Bucolico

Building Community Resilience
through Communication & Tecnology

1.2 ARTIFICAL INTELLIGENCE (AI)

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Results

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This module will answer the following questions:

? **What is the impact of Artificial Intelligence on individuals?**

? **How has the relationship between machines and humans changed?**

? **What changes does the "Second Age of Machines" bring to the world About work?**

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1.2: Artificial Intelligence

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What have been the most important leaps forward in the history of humanity?

As anyone who tries to ask this question learns almost immediately, it is difficult to answer.

To begin with, when does the "history of humanity" begin? ?

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1.2: Artificial Intelligence

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What have been the most important leaps forward in the history of humanity?

One of the reasons thi s is a difficult question to answer is that it is n ot clear what criteria we should use.

What is a real leap forw ard?

We almost all think it should be an event or progress that significantly changes the course of things, a moment that “turns the curve" of human history.

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What have been the most important leaps forward in the history of humanity?

There are some major evolutions that have nothing to do with animals, plants or warriors. Some are simple ideas. The philosopher Karl Jaspers underlines that Buddha (563-483 BC), Confucius (551-479 BC) and Socrates (469-399 BC) lived more or less in the same period, but in very distant places. In his analysis, they are the central thinkers of the Axial Period, which goes back from the 19th Century to 200 BC. Jaspers defines it as «a deep breath that favors Consciousness» and adds that these philosophers gave fertile schools of thought to three major civilizations: Indian, Chinese and European.

Karl Jaspers

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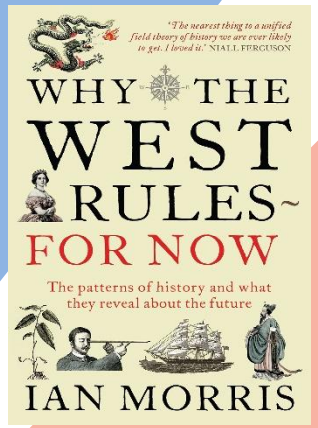
What have been the most important leaps forward in the history of humanity?



In *Why the West Rules - For Now* Morris addresses an even more fundamental question: whether it is sensible or legitimate to try to classify or compare the facts and progress of humanity.

Many anthropologists and many other human sciences specialists argue that it is not.

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How do we decide which is the most important of these leaps forward?

Morris disagrees and his essay is an attempt to quantify human development. As he himself writes:

"Reducing the ocean of facts to simple numerical results has its drawbacks, but it also has the great merit of forcing everyone to face the same fact, with surprising results".

In other words, if we want to understand what progress has changed the curve of human history, it is quite logical to try to trace it in the meantime.

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How do we decide which is the most important of these leaps forward?

For many thousands of years humanity has followed a very slow and gradual trajectory. Progress was painfully slow, almost invisible.

Animals and farms, wars and empires, philosophies and religions, nothing could have a great influence.

But a little more than two centuries ago a sudden and profound phenomenon arrived: it deflected the curve of human history by almost 90°, looking for example at the total population and at social development.

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How do we decide which is the most important of these leaps forward?

The sudden change that we see in the graph towards the end of the eighteenth century corresponds to a development we have heard a lot about: the Industrial Revolution.

It was the sum of several near-simultaneous advances in Engineering, Mechanics, Chemistry, Metallurgy and other disciplines.

It is not difficult to imagine that these technological innovations are at the basis of the previously mentioned, clear and protracted leap in the progress of humanity.

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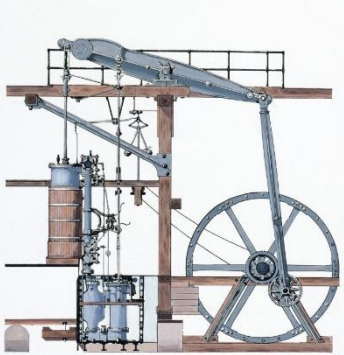
How do we decide which is the most important of these leaps forward?

We can be even more precise by specifying which technology was the most important one: the steam engine or, to be more precise, the steam engine improved by James Watt and his colleagues in the second half of the eighteenth century.

Of course, the Industrial Revolution is not just the story of the steam engine, however it is from the steam that everything started.



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Machines of progress: the impact of technology

Steam has allowed us to overcome the limits of muscle based strength, be it from humans or animals, and to generate staggering amounts of energy usable on com mand.

This led to factories and mass production, railways and to transport for many people.

In short, it led to *modern life*.

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Machines of progress: the impact of technology

And now comes the second age of machines.

Computers and other digital innovations are doing for our mental strength, for the ability to use our brain in order to understand and influence our environment, what the steam engine and its followers did for the muscle strength in the 19th century.

They allow us to overcome the previous limits and take us to an unexplored territory.

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Machines of progress: the impact of technology

For progress and development, to control the physical and intellectual environment, *mental strength is ind eed as important as physical strength*.

Such a powerful and unprecedente d impulse to mental power means a great stimulus for the whole of humanity, as happened with the impulse to physical potency.

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1.2: Artificial Intelligence

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Chasing each other

The last few years have been amazing.

Computers have begun to diagnose diseases, listening and talking to us, and writing high quality prose, while the robots started zipping around warehouse s and to drive without any help or with minimal help.

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Chasing each other

For many years digital technologies had proved ridiculously incapable in so ma ny of these activities, then they suddenly became very good.

How did it happen?

And what are the implications of this progress, astonishing yet now considered ordinary?

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Chasing each other

Today it is possible to travel in a car without a driver

it is possible that a computer beats te ams of Harvard and MIT students in a game of *Jeopardy*!

It is possible for an industrial robot to be "tamed" and it is possible to produce an elegant metal bowl thanks to a 3D printer.

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1.2: Artificial Intelligence

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Where we are

We live in an era of incredible advances in digital technologies, those that they have hardware, software and computer networks at their core.

These are not new technologies, companies have been equipping themselves with computers for over half a century and as early as 1982, *Time* magazine defined the computer as “Machine of the year".

However, just as it took multiple generations to improve the steam engine to the point of being able to supply energy to the Industrial Revolution, it took just as much to properly tune our digital machines.

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Where we are

Computers will continue to improve and do unprecedented new things.

By "full expression of power" we can simply mean that the bricks are already in place for digital technologies to prove themselves important and capable of transforming society and the economy as much as the steam engine.

Long story short, we are at a turning point, at the point where the curve rears up, thanks to computers. We are entering in the second age of machines.

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Where we are

Our second conclusion is that the transformations brought by technology will be profoundly beneficial for us.

We are moving towards an era that will not only be different, but will also be better because we will be able to increase both the variety and the volume of our consume.

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Where we are

Expressed in this way, that is, using the arid vocabulary of economics, it almost seems like one unfortunate scenario. Who is it that wants to consume more and more? But we don't just consume calories and gasoline. We consume information from books and friends, entertainment provided by big stars and even amateurs, experience from teachers and doctors and countless other things which are not made of atoms.

Technology can offer us more choice and even more freedom.

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Where we are

When these assets are digitized, when they are converted into many bits and archived on a computer and sent over the network, they acquire some strange and wonderful qualities.

They are subject to a different economy, where abundance, not scarcity, is the norm.

As we will demonstrate, digital goods are not like physical ones, and these differences are what truly matter.

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Where we are

Physical goods remain essential, and almost everyone would like to have them to a greater quality and variety.

It doesn't matter if we want to eat more: we all want to eat in a better or in a more differentiated way.

It doesn't matter if we want to burn more fossil hydrocarbons: we would like to be able to visit more places with more ease.

Computers are helping us achieve these goals and many more.

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Where we are

Digitization is improving the physical world, and these improvements can only become more important.

Economic historians broadly agree that, as Martin Weitzman puts it, “the long-term growth of an advanced economy is dominated by technical progress”.

As we will demonstrate in this module, technical progress is improving exponentially.

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Where we are

The last consideration is less optimistic: digitization will bring several thorny issues. Even the most beneficial advances involve unpleasant consequences to manage. The Industrial Revolution was accompanied by soot-saturated London skies and by the obscene exploitation of child labor.

What will their modern equivalents be? Fast digitization is on the way and it will likely bring economic devastation more than the environmental one.

As computers become more powerful, businesses will need less of certain types of employees.

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Where we are

In its run, technological progress will leave someone behind, perhaps a lot of people. As we will prove, there has never been a better time to be a skilled or educated worker in the right sense of the word, because this is the kind of person who can use technology to create and capture value.

But there has never been a *worse* time to be a worker who has to offer only "ordinary" capabilities because computers, robots and other digital technologies are acquiring the same skills and competences at great speed.

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Where we are

The problems of the digital revolution must be addressed as well, but at first we must understand what they are.

It is essential to analyze the likely negative consequences of the second age of machines, even by starting a daily debate within our community.

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Where we are

Almost all of the innovations described in this module have arrived in the last few years. We have seen them in areas where progress had been slow for a long time and in which scrupulous studies had come to the conclusion more than once that there would never be an acceleration.

Then, after so much gradualness, digital progress suddenly came. It has come in multiple industries, from artificial intelligence to self-driving cars and robotic.

How did it happen? It was a stroke of luck, the confluence of various improvements, happy yet temporary?

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Where we are

No. The digital progress that we have seen in recent years is definitely impressive, but it's just a hint of what is yet to come. It is the dawn of the second age of the machines.

To understand why it is happening now we need to understand the nature of technological progress in the age of hardware, software and digital networks.

In particular, we must understand its three key characteristics: *exponential*, *digital* and *combinatorial*.

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1.2: Artificial Intelligence

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General purpose technologies: the ones that really matter

Gordon and Cowen consider the invention of powerful technologies essential to economic progress.

Indeed the historians of the economy altogether agree that certain technologies are significant enough to accelerate the normal march of the economic advancement.

To do this, they must spread in many sectors, if not in every sector: they cannot remain relegated to just one.

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General purpose technologies: the ones that really matter

The steam engine and electricity, on the other hand, spread quickly almost everywhere.

The steam engine has not only massively increased the amount of energy available to factories, but also has revolutionized travel on land and sea allowing the birth of railways and of the steamers.

Electricity has given the factories a further boost by allowing the machines to be powered individually. He also illuminated factories, offices and warehouses and led to further innovations such as air conditioning, which made jobs pleasant.

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General purpose technologies: the ones that really matter

Economists define innovations as steam power and electricity *general purpose technologies* (GPT).

Economic historian Gavin Wright offers us a concise definition: “periodically new techniques that have a potentially important impact in many sectors of the economy”.

Here by “impact” we mean a significant boost in output due to substantial gains in productivity. GPTs are important because they are economically significant, because they discontinue and accelerate the normal advance of any economic progress.

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General purpose technologies: the ones that really matter

These technologies should be pervasive, improve over time and be able to generate new innovations.

Information and communication technology (ICT) certainly belongs to the same category as steam and electricity.

Almost all historians of the economy agree to underline that ICTs respect all the criteria mentioned above and therefore should automatically join the club of general purpose technologies.

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General purpose technologies: the ones that really matter

Cowen says: “the advantages of the Internet are very concrete and I am here to praise them, not to criticize them [...]. The big picture is this: we have more fun thanks to the Internet. And we have fun spending less. [But] we are a bit scarce on the revenue side, so it's hard to pay our debts, whether it's individuals, business or government”.

The 21st century ICT, in short, failed the main exam, the one that asks it to prove itself as economically significant.

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General purpose technologies: the ones that really matter

The most notable aspects of the second age of machines were presented:

1. **continuous exponential improvement in almost all aspects of**
2. **extraordinarily large amount of digitized information and**
3. **finally recombinant innovation**

These three forces are guaranteeing us achievements that turn science fiction into everyday reality.

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Human and artificial intelligence in the second age of machines

Just as free goods instead of physical products constitute an increasingly important slice of consumption, intangibles are also a growing capital asset of the economy.

Production in the second age of machines relies less on machinery and physical structures (capital assets) and more on the four categories of intangible assets:

- ☐ *intellectual property*
- ☐ *user-generated content*
- ☐ *organizational capital*
- ☐ *human capital*

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Human and artificial intelligence in the second age of machines

The second, and even broader, category of intangibles is organizational capital such as new management procedures, production techniques, forms of organization and business models.

The effective use of new technologies of the second age of machines almost invariably requires changes in the organization of work.

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Human and artificial intelligence in the second age of machines

User-generated content is the third, smaller but rapidly growing category of intangible assets.

Users of Facebook, YouTube, Twitter, Instagram, Pinterest and other forms of online content don't just consume the content, taking up the consumer surplus discussed earlier, but they also produce content by themselves.

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Human and artificial intelligence in the second age of machines

43,200 hours of new videos are posted on a daily basis on YouTube, and 250 million new photos are uploaded to Facebook every day.

Moreover the users provide valuable, if not measured, content in the form of reviews on sites like Amazon and TripAdvisor.

User-generated content includes even simple Information used to rank reviews and present the content itself, for example when Amazon asks “Was this review helpful to you?”

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Human and artificial intelligence in the second age of machines

Hardware and software companies today are competing to improve the productivity of their user-generated content business.

For example, smartphones and smartphone apps now provide easy or automatic tools to post photos on Facebook.

This content has value for other users and can be considered another type of intangible capital asset that is added to our collective wealth.

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Human and artificial intelligence in the second age of machines

The fourth and largest category is the value of human capital. The many years That we all spend in school learning skills like reading, writing and arithmetic, as well as the additional updates that can happen at work, make us more prod uctive and, in some cases, are intrinsically rewarding.

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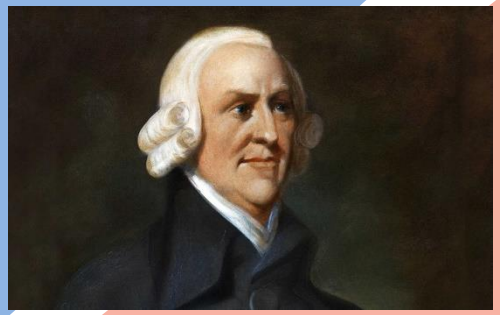
1.2: Artificial Intelligence

Bucolico
Building Community Resilience through Communication & Tecnology

Human and artificial intelligence in the second age of machines

Economist Adam Smith understood that one of the most disadvantages of the first age of machines was that it forced the workers to perform repetitive tasks.

In 1776 he noted: “The man who spends his whole life to perform few simple operations, which effects are maybe always the same, or almost, he has no way to comprehend”.



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Human and artificial intelligence in the second age of machines

Investments in human capital will become increasingly important with increased automation of routine work and the need for human creativity.

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1.2: Artificial Intelligence

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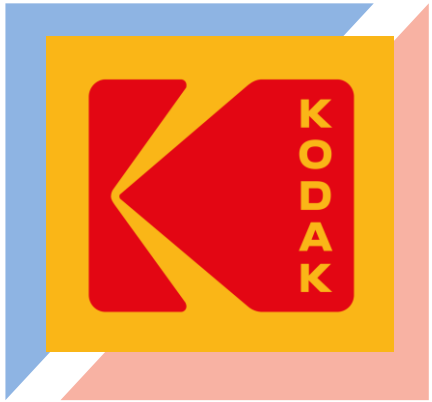
The gap. An example: photography

Kodak employed 145,300 people at one point, a third of them in Rochester, New York, while indirectly had several thousands employees through its large supply chain and retail channels.



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The gap. An example: photography

Kodak gave wealth to its founder, but it has also provided good job and paid multiple generations of people. Unfortunately 132 years later, a few months before Instagram was sold to Facebook, Kodak went into bankruptcy.

Yet photography had never been more popular. Today 70 billion photos are uploaded to Facebook every year at virtually zero cost. These photos are all digital: therefore the hundreds of thousands of people who used to work in the production of chemicals and paper for photography are no longer needed.

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The gap. An example: photography

The evolution of photography perfectly illustrates the abundance of the second age of the machines.

By *gap* we mean that there are large and growing inequalities between people in terms of income, wealth and other important aspects of existence.

Companies like Instagram and Facebook use a minimal fraction of the people Kodak needed.

Despite this, Facebook has a market value several times larger than what Kodak ever had. The transition from analog to digital provided an overabundance of digital photos and other assets, but also contributed to a income distribution more unequal than before.

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The gap. An example: photography

Photography is not an isolated example of this transition. Similar stories have been and will also be told in the music and media sector, in finance and in publishing, trade, distribution, services and production.

In almost all areas, technological progress will bring abundance.

More wealth will be created with less work.

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The gap. An example: photography

However, at least in our current economic system, this progress will also have enormous effects on the distribution of income and wealth.

If the work done by one person in an hour can be done by a machine for a dollar, then an employer interested in maximizing profit will not offer more than a dollar per hour for that job.

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The gap. An example: photography

- The theory and even the data indicate that this combination of abundance and gap is not a coincidence.
- Advances in technologies, especially digital ones, are fostering an unprecedented redistribution of well-being and income.
- Digital technologies can replicate ideas, insights and innovations at a fraction of the original price.
- This creates abundance for society and wealth for innovators but the demand for certain forms of labor decreases and this can reduce the income of many people.

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The gap. An example: photography

The combination of abundance and inequality challenges two worldviews, popular yet contradictory.

The first wants technological advances which always inflate their incomes.

The other wants automation to harm the wages of workers because people are replaced by machines.

Both views have a kernel of truth, but the reality is more nuanced.

The rapid advancements of our digital tools are creating a wealth everseen before, but there is no economic law that guarantees that all workers, or even just a majority, will benefit from the aforementioned progress.

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The gap. An example: photography

We could call it biased technical change in favor of talent.

In many sectors, the difference in wealth between the number one and the second has become an abyss.

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The gap. An example: photography

The growing gaps in salaries between people with or without a degree and between owners of capital and workers have been ridiculed by even more massive changes and inequalities at the top.

As noted above, between 2002 and 2007 the top 1% made two-thirds of all profits of the US economy.

But who is this 1% made up of?

Economist Steven Kaplan of University of Chicago found that nearly everyone works in other industries: in the great means of communication and in entertainment, in sport and in studies as lawyers, or they are entrepreneurs and senior executives.

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The gap. An example: photography

People can remain valuable knowledge workers in the new age of machines: ability to conceive, to recognize patterns in a broad context and complex communication.

And, whenever possible, take advantage of learning in self-organized environments, who are reputed to be able to develop these skills in people.

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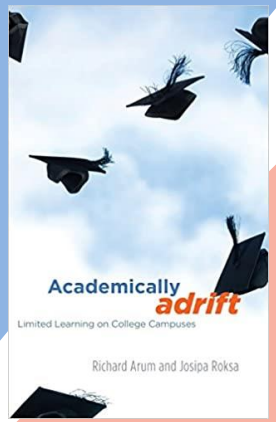
If you don't go to university



One of the strongest material evidence that confirms the fact that students are not acquiring the right skills is the work of sociologists Richard Arum and Josipa Roska summarized in their book *Academically Adrift: Limited Learning on College Campuses.*

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Arum and Roska used the Collegiate Learning Assessment (CLA), a test recently developed that college students must do in order to asses their critical thinking, written communication, problem solving, and analytical reasoning skills.

Even if the CLA takes place in front of a computer, it requires writing papers instead of giving a series of answers to multiple choice quizzes.

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One of its main components is the "performance task": it presents to students a set of accompanying documents and gives them ninety minutes to write an essay in which they must extract information from the materials given and develop a point of view or a recommendation.

In short, the performance task is a valid test on the skills of ideation, recognition of pattern and complex communication.

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If you don't go to university

What explains these disappointing results? Arum, Roska and colleagues demonstrate that today's university students dedicate only 9% of their time to study (compared to 51% devoted to "socialization, recreation and more"), much less than in previous decades, and that only 42% reported having taken a course in the previous semester that required reading at least forty pages per week and to write at least twenty pages in total.

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If you don't go to university

But the authors also find that in each college they surveyed some students demonstrate a noticeable improvement in CLA.

They are generally the ones who have spent more time studying (especially alone), who took courses that actually required a lot of reading and elaboration and had more demanding professors.

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If you don't go to university

This research leads us directly to our fundamental recommendation for students and their parents:

study hard, use technology and all other resources available to "fill your toolbox"

and acquire the skills and abilities that will be needed in the second age of machines.

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If you don't go to university

Arum, Roska and colleagues followed more than 2,300 students of a four-year degree program in several colleges and American universities. Their findings are alarming:

45% of the students do not showed significant improvements in CLA after two years of college

36% did not improve at all even after four years.

The average test progress after four years was quite limited.

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Policy recommendations

When technology advances too fast for education to stand up, the disparity usually grows.

Having realized this in the early years of the last century, the United States invested a lot in basic education.

Goldin reports that in 1955, for example, nearly 80% of American children between the ages of fifteen and nineteen were in high school, a level at the time more than double that in any European country.

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Policy recommendations

Over the past half century this distinct US advantage in primary education has disappeared and today the country does not go beyond the core positions among rich countries, and even worse in some important subjects.

The most recent survey by the OECD's Program for International Student Assess ment (PISA), the Organization for Economic Co-operation and Development, cond ucted in 2009, found that 15 years old Americans ranked

14th among thirty-four nations in reading	down to the 17th in science	the 25th in mathematics

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Support for our scientists

After growing for a quarter of a century, in 2005 government and federal aid to basic academic research have begun to decline. This is causing some concern because the economy teaches that basic research has great positive repercussions. This trivial fact creates a role for the government, whose dividends could be huge.

The Internet, just to give a famous example, was born from the research of the ministry of the US Defense to set up bomb-proof networks.

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Support for our scientists

GPS systems, touch screens, voice recognition software such as Apple's Siri and many other digital innovations also derive from government-funded basic research. It is quite logical to say that hardware, software, networks and robots would not exist in the volume, variety and form that we know without continuous public funds.

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Long-term recommendations

The element that will most likely change and that will bring problems and challenges is an aspect that we have not yet mentioned:

In today's capitalist economies almost everyone acquires the money to buy t hings by offering their jobs to the economy. We are almost all workers, not owners of capital.

However, if the theories about AI, androids and the Second Age of Machines are correct, this age-old exchange will become less feasible over time.

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Long-term recommendations

Now that digital work becomes more pervasive, capable and powerful,

will be less and less willing to give people acceptable wages,

wages that allow them to maintain the standard of living acquired long time ago.

When such things happen, people are left unemployed. It's a bad news for the economy as the unemployed

do not create as much demand for goods and as a result overall growth tends to slow down.

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Long-term recommendations

A good number of economists are concerned about this possible failure of capitalism.

Many of them have proposed the same solution: give money to people.

The government could distribute every year an equal amount of money to all citizens, without carrying out any evaluation to verify who really needs money or who should have more or less.

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Long-term recommendations

This “minimum income” project, according to its proponents, is relatively simple to manage and preserves the elements of capitalism that work well,

but solving the problem of people who can't survive offering their own manpower.

The minimum income ensures that everyone has a basic standard of living.

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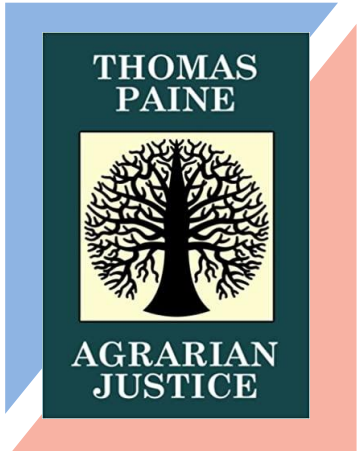
Long-term recommendations

Today the minimum income is not part of the official political debate but it has a surprisingly long history and was one step away from becoming a reality in twentieth century America.

An early proponent of him, the Anglo-American political activist Thomas Paine, in his 1797 pamphlet *Agrarian Justice* hoped that everyone would receive one lump sum once you reach adulthood to compensate the injustice of the fact that some were born into a landowning family and others did not.



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Long-term recommendations

Later supporters include the philosopher Bertrand Russell and the leader of the civil rights movement Martin Luther King Jr., who wrote in 1967:

"I am now convinced that the simplest strategy will prove to be the most effective. The solution to poverty is to abolish it directly with a measure today widely discussed: guaranteed income".

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Long-term recommendations

The president who was elected that year, Republican Richard Nixon, tried to make it law throughout his first term.

In a 1969 speech he proposed a *Family Assistance Plan* which had several aspect s of a minimum income programme.

This plan was supported by all ideological camps, but it also had a large and diver se group of protesters.

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Long-term recommendations

Conservative economist and Nobel Prize winner Milton Friedman disliked state interventions, yet he was in favor of what he called a "negative tax" to help the poor.

Here's how he explained it in a 1968 TV appearance:

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Long-term recommendations

"Under the present laws we have a positive income tax [...]. According to it, if you are the head of a family of four, for example, and have $ 3,000 in income, you do not pay taxes or receive any contribution. You are on the threshold of tax exemption. Imagine you have a income of 4000 dollars. Then you have a positive taxable income of 1000, on which at the current rates (14%) you pay $ 140 in tax. Imagine you have an income of $ 2,000 today. You are entitled to deductions and exemptions from a taxable amount of 3000, which on an income of 2000 means that you have a negative [...] taxable amount of $ 1000. But currently, under current regulations, you don't take advantage of these unused deductions. The meaning of a negative tax is that, when your income is below the disability threshold, you get a fraction paid "by" the government. Receive money instead of giving it".

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Long-term recommendations

The negative income tax combines the guaranteed minimum income with an incentive to work. Below the threshold of the example (which in 1968 was 3000 dollars but in 2013 would be 20,000), every dollar earned increases total income by one and half. This encourages people to start working and find different jobs, even though the pay they receive for it is low. It also encourages you to file your tax return and thus become a part of the classic and visible workforce.

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Thank you

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