

Perspectives of the Economic Theories in View of the Information and Knowledge Society

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Abstract

Contemporary economic problems, deeply intertwined with the knowledge and information society, are examined in the light of main economic theories. These theories, which evolved alongside the technological revolutions of the labour process, from artisanal to manufacturing, industrialization, automation, and scientific production, are somewhat out of synchronise with the current context. Therefore, the aim is to apply their concepts to tackle the pressing issues of service innovation, automation, the rise of knowledge-intensive employment, the dominance of platform firms and global capital concentration, environmental limits, the knowledge society, and the advent of artificial intelligence. This exploration underscores the importance of understanding the interplay between theories and the adaptation of their concepts in tackling new economic challenges.

Keywords

Economic Theories, Labour Processes, Information Technologies, Knowledge Society

1. Introduction

The knowledge society could be characterized by three aspects: the increasing participation of services in contemporary societies, the wide diffusion of Information and Communication Technologies (ICT), and the interconnections and shortening of the knowledge cycle from its generation to market and production application (Baird & Henderson, 2001).

The knowledge society, which had its roots in the information revolution driven by computer technology systems, can be traced back to the arrival of the microprocessor in 1971 (Intel 4004). This revolution began a new era in which

data, information, and knowledge became increasingly interconnected and accessible (Magoun, 2021).

Data (Note 1), information, and knowledge have natural accumulation characteristics because they are shared or sold but not transferred as commodities (Rigi, 2014). The accumulation of information resulting from human cooperation and the evolution of the division of labour implies a division of knowledge and specialization (Quintas, 2002). This phenomenon has uncertain impacts on communication and economic problems (Howard, 1966, Volume: 2, Issue: 1). Data uncertainties are a function of a communication model on five components: source, transmitter, channel, receiver, and destination (Shannon, 1948). Economic theories take different approaches to dealing with these contemporary problems and are oriented by the production context in which they were developed.

The intent is to assess how economic theories developed from specific contexts could capture and explain the contemporary problems arising from information technology-based qualitative changes and the knowledge society. New features arise first from the accumulation of knowledge (Prendergast, 2010), and second, from its speed of circulation, which increases exponentially (Tague, Beheshti, & Rees-Potter, 1981), leading to the emergence of artificial intelligence (AI).

Those changes include increasing social, economic, and environmental problems, significant demands for knowledge-intensive employment, global capital concentration in specific industries, and specialization in production maintenance. The impact on employment creation will require complementing basic social needs and migration policies through the roles of governments and international organizations.

2. Methodology

Economic theories built up in their specific context lag the evolution of economic problems. Considering these lags, the method selects contemporary problems derived from informatics, knowledge society, and AI applications to contrast them with economic theories' main concepts. Therefore, how could some concepts be applied or adapted to tackle contemporary economic problems?

To answer this question, first, the evolution of the context of the labour process is described, and second, selected contemporary problems are contrasted with those economic theories and their concepts.

2.1. Labour Process Evolution

Labour's components changed from artisanal tools to machinery and energy in the Industrial Revolution (Table 1). The information and the work object components create the information and the scientific-technological revolutions, generating a new division of labour (Tinel, 2012).

However, the nature of information as raw material has rapidly increased its process and accumulation with computer systems and scientific and technological advances.

Table 1. Labour processes and its components.

Labour Processes	MAN	Labour	Power	Machinery	Energy	Information	WORK OBJECT	MAN + Knowledge	Artificial Intelligence
Handcrafting	Manual Instruments				SCIENTIFIC TECHNOLOGICAL Revolution				
Manufacture	Division of labour organized with co-operation		INDUSTRIAL Revolution			INFORMATION	SCIENCE	Knowledge	Knowledge Revolution
SYSTEMS OF MACHINES	Labour subordination to the machines.								
Automation	Supervision and maintenance of automatic system.		Functional MT: machine of transference universal multitool		Automatization of the generation and distribution of electrical energy.	Computer systems & Telecommunications ICT (Information and Communication Tech)			Internet of Things (IoT)
Scientific	Intellectual Collective Work. Development of the creative capacity of the man.		Laboratories: chemicals, physics-chemical, biological, Nanotech		New power plants: nuclear, sun energy, biological.	INTEGRATION of INFORMATION: images, data and sound		Scientific NETWORKS	Shortening of science Sc-Tech cycle: Nanotechnology, Biotechnology
Systemic MAN-SC-TECH-PRODUCTION	Scientific CO-OPERATION		ACCESS to Databases & publications		Distributed and Diversified energy Systems	Virtual Communities, Data Mines		Horizontal Sciences: Systems	Institutional System Univ-Firms-Gov, Interrelationship. INTERFUNCTIONS

Source: Author's elaboration.

Those trends have led to a new technological level with the so-called “Knowledge Society” characterized by economic “servitization”. Anticipated by the Information (Note 2) services included in each component in the (Note 3) form of pre-sales and after-sales services or even “services around the product” (Furrer, Kerguignas, Delcourt, & Gremler, 2020). A consumer buys the ownership, the use of the product, and the service the firm provides (Gallouj & Djellal, 2015). In fact, when more than half of the total employment is in services, a Service economy is achieved.

Human-nature relationships are impacted by Artificial Intelligence (AI), population aging, unemployment caused by automation, and the deterioration (Note 4) in the Environment limiting their survival.

Consequently, if economic theories (Note 5) are extended to comprehend such contemporary problems, what are their possibilities, boundaries, or inadequacies? First, confirm that you have the correct template for your paper size.

2.2. Economic Theories

The main economic theories, classical, Marxist, neoclassical, evolutionist, and institutionalist, are analysed and compared in relation to contemporary economic problems. This reveals important lags in the approach to these issues, particularly in the context (Note 6) of the computer revolution.

In the recent evolution, the incorporation of AI raises fundamental questions on economics as “is not bound to a single specific application but opening up a vast array of uses [...] facilitating coordination across different areas of human activity by enabling efficient data processing, prediction, and decision-making” (Sinclair, 2024: p. 13).

Hence, problems are grouped into those explained by the theory, and those left aside as they were not considered when the theories originated (Table 2). These include recent issues such as environmental limits, the knowledge society, and AI applications.

Table 2. Economic theories in view of contemporary problems.

THEORY	MAIN CONCEPTS	Economic Theory's INFORMATION TECHNOLOGY REVOLUTION: CONTEXT		KNOWLEDGE SOCIETY	
			Computers and Internet	Knowledge	Artificial Intelligence (AI) Environment
Classic	Division of labour: Technical and social.	Industrial Revolution (First phase): steam engine, machine-tools.	Reconceptualization of services instead of considering them <i>unproductive</i> labour.	“Servitization” implies an increase in service employment.	New paradigms of economic theories must be developed.
	Mass production.			Product customization.	
Marxist Dialectical-Materialism	Capital accumulation: Value and surplus value. Organic and technical capital composition.	Industrial Revolution (Second phase): Electricity, railroads.	Information creates value and surplus value. Information accumulates and circulates as capital.	International division of intensive knowledge labour (IDIKL).	From the artisan to the scientific worker, AI generates the emergence of a novel worker entity, a duo <i>homo sapiens-artificialist</i> .
	Labour is a commodity. Endogenous explanation of technology change.			Technology is part of the Productive forces.	
Neoclassic	Rational choices.	Industrial revolution (Second phase).	Bounded rationality, as people make satisfactory choices instead of rational choices. Zero marginal cost of information.	The cooperation possibilities are multiplied by knowledge value.	Large impact on technological change.
	Maximizing utilities or profits. Perfect information.				
	Production function explained by Factors (K,L).	Technology has an exogenous explanation (<i>Blackbox</i>).	New countertendency to the falling rate of profit.	AI is embedded as a counter trend to the “decreasing rate of profit”.	To endogenized “nature” in the Marxist model.
Evolutionist	Translation of biological concepts to economics.	Technology path dependency.	Platform firms (PF) are based on information.	Islands concentration of knowledge by regions and countries.	AI generates new forms of collective employment, uncertainty, complexity, and “impactedness” (transactions with opportunistic decisions).
	Innovation & Entrepreneurship are essential to capitalism.				
		The “digital universe” growth will reach 180 zettabytes by 2025 (Economist, 2017).	New tacit and codified window opportunities in knowledge trough product and service cycles.	AI would create learning systems, and individual tutorial platforms.	

Continued

Institutionalist	Regulations.	Transaction costs of technology assets: Information costs and Compliance costs. Regulations for the increase of the performance and innovation of firms.	Contradictory PF's regulations between protecting individual data and innovation. Regulation of the stock of digital innovations.	Increased demand of explicit and hidden regulations on knowledge fluxes.	Regulations for the collection storage and use of data. Encryption and security measures.	Natural regulations of the United Nations 30 goals agenda.
		Intellectual property rights.	Spread of data basis.	Incentive to knowledge and entrepreneurship culture.	*Ethical AI development. Retraining and upskilling. *Universal Basic Income (UBI) for people who lose their jobs.	Planetary approach with the participation of multiple actors.
All economic theories	<p>Man is the origin and destiny of production, although it was substituted by “machines” during the technological revolutions. The economic theories complement each other guided by the specificities of the economic problems and applying the method of the labour process changes.</p> <p>*The International Division of Intensive Knowledge Labour (IDIKL), generates a new <i>machine</i> where it is a multifunctional worker, who incorporates artificial intelligence tools.</p> <p>* Institutional theory connects the different theories, as it could be added to all of them. The regulation is related to the social distribution of wealth and diminishing of weekly working hours, tending to a universal basic income (UBI). *The globalization disrupts the concept of <i>sovereignty</i>, as the principle of <i>subsidiarity</i> complements it. There is a growing contradiction between the State regulation and the emergence of sub-state and supra-state policy and political decisions.</p> <p>In Gray aspects related to the context of the Economic Theory's origin.</p>					

Source: Author's elaboration.

Theories and concepts are evaluated, adapted, and interrelated to explain certain economic aspects of contemporary problems (Postulation 1).

Understanding the limitations and possibilities of economic theories and their concepts allows the application or creation of new concepts to analyze contemporary economic problems (Postulation 2).

3. The Economic Theories vis a vis Their Lags and AI's Problems

The selected economic theories (classical, Marxist, neoclassical, evolutionary, and institutionalist) are first presented through the economic problems involved; second, the theory is compared with its lags regarding new topics that are not illustrated; and finally, contemporary phenomena are contrasted, such as environmental limits, the knowledge society and its most recent deployment of AI technology, looking forward to the limits and adaptations to the theories' concepts (Lu & Zhu, 2021). All of this is under the framework of the evolution of the labour process (Table 1).

3.1. Classic

Classic economic thought focused on comprehending the manufacturing industry based on the Industrial Revolution. Labour productivity increased through organization, machine tools, and external energy sources.

Classical theory considers service activities as unproductive labour, meaning they do not create value. Also, it is still believed that service characteristics are not capital intensive, have low productivity, and are passive activities (Gallouj & Djelal, 2010: p. 2). However, the increasing number of service activities related to the

information revolution requires a reconceptualization of the labour process services.

Some countries are spreading a wide variety of services, including software and computing techniques, where service workers outnumber product workers. The intermediate business models of multi-sided platform companies (PF) are concentrating value. Then, a global, regional, and non-fixed International Division of Labour (IDL) is being created, with movements between intelligent cities and digitalized non-urban areas. Thus, social problems such as wage decline, resource concentration, and risks arise, necessitating welfare distribution through other channels, mainly via the State.

The International Division of Knowledge Labour, IDKL, tends to concentrate on it in some countries and regions, creating knowledge specialization gaps between them and islands within them. The basis is the capabilities of the multifunctional worker who recently used artificial intelligence tools incorporated into networks' information systems (**Table 2**).

3.2. Marxist Dialectical-Materialism

Based on classical thought, the Dialectical Materialist Method was developed during the second phase of the Industrial Revolution (i.e., with the change in energy sources). It creates a theory of value generated by the labour power which becomes a commodity. It also concludes that capitalism has a historical function of developing productive forces, and within this technology, due to the competition of companies in the market.

Applying this theory to the contemporary service economy suggests that Information also generates surplus value (Rigi, 2014), even if there is either a product or a service in the circulation of capital whether financial or commercial.

The attribute of capital accumulation also applies in a certain way to information. Data exhibited as capital has also “decreasing returns to scale” (Economist, 2017: p. 6). Hence, by understanding data as a form of capital, we can better analyse the meaning, practices, and implications of datafication as “the collection and circulation of data is now a central element of increasingly more sectors of contemporary capitalism”. (Sadowski, 2019: p. 1).

Therefore, channels of capital and information duplicate the ways of accumulation, circulation, and sustainability. Then information could be interpreted as a countertendency to the falling rate of profit.

On these lines, information still needs to be fully incorporated into the general theory of capital accumulation (**Table 2**).

3.3. Neoclassical

The behaviour assumption of the neoclassical theory departs from a simple model approach of three axioms:

- Rational choices.
- To maximize utility or profits.

- Perfect Information.

From this point on, the neoclassical method proceeds to incorporate and approach more realistic economics without losing its ability to explain it as a mathematical model.

An example of this is the term “bounded rationality,” which replaces the perfect rationality assumptions of homo economicus with a conception tailored to cognitively limited agents, and also by information and time. The task is to replace economic man’s global rationality with rational behaviour compatible with access to information and computational capacities (Simon, 1955).

Another case is introducing “asymmetric information”, a more realistic situation for the interaction between economic agents (Stiglitz & Rosser, 2008) or inter-rationality in open innovation dynamics.

The “production function” is applied to analyse technological change, explained from the “factors of production,” mainly labour and capital. In the case of a Cobb-Douglas-type function, the exponents measure the productivity of each factor (Douglas, 1976). The knowledge factor has been added to endogenize this source of contemporary technological change.

The zero-marginal cost of information technology (Rifkin, 2014) affects the digital break-even point of the digital firm, which is reached with lower output than product industries (Lee et al., 2018). These economic characteristics, combined with the almost infinite scalability (Frank, Schumacher, & Tamm, 2023), lead to open trends in the informational economy.

Infonomics is a recent economic theory that attributes economic importance to information and data. Digital information is not rivalrous, as it can be copied and used simultaneously by multiple people, firms, or algorithms. Despite its abundance, “data flows are not a commodity, and the lack of fungibility makes it difficult to develop pricing methodologies.” (Economist, 2017: p. 2).

3.4. Evolutionist.

Evolution theory is centred on technological processes and translates biological evolution’s foundations into economic concepts. At the firm level, routines are explained by “path dependency” and technology changes or disruptions as innovations.

In Schumpeter’s explanation of business cycles, innovation and entrepreneurship come together (Schumpeter, 1989).

Knowledge-intensive Business Services, or KIBS, are firms that increase innovation. Disrupted technology in different areas creates barriers and entrant gateways. So, there is a complex PF life cycle with new equilibrium points.

Initially, the big PFs of social networks (Facebook and Google) collected data from users to target advertising; nowadays, applying AI generates new sources of revenue through translation, visual recognition, and assessing writings—“all of which can be sold to other firms to use in their own products.” (Economist, 2017: p. 3).

AI, because it is fed by subsets of known information that can be easily communicated in machine-readable form, but cannot “know” enough to replicate the business function, and AI cannot “think” beyond it (Sinclair, 2024: p. 15).

Big data analytics using artificial intelligence are rapidly taking place as companies build data banks. In 2016, Amazon, Alphabet, and Microsoft raised nearly \$32 billion in capital expenditures, up 22% from the previous year. The “digital universe” growth is estimated to reach 180 zettabytes (followed by 21 zeros) by 2025 (Economist, 2017) (Table 2).

3.5. Institutionalism

For New Institutional Economics, NIE, the rules are the institutions that matter because they reduce uncertainty, enable cooperation, and set a context for economic agents’ expectations, mainly on assets’ transaction costs. These assume bounded rationality and opportunism behaviours, depending on the complex attributes of the asset specificities (Williamson, 1985: p. 16).

The PF regulation is contradictory between promoting innovation and protecting individual data. 137 out of 194 countries have regulations for collecting, storing, and using Data (UNCTAD, 2024). Legislation to secure data protection and privacy, such as GDPR in Europe and CCPA in California, gives individuals some control over their personal data.

The information revolution is no longer based only on stocks of digital information—databases of names and personal data. Nowadays, it is about analysing rapid real-time flows of unstructured data generated by social networks and forming sensors so that people will leave a digital trail, even if they are not connected to the Internet. “Data will be the ultimate externality: we will generate it whatever we do.” (Economist, 2017: p. 3). What matters is the quality of the algorithms that crunch the data and the talent a firm has hired to develop them (Economist, 2017: p. 3).

There is an increasingly explicit and hidden demand for regulations on the knowledge flux at national and international levels to boost technology diffusion and foster new forms of entrepreneurship culture to apply and develop science and technology. Therefore, AI and PF’s regulations must solve the contradiction between promoting innovation and protecting individual data (Table 2).

4. Discussion

A postulate for the methodology is that despite significant structural differences between the economic theories, it is possible to look for selected complementarities to understand better and explain the problems.

Economic problems and theories are anchored in the evolution of the labour process, which is defined by technological disruptions of its components. First, disruptions in the artisanal process occur when tools change to machine tools, followed by man’s or animal’s force replaced by external energy sources. Then, the information revolution, as man’s thinking is potentially improved by external

information, such as ICT, computers, etc. Nowadays, a new level of disruptions begins in the knowledge labour process enhanced by the spread of AI service technologies.

The axiom is that Man is the origin and destiny of production even in its substitution on the different revolutions of the labour process.

Even if the neoclassical theory that the economy is self-correcting is stated, opposing Keynesianism, which encourages government monetary and fiscal programs to stimulate business activity and increase employment, both could complement the enlightenment of the implications of the knowledge society, environmental problems, and artificial intelligence technologies (Note 7).

An analysis considering theoretical underpinnings of each school and an interdisciplinarity scope are limits of this article, in such fields as sociology, political science and psychology (Note 8).

5. Conclusion

Economic theories usually lag changes. It is proposed that foresight be used to suggest trends and guide the dynamics of economic thinking by applying and adapting its concepts to unconsidered and emerging issues (Table 2).

This exercise implicitly validates Postulation 1, that the interrelation between theories and concepts allows us to adequately begin to understand new economic problems, as in the following cases:

- The evolution of the labour process is a basis for analysing technological changes from artisanal to manufacturing, industrialization, automation, and scientific production. Each stage is built on a specific kind of machine. Let us apply the concept of the division of labour (Smith, 1776), to the development of technology and contemporary knowledge, then an International Division of Knowledge Work, IDKL, emerging a new machine built based on the multifunctional worker who begins to use artificial intelligence tools incorporated into networked information systems.

The Marxist contradiction between the socialization of production and the privatization of the Means of Production disentangles dynamically through technological change, generating productivity gains. This contradiction is solved by regulations—institutional theory—that diminish the number of working weekly hours and socially distribute income, tending to a Universal Basic Income (UBI) (Table 2).

In addition to assessing, adapting, and complementing economic theories, new concepts must be created to understand the lagged and contemporary economic problems, as the following (Postulation 2) (Table 2).

Data are part of the capital in increasing economic activities, as in platform firms. Thus, with the information revolution, there are now two channels of accumulation in practice: 1) traditional physical capital and 2) data, which have yet to be incorporated into the general theory of capital accumulation.

Uncertainty is part of the economic and environmental crisis, so new paradigms

of economic theories must be developed. To this end, institutionalist theory is a connector that interrelates economic theories to build an integrated approach. Thus, encryption, security measures, and ethics are part of the regulatory system that must go hand in hand with AI's trajectory (Note 9).

The State and other organizations generate regulations and public service delivery. Their evolution multiplies the number of regional, national, or international organizations, creating a complex system that disrupts the concept of Sovereignty, which is complemented by the principle of Subsidiarity (Evans, 2014), "social and political issues should be dealt with at the most immediate or local level that is consistent with their resolution" (World Bank, 2021: p. 29). There is a tendency for an "overabundance of new sovereignty claims emerging in sub-state and supra-state contexts." (Walker, 2020).

The knowledge society closes a cycle from the artisan to the scientific worker, starting a new labour process. Consequently, artificial intelligence fuels the formation of a duo *homo sapiens-artificialist*, throughout diverse economic activities.

The evolution of the labour Processes' components is a framework that helps to ubicate recent technological changes, assess them against the possibilities and limitations of economic theories, and create concepts to explain the contemporary problems arising from information, knowledge, and AI technologies.

Notes

1) **Data** refers to raw, unorganized facts or figures collected and stored. **Information** is the processed and organized form of data that have been analysed, structured, and given context. **Knowledge** goes beyond information in that it involves understanding and expertise. It is the result of gaining insights and experience, and being able to apply information in a meaningful way is the culmination of information and personal or collective understanding. This allows us to make informed judgments and take effective action (Zins, 2007; Spilker, 2023).

2) The framework of labour processes revolutions based on how change each component is similar at the contemporary concept of Industry 4.0. Therefore, using a numerical order to describe them. The fourth one "combines processes, machines, data, information systems and people. Technologies associated with this concept include autonomous robots, big data analytics, incremental manufacturing, cyber security, cloud computing, the Industrial Internet of Things (IoT), vertical and horizontal system integration and artificial intelligence" (Brodny & Tutak, 2022: p. 3).

3) The trends of the industrialization of services and the *servitization* of goods are evolving to product-service systems along with the *customization* of how consumers use a product and participate in the business model (Gallouj & Djellal, 2015).

4) AI has two types: Narrow and Generative. Narrow are nearly all existing technologies. The General or generative "possesses the capacity to understand,

learn, adapt, and implement knowledge” (Sinclair, 2024: p. 2). Generative AI can create new things, like text, pictures, music, or computer code. It works by learning patterns from a lot of data based on what it has learned instead of following a set rule (<https://www.walkme.com/glossary/generative-ai>).

5) An overview of technology, services, and innovation is described with critical and dynamic analysis in (Lee et al., 2018).

6) Each economic theory is simplified in order to explain how they could be changed, adapted and developed in face of the contemporary problems.

7) Keynesianism is not explicitly considered. However, it is related with the institutionalist theory (Table 2).

8) As an example, psychology opens a new field of research on economic behavioural science in the “midst of a paradigm shift between outcome-based and language-based preferences” (Capraro, Halpern, & Perc, 2024).

9) Other trajectories, such as those covered by the concept of “Metaverse” using augmented and virtual reality technology, involve creating virtual spaces and avatars that could impact business, marketing, education, healthcare, and social interactions (Dwivedi et al., 2022).

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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