana
Google
amazon
SIRI



rede
research group in energy, innovation and environment

PROCESS

PRODUCT

BUSINESS

JEALSA RIANXEIRA

marine instruments

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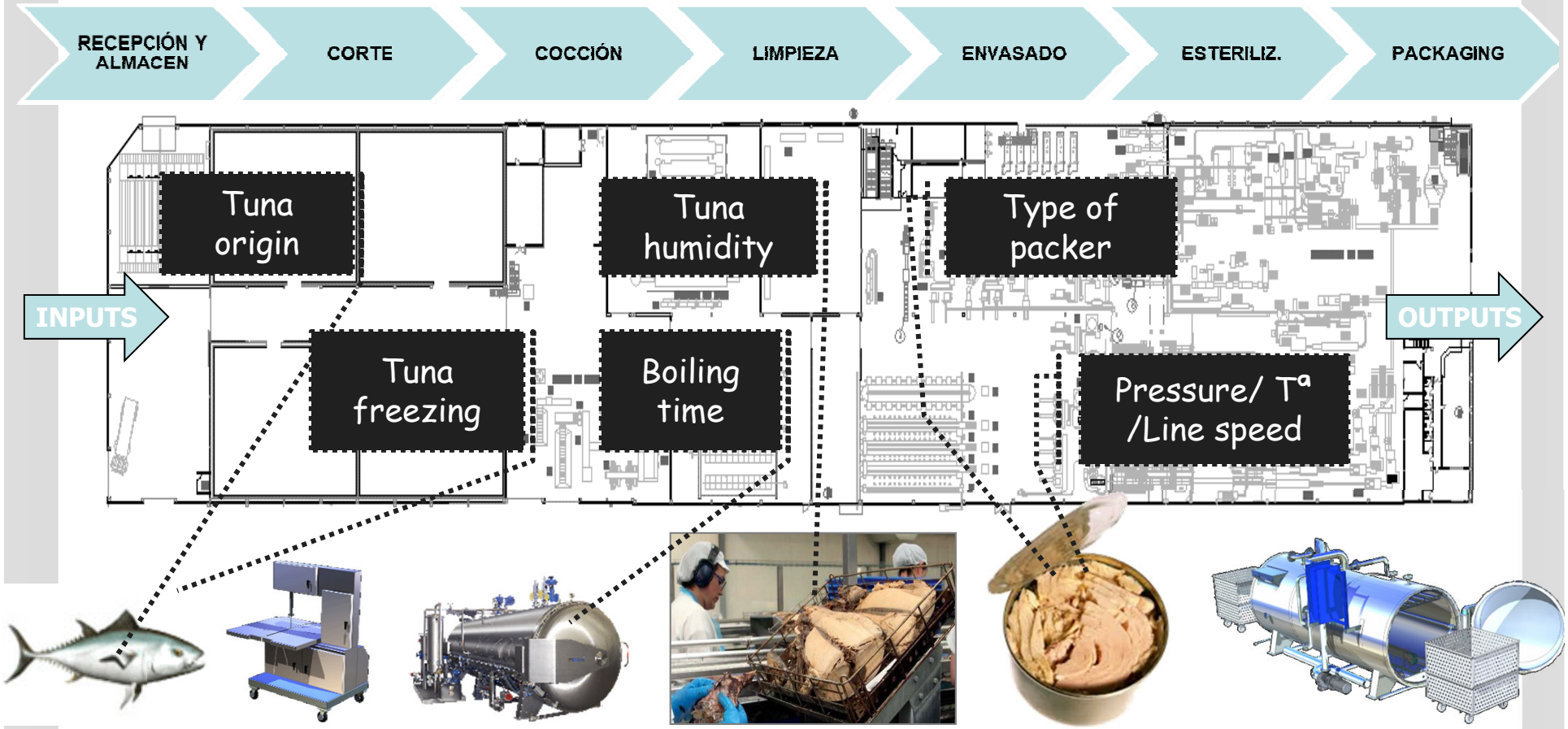
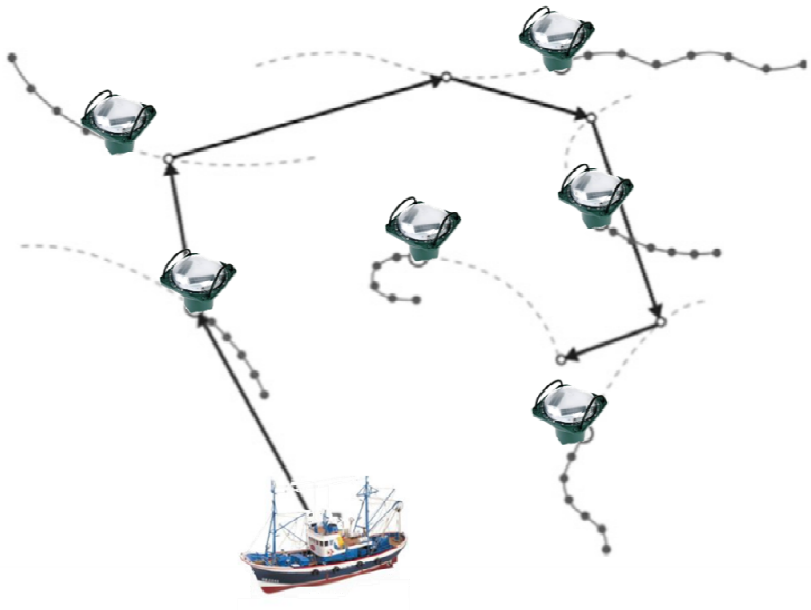
CHALLENGE 1: REDUCE TUNA SHRINKAGE IN THE PACKAGING PROCESS THROUGH MACHINE LEARNING

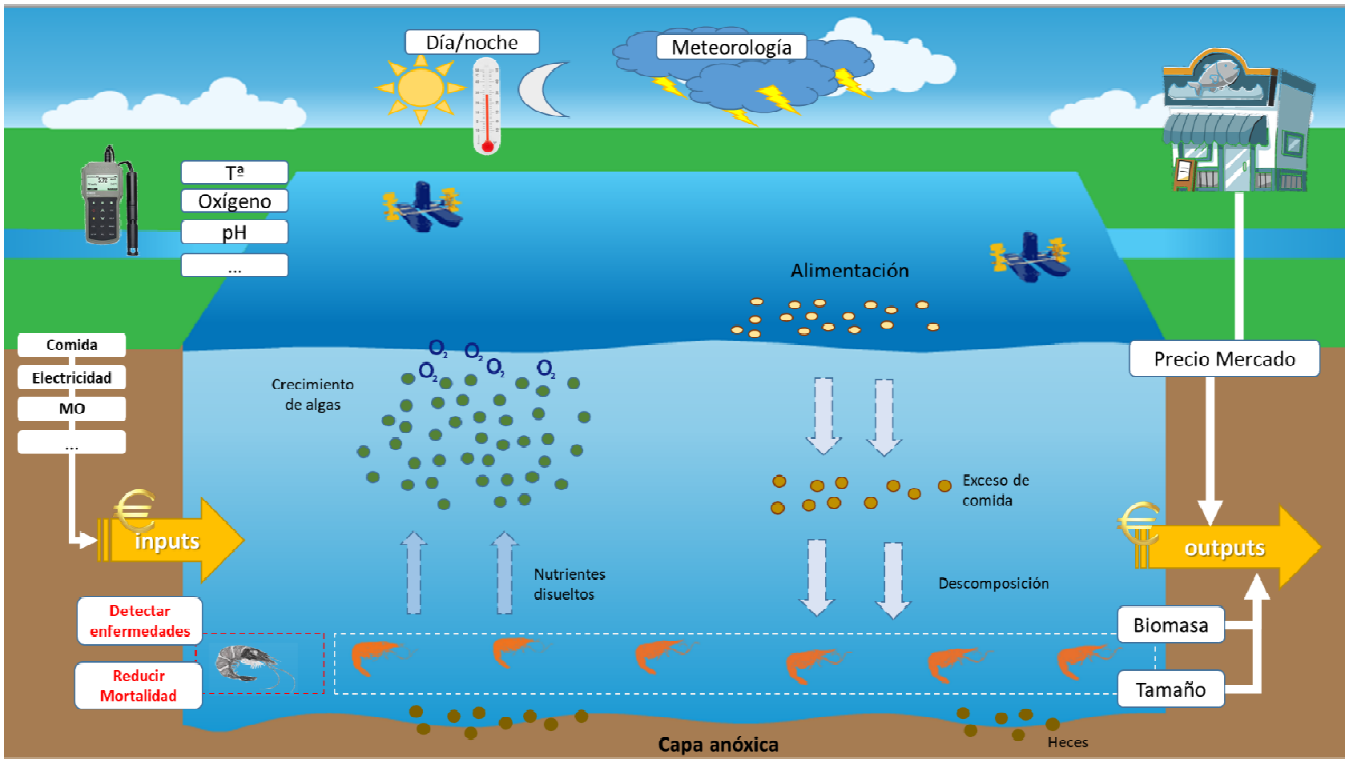


CHALLENGE 2: LOGISTIC ROUTES OPTIMIZATION THROUGH GENETIC ALGORITHMS



marine instruments

CHALLENGE 3: REDUCE MORTALITY RATE IN SHRIMP FARMING



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Variables involved in shrimp farming