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ENVIRONMENT, ETHICS, AND ENTITY ECONOMICS, ECONOMIA AZIENDALE. HISTORICAL AND ONTOLOGICAL ASPECTS

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Abstract: The paper stresses the failure of 'economics' to predict and prevent repeated economic crises and the most critical topic of the environmental failure and ecological crises, founded also on economic theories and misconceived choices. The implication is a search for alternatives through an *ontological-evolutionary-institutional* approach and empirical investigations.
The search for political 'normative economics', entity economics, accounting and information science copes with social and ecological-environmental problems, and systems science; it is necessary to keep always in mind these interactions for fully understand and correctly interpret the present 'social-economic reality'.
The problem concerning environmental decisions goes beyond ontology and belongs to ethics. It must underline the debates on 'evolutionary ethics', not only related with 'environmental and ecological economics', the management of environment and reporting, but also with 'evolutionary ontology'; the new perspective affirms that 'existence', for instance, of a moral behavioral attitude, can reveal itself as a 'norm' thus relating ethics to ontology.
General economists, entity economics theorists, as well as accountants and information scientists should be familiar with the potentials and limits of 'ontology', also for the ongoing expansion of computerization of scientific research in most of the scientific domains. The renewed interest, particularly in ontology, arouse specifically from systems scientists in constructing a wide variety of *artificial intelligent systems*. For its analysis, the study has been structured into two periods of time: until the middle of the 20th century and from that moment on. The paper ends by showing the new developments in information systems and their ontological approach.

Keywords: *Economia Aziendale, Environmental Control, Ecological Crises, Ethical Environment, Ontological-Evolutionary Approach, Accountability, Sustainability, Heterodox Criticism, Artificial Intelligent Systems, Systems of National Ecological and Economic Accounts.*

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1. Introduction

The conceptual foundations of *economia aziendale*, entity economics, and information systems are to be sought not only in general economics, civil economics, and law, but also in social psychology, socio-linguistic and other branches of social sciences as well. The strong argument is in setting ends, objectives, and referring to the 'sociological forces' that shape and form the aims and determine the necessary 'socially acceptable' instruments in this regard.

Ethics is defined as the union of its scientific (moral behavior from a psychological, sociological or historical point of view) and philosophical (same subject from logical, epistemological, ontological or axiological viewpoint) aspects. By definition *scientific ethics* is included in the combination of psychology and other social sciences, whereas *philosophical ethics* is part of philosophy. Definite changes in ethical environment affect the kinds of internal control process that are effective.

General economists, heterodox economists, entity economics theorists as well as information scientists should be familiar with the potentials and the limits of 'ontology', also for the ongoing expansion of computerization of scientific research in most of the scientific domains. Hence a revival of interest in philosophical issues. The renewed interest, particularly in ontology, arouse specifically from systems scientists in constructing a wide variety of artificial intelligent systems. The systems approach might be enhanced by giving it an ontological grounding and by showing the system notion as being rooted in the foundations of science.

It is ontology not science where we attempt, on the highest level of generality, to connect the specific scientific disciplines not simply from a taxonomic but from a deeper 'evolutionary' perspective. The major advantage of ontology lies in presenting the 'knowledge common to all sciences' not revealed (or not revealed to such general extent) in any individual discipline.

Some major aspects in the development of an international information system, that makes allowances for environmental issues, say also about the significant restrictions of mainstream economics, highlighted by heterodox critics, who are tightly connected to the present ontological and evolutionary trend of economics, entity economics, and information science: the most critical topics are the repeated economic crisis, the environmental failure, particularly the ecological crises, that are founded also in economic theories, and misconceived choices. This group calls for a new multi-disciplinary effort for solving environmental economic and ecological problems.

2. The emergence of new academic spirit until the mid of the 20th century

2.a. Entity economics, social systems, and environment

The foundations upon which specific disciplines rest are inferences and assumptions related to the needs of 'aims oriented' individuals and entities. The definitional relevant borders of a discipline, *economia aziendale*, entity economics, information systems and so on, and the related profession, from the methodology point of view, is between the symbolic apparatus and the statements that connect this apparatus to the data of empirical world; therefore the critical border tends to separate the psychological features of human being fighting for their ends and attempting to satisfy their needs from the more conventional apparatus of logic and mathematics (extensively Mattessich 1995: 11, Conditional-Normative Accounting Methodology, CoNAM).

If principles are guidelines derived from behavioral and social generalizations, their usefulness and consistency must be expressed in the broader context of aim-pursuing activities and valuable social ends. The methodology therefore includes instruments for appraising valuable ends,

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for defining appropriate means and for establishing necessary devices essential to allow flexibility to face changing automations and effective social ends.

We are struggling with the probable consequences of events as wars, revolutions, inflations, deflations, technological progress, changes in competing enterprises, conflicts of interest between stakeholders, variation in liquidity of the general economy, and in fiscal policies and so on and so forth.[1]

Large 'value production' does not necessarily imply worthy social ethical behavior. In other words, whether the current magnitudes of income and wealth are acceptable data in this regard is a questionable question; this involves, among other things, to keep the 'production conditions' in good economic and physical shape that will increment the beauty and dignity of the community, support excellent work force generally, participate in social political affairs, and operate harmoniously with general accepted social standards (cf. Galassi 2015). Certainly, there is more to *accountability* than 'profit maximization' and 'entity survival' (Gaglione and Girardo 2022; Mancini 2023); the information system has to determine also the 'esthetic values'.

Once again it has to be stressed the interplay of *economia aziendale*, entity economics, and information systems with social systems at work on forging ends and means for reaching these aims, the purpose of information system in society and the influence of social institutions on single and group behavior; this implies coordination of responsibilities (cf. Catturi 2022), management according to the *system of values* and the search for inconsistencies and deviations between a given code of some kind and a 'system of value judgments'.

There can be conflicting ends in specific cases, thus the need to interpret the defined hierarchy of values; such approach tends to bring ethical problems in the domain of scientific methods (see Caselli 2023) by establishing the laws governing the process of value judgements and the operational principles for comparing actual behavior with the generally accepted one. This is an extension of the usual scientific and juridical problem, that is the chain: *facts*, *evidence*, *code or custom*, *similarities and differences*, *variances and finally the decision;* it is clear that the methodology involves also the *social welfare* to reach the decision.

Societies are identified by their *systems of values* (Galassi 2021). The topics investigated by scientific research, the operators who exercise the activity and even the methods of 'causal analysis' are greatly modified or determined by the *values system* and the orientation of the social group.

The culture is a *concept of value* according to Weber (1949, first ed.) The cultural institutions say what knowledge must be recorded and accumulated, conserved, and transmitted to future generations and which area of knowledge is to be developed.[2]

A relevant point is the question of the 'doctrine of objectivity' with respect to the general aspects of 'sociology of knowledge'. This issue is tightly connected with the problem of how a person, or a group can break through the social environment and free himself from the *system of values* (Popper 1962/1966, fifth ed.). The emphasis is on the social character of science and scientific

[1] Favorable situations common to all entities, such as good air, stable governments, peaceful times, are usually considered a general condition in the environment, not subject traditionally to measurement and treatment as 'production conditions'. In some cases, the expected favorable circumstances are 'differential' in the sense they are peculiar to the specific entity. 'Production conditions' include differential advantages related to potential to reach objectives. Some of them may be attained quickly so that most of the benefits are received in a relatively short time. Thus, it is necessary to consider stability of aims for members of the entity and for society.

[2] The integration of sociology and individual psychology and their interaction with *economia aziendale,* entity economics, and accounting research leads to fruitful and meaningful results, taking into account, according to Weber, that insights into psychological preconditions and consequences of institutions presupposes a precise knowledge of the latter and the scientific analysis of their structure; so the institutions are not deduced from psychological laws, but it is exactly on the contrary. The conceptual foundations of entity economics and information systems are to be sought not only in general economics and law, but also in social psychology, socio-linguistic and other branches of the social sciences as well (cf. Bunge 1989: 122-28; 266-67). Furthermore, among the social sciences psychology is particularly prominent in dealing with measurement problems.

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method, considering that theories are elaborated so that they can be tested and confirmed by others. Thus, social institutions govern the methodologies of science and scientific investigation. So Popper concludes that what we call 'scientific objectivity' is not a product of the individual's impartiality, but a product of the social or public character of scientific method.[3] Richard Mattessich (2014: 113), quoting Alexander and Archer (2003:7) points out that 'the desire for objectivity is best understood as a desire to achieve *as much consensus on one's community as possible'*; furthermore he stresses that the objectivity of a theory is best served by disclosing all of its value judgements, and by offering a comparative analysis of their effects as far as this is reasonably possible.[4]

It is worthwhile to concentrate on the needs of society in connection with the information system and the controllers who give feedback; furthermore, it is appropriate to highlight the relationships of entity economics and information systems to the parts of the society who have a claim for information (cf. Moussa *et al.* 2022; Zhao *et al.* 2023) This valuation is a problem of graduating ends and competence and forging hierarchies of quality. Clearly the rating scale is determined by the entity economist's and information scientist's environment and the proper values they assign are part of, and must be consistent with, the general *system of values* in which they operate. (cf. on display Zappa 1962: 284, ff.; Masini 1979: § 8)

2.b Environmental control and ethics in different cultures

The usual approach to environmental control begins with statements about the needs of the environment in which the entity operates and develops information systems to implement these needs (see Minichelli *et al.* 2022); it takes to identify and order the users of the information system, to specify socially legitimate ends, the connected necessary information, and decisions; the controlling process cannot impose a particular set of cultural attitudes on all social groups. Certainly, the influences of the profession, expertise, on group behavior and discipline are particularly relevant to controlling and must not be neglected (Galassi 2019).

It is not feasible to offer full disclosure in a literary sense, and thus becomes necessary to select from numerous events and situations. This selection is a process of abstracting pertinent events and their relevant aspects and dimensions[5]; it is a matter of assigning subjective utilities and determining probabilities and it is precisely at this point that cultural and ethical influences become significant.[6]

[3] It is the case of Russell's (2000/1948) 'scientific man' who is the equivalent of 'economic man' and is rational in the sense of conforming to social institutions of science and standards for rationality. See also Bruni (2019).

[4] The same Author (1995: 186) is "aware of the difficulty of attaining complete objectivity in the social sciences…objectivity is a matter of degree, and I am prepared to accept different shades of objectivity. Since we can hardly attain absolute truth, our objectivity (even in the sciences) is rarely, if ever, pure but usually tainted by one or the other human element."

[5] One relevant point which offers, combined with others, a framework for management science and accounting systems is the assumption of some sort of fundamental 'flow' or some kind of fundamental rights. Richard Mattessich (1957:328-55) gave a great contribution considering a series of events to be a *flow*, and with the help of some axioms, definitions, and requirements, built an axiomatic structure for accounting. See also Galassi 1978.

[6] Some remarks can be made with regard 'truth' and its variants, for example 'truth in entity economics and accounting'. It is possible having a sentence, proposition, true, but due to selection of events, the aspects to be reported, and the measurement rules and scales, the system may encourage misleading inferences. The syntactical concept of 'truth by definition' is not helpful for social problems.
The ethical statements are not subject to the direct true-false moment of formal logic. Most ethical statements are as pseudo-statements, because they do not contain the usual subject-predicate construction. Similar difficulties arise in the field of esthetics. Propositions in formal logic are true or false by stipulation, but in practice there is often disagreement as to whether a proposition is as a matter of fact true or false. This is the difficulty that has led for some authors to replace the true-false dichotomy with the more probabilistic 'warranted assertion', which comes presumably from group consensus. This kind of argument requires induction as to probable results and agreement as to definitions involved.

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The controlling process in any complex integrated society must determine the necessary valuation and reporting standards for the accepted ends and to measure and represent events in order to useful inferences. All such efforts relate to a specific *values system*; the main difficulty is in determining accepted social needs and identifying the classes of interest whose needs are relevant[7].

Classes of interest, stakeholders, often vary widely through time and from one social environment to another. In societies these interests have to be valuated and deciding a hierarchy of values (widely Masini 1964). The information system must determine 'progress' and 'status' of conditions considered sufficiently valuable; a relevant point is whether such information system is to react indifferently to change of social patterns or whether is to take an active part in shaping and shifting the ethical structure itself. Certainly, the information system can play both compliant and positive functions.

All ethical problems are interrelated, and the attention is towards the forces operating to define the *system of values*[8], the measuring instrument, and providing the necessary change. The strong argument is setting ends and objectives and referring to the 'sociological forces' that shape and form the aims and determine the 'socially acceptable' instruments for reaching them. These purposes and processes and combinations are 'socially determined', they are nowadays in a time of rapid change and the experts for every operational field must be highly sensitive in this regard (cf. Borgonovi and Coronella 2022).

Controllers normally feel required to determine whether 'production conditions' are received, processed, and distributed according to the rules of the economic entity, and often less obliged to verify if the rules are desirable (cf. Ferrando 2023). Some degree of authority and freedom usually persists with each individual in an entity, and it is responsibility of controllers the entity valuation and the judgements as to the legitimacy of internal actions at all levels.[9]

As to the disclosure there can be variations in the operations efficiencies of various environments, social, economic-financial, physical, global, and the impact of variable disclosure in different cultures are observable and measurable (Moussa *et al.* 2022). One might guess that great emphasis for disclosure is found in liberal societies.[10] A foundation of a real democratic country is

"If on agrees (1) that the truth of no universal scientific hypothesis is known with certainty and (2) that some inferences (*e. g.* inductive inferences) are better than others (*e. g.* crystal gazing), then it is difficult to deny that all other knowledge consists of nothing but beliefs, though some more reliable than others. This thus not deny the existence of absolute truth, it denies only the certainty of knowing this truth which induction enables us to approximate more or less, but not necessarily to reach." (Mattessich, 1978: 177).

[7] It could happen that in some societies the function of the controlling process may be to conceal information rather than to reveal it. Suppose there is no personal or social censure, and no feeling of guilt or concern over the action: in such cases there is no supreme ethical reason for either concealing or revealing the information. In a poorly integrated social order, there may be little or no feeling of personal misconduct, for instance to suppress information to avoid tax assessment, but there may be a feeling that society must disapprove or that negative economic effects might result. In most cross-cultural cases it is probably easier to make reports socially acceptable than to adapt deep rooted behavior to new moral codes. Spiritual leaders and controllers are in preferred positions to observe such activities.

[8] Following Bunge (1989: 287, ff.) ethics may be *scientific, philosophical,* or both. 'Scientific ethics', or moral science, investigates moral behavior from a psychological, sociological or historical point of view, whereas 'philosophical ethics' investigates the same subjects from a logical, epistemological, methodological, ontological or axiological point of view. By definition, *scientific ethics* is included in the combination of psychology and social sciences, whereas *philosophical ethics* is part of philosophy. Given the tight relationship between *scientific* and *philosophical* ones, *ethics* is defined as the union of its scientific and philosophical aspects.

[9]The stages of responsibility and accountability are tightly connected with the purposes or 'things' with value to the parties, that is *value oriented* (see widely Becchetti 2020). For instance, if a society is interested primarily in the quality, subjectively interpreted, as 'constant loyalty', then the scale for measuring progress to social ends is in term of this quality; in extreme situations it can be abstract from all other features and attributes. It follows the great advantage of a generalization of value, a common denominator of value, to weight different ends and aims.

[10] In democratic areas the expectation is for information widely available, so that the members of a vigilant electorate have a greater base for selection and valuation; in this setting outsiders should have access to more information, which thus enter the public domain.

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the belief that the constituency (intended as a group of people with shared interests or political opinions) is wise enough to distinguish the eventual external claims of politicians from the real situations, with consequent good choices. This wide attitude together with people's sovereignity and the legal defence principle are indirectly connected, in the case of financial markets, to the "efficient market hypothesis". Somehow, intermittently, the constituency is assumed to be able to absorb available information, and its charisma (cf. amply on display Bruni 2021) or the justice system or others[11], replace the usual appeal of the market or different mechanism. Decisions of the constituency as well as of the 'efficient market', in the light of subsequent information, can result unsuccessful. Anyway, for the market or other institutions is preferable to react to precise relevant information than to unsuitable and deceptive data.[12]

The problem is to interpret the 'new value orientation' and to find principles that help replacing absolute faith in the market. Doubtless in present societies one fundamental dynamic controlling force is the information system as an instrument for establishing and maintaining equity among classes of interest, stakeholders, which has never satisfied all social philosophers. Of course, in one past stage of development, the price system, together with its proper complementary *values system* could be relied on to offer an acceptable composition to many evident conflicts of interest.

In present economic environment the management, at least in great corporations, moving in the space left by the decline of the 'price system', sees that its primary obligation is towards the entity and its first duty the mediation between conflicting converging interests of all the stakeholders[13].

Most democratic economic orders' are interested in sponsoring competition and production innovation in the private and public sectors; competitors react to existing markets and innovations, willing to step into situations with favorable prospects, and generally it is better for society that they react to accurate rather than inaccurate or no information of costs, income margins, capital investments and so on, of other enterprises, because this leads to a more efficient and effective 'economic order'[14].

In many developing countries, characteristically, the business enterprises are state owned, so that social cost and social benefit should be dominant. In a capitalistic economy, traditionally, it is assumed that business ethics is a task of legislative power so that social costs are included in private costs, but political and business categories are often similar and the dependence on the legislative power for safeguarding the 'common good' may be misplaced (cf. Bruni 2021). In socialist countries the combination 'politics-economics' may be different; the capitalists often dream someone *demiurge who* provides over the management of capital and the distribution of the resulting values, incomes, among contending parties in a harmonious and equitable way.[15]

Instead to restrict information to competent users such societies try to improve the overall effectiveness of their socio-economic, political, global, environment by encouraging every kind of decision-making dimensions.

[11] Nor is law the only related source of possible wisdom and guidance. Sociologists and anthropologists encounter similar problems in connection with conflicts among cultures, subcultures and other groups, and political scientists struggle vigorously with international law and international relationships.

[12] Liberal economies have particular *elite* groups with more ability than ordinary members, who filter and evaluate the information for them: in less democratic orders such *elite* groups not only assume the function of the market analysts or other mechanisms, but also adopt, as a matter of fact, all the information for the multitudes.

[13] The distribution of 'new value' between present stakeholders (in the form of current dividends, premiums, and so on) and all groups, present and future, who aspire to benefit from a strategy of 'new value production', is a management responsibility, who valuates the need and aspiration of each contending group, and after providing for entity survival, makes the distribution that appears 'appropriate' and 'fair'.

[14] Even in socialist economies disclosure is desirable. A greater diffusion of information means that a liberal socialist constituency can better appreciate the bureaucratic performance and so make pertinent pressures to be a burden to its government. In totalitarian states, regardless social bias and inclinations, wider disclosure helps to undermine absolutism by adding responsible information.

[15] Traditionally the ethical structure appeared comparatively simple, explained by some supernatural being on the basis of written or other evidence, and the evidence normally included a ranking of major social values. With a great competition and an informed environment, the need for single responsibility towards other classes of interest seemed to decrease. The emphasis in the field of

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Information inevitably will come out in some inexorable way and be disseminated regardless of any disclosure methods. It is relevant the path to control it for accuracy and relevance; there is a tendency for inside information with optimal timing to precisely flow the correct distance, not disseminated too far (of little interest and weak), not circulated at short distance (there should be for instance an eager group doing pressure to receive more). In the same way unreliable information sooner or later is detected and its disseminators no longer favored or otherwise punished; but these forces are precisely those at work in any 'efficient-rendering society'. It takes sensing the conditions of disclosure and finding more efficient ways to help those forces to operate. In the short run disclosure is not so equally intensive or extensive in all cultures and each culture has to be evaluated along these lines (on display Devine, IV: 147, ff.).

Economic and general control have relevant psychological overtones. Definite changes in ethical environment affect the kinds of internal control that are effective. The general hypothesis, foundation of the internal control, is that does exist some reluctance in sharing thoughts considered socially undesirable. With powerful internal controls, the controller has a problem whose solution requires collaboration with other operators. The need to convince others implies persuasion, and the difficulties and methods of persuasion differ among cultural groups.

3. The late twenty and early twenty-one centuries

3.1 Heterodox economics, entity economics and environment. Ontological aspects

It is interesting to refer at the economic disciplines and their extension to 'entity theory', *economia aziendale*, and 'information science'. As a matter of fact, economics is in a scientific as well as a practical crisis (cf. Becchetti 2020; Bruni 2021). Above all there is a debate that economic models are insufficient unless their distance with reality is constantly controlled and borne in mind. Moreover, the scientific activities of the various disciplines must be connected to each other by means of philosophic analysis and speculate about those questions that science cannot yet answer, taking into account that even science is fallible; a more disturbing example might be Einstein's theory of general relativity as a fundamental revolution, replacing Newton's theory of gravity in the realm of astrophysics.

At the end the 'application' of every science requires value judgements that may affect, positively or negatively the welfare of some people or even humankind in general. However as relevant as foundational and ontological classification is, ontology cannot be a substitute for model building or for any other methodology or even epistemology. [16]

In heterodox economics, concern with ontological issues fostered a growing interest in the following three expanding subareas:

entity economics and information system changed from the "accept-discharge" form of responsibility statement, with its trusted overtones, to the accounting for gain or loss to residual part, whose set of interests were represented as owners' net equities. Even the basic equation, which emphasized 'responsibilities imposed, and responsibilities cleared', changed to assets equal to 'claims to assets', or some variant, for instance 'assets equal equities', underlying again 'net equity interest'. The relative shift of attention from the *capital account,* which could be interpreted as a kind of responsibility statement, to the *income account* is related to favorable exercises, that stressed self-interest and evidence of 'supernatural approval'. It is only in relatively recent times that it happened a return to the *cooperative ideal of society* with more emphasis on responsibilities to all the other classes of interest and less to self-interest and benefit.

[16] Economists, entity economics theorists, accountants, as well as information scientists should be familiar with the potentials as well as the limits of 'ontology', for the ongoing expansion of computerization of scientific research in most of the scientific disciplines during the next decades. Another reason is that the systems science has anticipated such a trend by attempting to establish 'high level' ontologies and 'lower level 'ones for serving as unified and precise taxonomic systems (cf. Mattessich 2014: § 2.5).

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First, *evolutionary economics* with a critical attitude towards mainstream research, with some pioneers as Veblen (1898); Schumpeter ([1912] 1934, 1942, 1986); Georgescu-Roegen (1971); Boulding (1981); Winter (2005); Witt (2003); Dopfer and Potts (2004, 2008, 2014) and so on. For an extension see Bruni 2019. Second, *ecological economics*, as seen in Boulding (1978); Daly and Cobb (1989); Nadenau (2003); Costanza *et alii* (2004); Ropke (2005); Franco and Missemer (2022) and so forth. Widely in Becchetti 2020. Third, *critical realist school of economics* as presented in Fleetwood (1999); Lawson (1997, 2003); Maki (2001); Soderbaum (2000); Bhaskar (2010) and so on. On display see Becchetti *et al.* 2020.

Economics, entity economics, *economia aziendale,* is constantly imposing implicit value judgements upon businessmen, politicians, administrators and the community at large. The strongest voice defending this argument is Boulding (1969), whose major thesis comes from the systems approach[17]. More precisely Boulding holds that sciences are inevitably endowed with value judgements; it is relevant to underline that in economics, entity economics, *economia aziendale, t*he factual observations themselves are the results of interpretations and value judgements.

As already said, the most fertile soil for ontology seems to become information science. But this exploding interest in reality issues by economists and information scientists received hardly any attention from accountants and entity economists, with exception, for instance, of the comprehensive work by Richard Mattessich (2014), which constitutes a great effort to overcome this particular problem (whose major purpose is exploring an extension of Mattessich's Onion Model of Reality, OMR).

In recent decades a revival of interest in philosophical issues came particularly from the quarters of heterodox economics, management, 'entity theory' and information sciences.[18]

The old topic and criticism of unrealistic mathematical models and their hypotheses as well as the failure to verify empirically many economic propositions implies a search for alternatives through an ontological approach; the first argument is the need for a 'realistic' evolutionary–institutional rather than an 'unrealistic' *analytical* approach to economics. The second reason regards the failure of economics to predict and prevent repeated economic crises, for example the 2008 one and subsequents (see Mattessich and Galassi 2016). The third most critical topic is the environmental failure and ecological crises that is founded also in economic theories, operations, and misconceived choices (Cf. Becchetti *et alii* 2020). All this sponsors a fresh look at traditional economics, included entity economics, *economia aziendale,* and accounting; but this attitude fluctuates from the most radical group, 'the ecological economists'[19] to the moderate 'evolutionary economists', as well as the'critical realists', and conclusively to economists who try to reclaim economics 'from within'. This last group is formed by the more traditional 'environmental economists' and the 'new keynesians', who are different respect the 'neo-keynesians' prominent in the 1950s and 1960s. Anyway, apart the different positions and endeavours, the 'ontological-evolutionary' investigation of economic activity and speculation is relevant, to some degree, at least in clearing the issues.

[17] This topic may concisely be depicted as follows: In some sciences, the center of gravity by necessity is shifting from the purely cognitive to the instrumental aspect, because by improving our understanding of the world, we progressively change it.

[18] The renewed interest, particularly in ontology, arouse from systems scientists for lexical, taxonomic, and related purposes in constructing a wide variety of artificial intelligent systems; this area seems the most promising use of ontology from a practical point of view.

[19] One must recognize the basic relationship between economics and 'ecology' with reference to the study of the 'economy of nature', *i. e.* examining 'how living beings procure their livelihood, compete for it, interact', and it should be no surprise that in the two last decades of the twentieth century an 'ecological economics' emerged. Cf. Gomez- Baggethun and Martin-Lopez (2021).

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In confronting all the different views, it is evident that in to-day 'heterodox economics', and even more in *econobiology*[20], many contributions converge, forming a mighty flow of various positions. Nevertheless, the central core is dominated by an institutional-evolutionary prospect, *institutions and their evolution as shaping the individual,* that claims as its first precursor such classical institutional economist as Veblen (1898, 1904, 1923).

In the interpretations of 'evolutionary economics' a generic 'evolution-monistic' concept is addressed as 'naturalistic approach'; major representatives are Veblen (1904), Hayek (1948), Georgescu-Roegen (1971), North (2005). Topics of analysis are 'long run development, institutional evolution, production, consumption, growth and sustainability'. The radical growing movement of 'ecological economics' began with Nicholas Georgescu-Roegen (1971) and others. These scholars also address the interdependence and evolution of *human economics* and *natural ecosystems* (see widely Pope Francesco, 2023).

As to mathematical analytical economics, entity economics and information science certainly still have great potentials; only it is necessary to keep always in mind that these models are representation of something as ideal, that must be supplemented by ontological, 'evolutionary-institutional' and empirical investigations. Since both subdisciplines of 'ecological economics' and 'evolutionary economics' are in opposition to the mainstream trend there is some common ground to form a united front against neoclassical economics.[21] One of the first work which tried to amalgamate the two subdisciplines is by Boulding (1978).

The difference between the more traditional 'environmental economics' (cf. Anderson 2019; Wiesmeth 2022) and the more radical 'ecological economics' goes to the problem of *externalities* (an externality, negative or positive, is external to a market system). The first answer comes from Pigou ([1920]1932) who suggested to impose a tax un industries that pollute or exploit 'free' natural resources, and so on. Such an approach would internalize negative environmental effects, externalities, and put a cost on the pertinent practices of pollution.

Another approach of 'environmental economics' to internalize the costs of externalities is based on a work by Coase (1960), so called 'Coase's theorem', with the practice of 'tradable pollution permits', whereby a non-polluter sells such a permit to a polluter[22]. Then 'environmental economics' offer further possibilities beyond taxation or buying pollution permits.

There are many difficulties in the application; a major reason why 'emission charges' and 'pollution permits' are not effective solutions is found in a basic assumption of mainstream economics, which assumes that an economy is a closed system. Neither our world nor our galaxy, perhaps not even our universe, in the case the cosmos consists of multiple universes, might be a closed system (see Mattessich and Galassi 2016). Thus, deductivism and the claim that mainstream economics is based on unrealistic hypotheses form the very core of the ecologist's critique.

The hypotheses that economics ought not be limited to markets and their negotiations but enlarges to wider systems that comprises the entire biosphere is nowadays often declared; the emphasis is on human beings as an integral part of nature (for humanist entrepreneurship see Coda 2023; cf. Gomez-Baggethun and Martin-Lopez 2021).

[20] Econobiology is an interdisciplinary academic research area, combining the methods and subjects from economics and biology, such as evolutionary approaches to dynamics of economic events. It is tightly connected to 'circular economy', an economic system which auto-generates, allowing therefore also its eco-sustainability.

[21] There are various *evolutionary* trends, as well as their parallels and differences, so we have to pay attention to another branch of heterodox economics, that between the more radical 'ecological economics' and the more moderate 'environmental economics', usually considered as a separate part of traditional economics.

[22] "They give companies a legal right to pollute a certain amount per fixed time span. Firms that pollute less can then sell their leftover pollution permits to firm that pollute more" (https://gwp.org, C7.03).

De Computis, Revista Española de Historia de la Contabilidad
20 (2), diciembre 2023, 29 - 47
ISSN: 1886-1881 - doi: http://dx.doi.org/10.26784/issn.1886-1881.20.2.9376

Yet, the purpose of 'ecological economics' is to investigate the connections between economic activities and ecosystems (Panfilo and Krasodomska 2022), as well as assuring the sustainability of our biosphere (cfr. on display Pope Francesco, 2023). Thus, the assumptions, the premises, methods and aims of 'ecological economics' are so acutely opposed to mainstream economics, that the integration between the two fields appears extremely difficult (for differences and similarities between them see Mattessich 2014: 200).

'Ecological economics' is a trans-disciplinary tentative set (multi-objective optimization and advanced topics) with intricate connections to biology, sociology, psychology, even physics; the trans-disciplinary status of the subdiscipline provides it with a quite novel cognitive basis, and has not simply a positive function, but also a normative purpose, that is to save our biosphere from changes that would lead to the failure or end of humankind, or at least a major part of it. In this way economic science is not merely accused to produce gross economic mismanagement and the failure to predict major economic financial crises, it would also hold responsible for endangering the welfare and survival of humankind in general. Even if ecological economists are only partly right, their arguments can hardly be disregarded.

3.2.- Evolutionary, environmental, ecological ethics, and ontology

It is worthwhile a short discussion about the kind of controverses of 'evolutionary ethics', not only in connection with 'environmental and ecological economics' (on the management of environment see Bunge 1989: 356-362) but also with 'evolutionary ontology'. The terms 'ethics', 'moral' and 'morality', and connected verbs, and so on, are normally used as synonyms. Nevertheless, it is necessary a more precise terminological differentiation, as offered by Schweitzer and Galassi (2012: 64-5). There, 'morals' are defined as a 'system of rules, norms and values set up in common by a group of persons, and accepted as bounded per se', while morality is seen as 'the will to be good'. 'Norms' are considered as 'general prescriptions, value judgements, imperatives, instructions and affirmations of duties from human behavior'. 'Ethics' on the other hand is defined as 'a system of statements relating to moral decisions and actions'.

'Environmental ethics' developed during the 1960s and 1970s, has precursors in Immanuel Kant and Albert Schweitzer. Beyond that, 'environmental ethics' is based on principles of general ethics developed by Kant, emphasizing the notion of 'absolute or categorical imperative' on one side[23], in contrast to later developments, such as Jeremy Bentham's utilitarian philosophy on the other side. From these two opposite positions a large number of different variations of 'environmental ethics' were developed during the last half century (among numerous publications see Boylan 2001, Des Jardin 2001, Fox 2007, Rolston 2020).

Despite that Kant's imperative, if assumable not categorical, and Bentham's principle are ethical norms for the benefit of humankind. This reasoning, based on the abandonment of an absolute or God-given imperative, drives to the consideration of modern 'evolutionary ethics' that attempts to found different systems of morality in multiple empirical investigations and their development. In this regard we have to differentiate precisely 'environmental ethics' and 'evolutionary ethics' (cf. Wilson 2000, Boniolo and De Anna 2009): the former is concerned with ethical issues of the biosphere, while the latter with the origin of ethical norms. The new perspective affirms that

[23] Particularly the imposing of a categorical imperative is a difficult if not impossible task. For this reason, Richard Mattessich considers categorical imperatives as *ideals* and valuable guidelines for society and specifically for individuals who believe in them and have the determination to adhere to their prohibitions; a categorical imperative is *absolute* only as an ethical but not as an ontological principle. This keeps even if Kant's transcendental *idealism* express itself on all levels: on the ontological level in the things-in-itself, on the epistemic level in the *a priori* knowledge, and on the ethical level in the categorial imperative itself.

De Computis, Revista Española de Historia de la Contabilidad
20 (2), diciembre 2023, 29 - 47
ISSN: 1886-1881 - doi: http://dx.doi.org/10.26784/issn.1886-1881.20.2.9376

'existence', for instance of a moral behavioral attribute, can reveal itself as a 'norm', thus relating ethics to ontology[24].

There are the issues of cause and remedy of the global as well as local ecological crises (see extensively Pope Francesco 2023). Even if the increasing population growth as well as the industrial development must be regarded as major offenders of the environmental crisis, the problem of remedy and possible compromises constitute huge moral and juridical questions debated by philosophers, economists, politicians, and population generally. But besides the vast literature on 'ecological ethics' there is also a considerable literature on business ethics, that sometimes includes ecological issues[25], but mainly concerns problems of fairness, equity, honesty towards the stakeholders, stockholders, majority and minority, employees, financiers, public entities, social responsibility, and so on and so forth. Indeed, Carlo Masini characterizes business ethics as follows:

"Economic principles are not firm aims. The 'moral' defines the high aims of business community; other aims, also economic ones, find their own limits in ethical aims. The various combination of aims brings at different configuration of economic relationships and of principles that outline the theory. Ethical aims, together with other aims, are considered by *economia d' azienda*, entity economics, constraints for its principles" (Masini 1960: 2-3, 6) [*our translation*].

Taking into account the limits of 'idealism and categorical imperative', it is necessary a 'realistic approach', to the decision in the competing 'utilitarian principle', which encounters difficulties with reference the measurement of benefits and costs, but with definite advantages from the pragmatic point of view. If an agreement is possible concerning some environmental decisions, that is assigning 'moral status' to some entity or action, be it on a regional or higher governmental or inter-governmental level, this would still be a 'normative act'. On the other side, as the execution of such decision will involve social reality, it affects real or factual consequences. Needless to say the problem of the sort of agreement to be achieved goes beyond ontology and belongs to ethics, that means to the choice between 'instrumental value', the value of things as *means* to reach some other ends, and 'intrinsic value', the value of things as 'ends in themselves' regardless of whether they are useful as instruments to other purposes; evidently the methodological problem of measurement has to be separated from the ontological problem of existence.

4.- Further developments. National and social information systems. Ontological approach to enterprise applications

Apart the ontological status of such notions as cost, revenue, income, capital, and so on from a micro viewpoint, the trends of evolutionary and ecological economics make necessary to look at the corresponding problems, product, expenditures, income, wealth, welfare and so forth, also from a macro point of view, particularly under environmental considerations[26]. Some interesting questions arise, such as the adjusting and enrichment, if possible, of traditional information systems to satisfy ecological requirements (e. g. Acunzo and Abate 2021; Fiorina et *al.* 2023); perhaps we need entirely

[24] The systems approach might be enhanced by giving it an ontological grounding, that is by stating assumptions about the 'existence' of definite entities and events and by showing the system notion as being rooted in the foundations of science.

[25] The search for a political or normative 'entity economics' and accounting copes with social and ecological-environmental problems. Information science, ecology, systems science, and the widespread concern for environmental pollution have vividly demonstrated that we cannot understand our 'social-economic reality' without studying the *interaction between cognition, valuation, and action* and without incorporating normative propositions in our models.

[26] To make environmental information meaningful it is relevant to investigate environmental issues from the points of view of economic-financial, management, and macro-information system (Borgonovi and Coronella 2022).

De Computis, Revista Española de Historia de la Contabilidad
20 (2), diciembre 2023, 29 - 47
ISSN: 1886-1881 - doi: http://dx.doi.org/10.26784/issn.1886-1881.20.2.9376

new magnitudes as indicators of 'true' cost, wealth, growth, deterioration, and the 'true' cost of human activity in different countries as well as globally. It is evident that this issue, as most economic ones, has a normative flavor.

'Systems of national accounting' constitute the area of economics with great efforts during the last few decades to include environmental considerations than in other economic subdisciplines; it seems also that 'national accounting' has a program that justifies more stability than other economic subdisciplines[27]. Such ideas seem being considered in recent attempts to revise national income accounts (for instance United Nations *et al.*, SEEA-2003, *System of Integrated environmental and economic accounting* [cf. Smith 2004]). In recent decades there have been many endeavors to extend the theoretical basis as well as the practical aspects of the more traditional 'systems of national accounts'.

System of ecological and economic accounts, SEEA-2003 is a mere proposal for a system that considers also ecological issues, greatly developing the *System of national accounts,* SNA-1993 (see United Nations 1993), by means of satellite accounts and other extensions. So great endeavors are continued for the welfare of future generations as well as to take in consideration the technical progress. On the other hand, such endeavors complicate the theoretical framework, presenting additional obstacles for practical application. All these experiments are unified by a basic issue, that is a *purpose-orientation*, with the same normative problems as encountered in valuation issues of business accounting.

Through SEEA-2003 (United Nations *et al.* 2003), was established a *System of social accounts* that solved many limitations of the traditional SEA system, even if SEEA-2003 has been much appreciated but also highly criticized. Some major aspects in the development of an international system of national accounts that makes allowances for environmental issues say also about the significant restrictions of mainstream economics, highlighted by heterodox critics, who are tightly connected to the present ontological and evolutionary trend of economics.

Excepting traditional philosophic attempts by Edmund Husserl (1900-01), Nicolai Hartman (1948, 1953) and other philosophers, one of the first comprehensive ontologies for *artificial intelligence*, 'systems ontologies', was the Cyc-project. It was conceived in 1984 by Douglas Lena and has since been developed by Cycorp. This particular ontology has been judged one of the most controversial projects in the history of *artificial intelligence*, AI.[28]

Among the major attempts of connecting 'systems ontology' to accounting and business economics is 'REA Enterprise Ontology' for analysing economic 'Resources, Events, Agents'.[29] The goal appears the design of 'domain ontologies', that is the categorization and taxonomy schemes for accounting purposes, specifically for an improved codification of Generally Accepted Accounting Principles.

The REA project was based on the observation that the direct input of traditional accounting data into computerized databases may involve dysfunctional effects. Its framework is developed from an investigation of conventional accounting structures, and it is interpreted using the ideas of many accounting theorists, mainly Richard Mattessich (1964) and Yuji Ijiri (1975) [see Galassi 2018]. To

[27] It is interesting the possible integration of the United Nations macro-environmental accounting, SEEA (United Nations 1993) with the micro-environmental accounting in relation to the Environmental Management System, EMS, as proposed by the International Organization for Standardization, ISO. As to macro-accounting and micro-accounting, both referred to public entities, cf. Lombrano 2022.

[28] An even narrower notion of ontology is found with OWL, Online Writing Lab, taking into account that OWL is neither a philosophic nor a system ontology but a computer language, that can be used in combination with such upper-level ontologies as BFO, DOLCE, GFO, SUMO.

[29] This project began in 1992 by McCarthy, with development and extension in a vast literature, among which Geerts and McCarty (1992, 2002), Gailly *et al.* (2008), Lupasc *et al.* (2010), McCarthy *et al.* (2022). Another branch related to REA is represented by Chow *et al.* (2008), Swanson and Freeze (2009), Chou and Chi (2010).

De Computis, Revista Española de Historia de la Contabilidad
20 (2), diciembre 2023, 29 - 47
ISSN: 1886-1881 - doi: http://dx.doi.org/10.26784/issn.1886-1881.20.2.9376

overcome the limitations of traditional accounting, REA incorporates a specific semantics – founded in a set of basic business activities, such as the cycles of 'acquisition', 'conversion' and 'revenue generation'—into the entity information system. The latter may, in sequence, be enclosed into a specific Systems Ontology. In this way a REA-based architecture can be designed for a specific enterprise.

There is a third branch of this ontological approach towards business application, named Information Systems Analysis and Design, ISAD, introduced by Wand (1988) with subsequent papers by Wand and Weber (1995, 2006), Evermann and Wand (2009). This branch is based on Bunge's (1977, 1979) axiomatic ontology.[30]

Information science, as applied to any discipline, has the task of designing computers suitable of offering information for a great deal of aims, among which the representation of the supposed reality is the first one. The aspiration is generating new knowledge for a wide range of disciplines and sub-disciplines; consequently, computers are expected to undertake some functions previously solved only by human minds, or not solved at all. However human minds are infinitely more flexible and adaptable to new situations than are computers. These may be more powerful and much faster, but they have not the intuition necessary to complete data or make decisions when totally new and not defined problems are faced. Thus, computers must not only be pre-programmed in special language codes, they also must be made much more flexible. This possibility for artifacts, even for quantum computers so powerful -- that cannot feel emotions, hopes, aspirations, pleasure, pain, and so on – seems a dream, as a matter of facts not realizable.

In any case the first move for a 'systems ontology' is to devise categories and precise definitions comprehensive enough to anticipate many significant situations within the aim of a specific task. Classification and categorization are essential for the success of automatized information systems.

It is relevant the distinction between 'ontology in the traditional and philosophic sense', and ontology in the new meaning as interpreted in the 'systems sciences'. The latter stresses the classificational and semantic issues and it is much interested in processing the resulting 'domain ontologies' as in implementing a fairly general 'top-level ontology'. For this motive a 'systems ontology' has to embed a common taxonomy, with a specific definition of objects, their properties and relations, a vocabulary, for ordering knowledge in a great variety of areas. The scale of application should be all including and should, through a hierarchy of specific 'domain ontologies', reach from management and accounting to physics, biology, and medicine, as well as the 'systems sciences' and other fields of knowledge.

It is ontology not science, where we attempt, on the highest level of generality, to connect the specific scientific disciplines, not simply from a taxonomic but from a deeper 'evolutionary' perspective. The interrelationships among different scientific areas are the forces on which ontology, as Richard Mattessich and most scholars interpreted it, flourishes and becomes genuinely fruitful.

Consequently, the categories and interrelationships of 'philosophic ontology' express the fundamental constituents, structures and interconnections of the entire universe, not simply of concepts. And this says the need for specific 'domain ontologies', that are related on individual sciences, with the major problem of interrelating all 'domain ontologies'. Finally, further research of 'systems ontology', not present in the ontology of traditional philosophy, has to be joined, that is the

[30] As to SUMO, Suggested Upper Merged Ontology, it is the largest formal public ontology. Moreover, there is the attempt of integrating SUMO with various domain ontologies into MSO, 'Multiple-Source Ontology'. There are many others standardized upper ontologies, but not yet any workable large-scale system to show ontology promise of superior information, organization, management of business enterprise. Until now most ontologies have been produced manually. Hence the need for alternatives apt of achieving ontologies by means of *artificial intelligence*. There is not yet a standard ontology in the information science community.

De Computis, Revista Española de Historia de la Contabilidad
20 (2), diciembre 2023, 29 - 47
ISSN: 1886-1881 - doi: http://dx.doi.org/10.26784/issn.1886-1881.20.2.9376

computerization of the process of knowledge production and dispersion; but the huge computer power requested in this regard needs the arrival of quantum computers above the present ones.

5. Conclusions

Great 'value production' does not necessarily imply valuable social ethical behavior, being more to *accountability* than 'wealth maximization' and his overriding influence; in the real world there exist multiple objectives, often, especially in past times, suppressed under this restricting assumption. A related issue is the neglect of environmental and social issues, consequently the wealth maximization becomes short term instead of long-term maximization, and the disastrous consequences of this can be seen everywhere in the economic social life on many countries and continents. There is a sufficient reason to stress again and shift on the more basic issues of *accountability and ethics*. Whatever the opportunity costs arising out of the past and present neglect of these crucial problems are, everyone can see the immense economic and social damage incurred by all the connected choices and decisions, including omissions.

The connections of 'entity economics', *economia aziendale,* and information systems with social systems is fundamental in focusing a 'conditional normative' methodology. One would assume that this concern for objectives directly translates into the investigation of the related means; the value judgements proper of the objectives are to be clearly defined and perceived: *societies are identified by their* '*systems of values'.* Usually the disclosure, observable and measurable, is different in various cultures and environments, social, economic-financial, physical, global.

General economists, entity economics theorists as well as information scientists should be familiar with the potentials and limits of *ontology* for the *continuum* expansion of computerization of scientific research in most of the scientific disciplines in next decades, taking into account that the most fertile soil for *ontology* is becoming 'information science'.

The renewed interest in ontology arose from 'systems scientists' for lexical, taxonomic and related purposes in constructing a wide variety of *artificial intelligent systems*; this area appears the most promising exploitation of ontology from a practical point of view.

The critical topic of repeated economic crises, the environmental failure and ecological crises, founded also in economic theories and misconceived choices, implies a search for alternatives through an *ontological approach*. Anyway, apart the different positions and endeavors, the *ontological-evolutionary-institutional* analysis of general economics, entity economics, *economia aziendale,* information science, is relevant, to some degree, at least in clearing the issues.

Ecological economics, as a transdisciplinary tentative set, multi-objectives optimization, with intricate relations to sociology, psychology, biology, even physics, aims to investigate the connections between economic activity and *ecosystems*, as well as assuring the 'sustainability' of the biosphere. The widespread concern for environmental pollution has vividly demonstrated that we cannot understand the 'social-economic reality' without studying the interactions between *cognition, valuation and action* and without incorporating normative propositions in our models.

If we assign 'reality status' to 'social entities', there should be no problem in regarding the 'moral status' of a social action as an 'ontological entity'. If agreement can be reached related to such environmental decisions, both at local, and intermediate or global level, this would still be a normative act; on the other hand, as the execution of such a decision will affect social reality, it has *ontic* consequences. Of course, this question goes beyond ontology and belongs to ethics, in other words to the choice between *instrumental value*, the value as mean to other ends, and *intrinsic value,* the value as an end in itself.

De Computis, Revista Española de Historia de la Contabilidad
20 (2), diciembre 2023, 29 - 47
ISSN: 1886-1881 - doi: http://dx.doi.org/10.26784/issn.1886-1881.20.2.9376

'Systems of national accounts', 'systems of ecological and economic accounts', and their integration, represent the area of general economics, entity economics, *economia aziendale* and information science that made allowances for environmental issues in last few decades; some major aspects of the developments at international level say also of the significant restrictions of mainstream economics, highlighted by heterodox criticism, which is tightly connected to the present ontological evolutionary trend of general economics, entity economics, *economia aziendale* and information science.

Economics, Events, Agents, *REA enterprise ontology*, is among the major attempts of relating 'systems ontology' to entity economics, specifically business economics, *economia aziendale* and information systems; the entity information system may be enclosed into a specific 'systems ontology'. In this way a REA-based architecture can be designed for a defined enterprise.

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