# SUSTAINABLE DEVELOPMENT WITH *INDUSTRY 4.0* IN PROSPECT

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**ABSTRACT:** *Industry 4.0* and the associated idea of *society 4.0* pose specific challenges for the concept of sustainable development. These challenges relate, *inter alia*, to responsibility, in which the changes to date have overall entailed:
- a transition from *ex post* responsibility to *ex ante* responsibility (H. Jonas);
- a transition from individual responsibility to corporate social responsibility.

In the context of society 4.0 there is a need for shared responsibility. The problem of justice and therefore the implementation of sustainable development not only becomes an open problem, but also requires constant updating and specific optimisation.

**KEY WORDS:** *Industry 4.0, society 4.0*, technology, responsibility, corporate social responsibility, sustainability.

## INTRODUCTION

Globalisation processes, as the main factors helping to dynamise contemporary transformations, are in general characterised by a certain opacity and uncontrollability. This reflects a complex nature; with so many determining factors present that various chance effects appear alongside what is regular and foreseeable. Today, the dynamics underpinning globalisation processes mainly result from factors of an economic or technical nature. In fact, though, within the said processes it is simultaneously possible

to encounter the global and the local, and it is the capacity of each to determine the other which ensures that no dimension operates entirely in isolation, given the total lack of primary, completely independent factors. The concept of sustainable development, while also characterised by an inherent lack of transparency, may nevertheless be regarded as a regulating idea where globalisation processes are concerned. While the concept underpinned by inter- and intra-generational justice is hard to instrumentalise, not least because of difficulties encountered with finding a universal measure of what belongs to whom, justice as a constitutive idea may be supported by the idea of responsibility, which is more suitable for instrumentalisation than justice, even if that is linked with certain defined difficulties of its own, as well as some unavoidable "costs". These reflect the way in which responsibility and its requirements are conceptualised, with challenges in consequence posed to both theory and practice.

## THE TRADITIONAL CONCEPTUALISATION OF RESPONSIBILITY AND ITS LIMITATIONS

Traditional ways of understanding responsibility linked it with a "perpetrator" – as an object of relevant activity, and one who is at the same time aware of the consequences that arise from that activity. Responsibility lies along the boundary between knowledge and an object acting with intent. The object of the said responsibility was thus an individual directed by a relevant intention and – in an aware manner – giving rise to something that is the effect of his or her actions. H. Jonas defines this as *ex post* responsibility, which is to say the kind that has been rendered or effected and is, as it were, a done deal (Jonas 1996, 167 *et seq.*).

The horizon for looking at the action and its consequences is here confined to direct outcomes of actions that are also proximate in terms of both space and time, with responsibility then residing in the sphere of the perpetrating power of the human being and whatever it is that is given effect to as a result. The objects of responsibility are merely individual entities, the subject the consequences of actions given rise to, and the instance – conscience (Ingarden 1987, 97 *et seq.*).

Today, this kind of understanding of responsibility would seem inadequate, given the changed nature of human activity. In fact, new features are now being taken on given that:
- collective activity organised institutionally is coming into being, with the objects of actions then becoming collective, as opposed to being individually-based;
- the consequences of relevant collective actions can be cumulative in nature, because those arising from individual actions become summed, to give appropriate final results;
- consequences arising out of joint action – in structures more in the nature of networks (heterarchies) than hierarchies – reflect the appearance of many chance consequences that assume an intentional nature; however, alongside the network-related interdependences, a consequences of this type also arise from the institutionalisation

of activity, as well as the fact that technology – inseparable from many actions as it is – is not an entirely neutral medium (Lizut 2014, 71 *et seq*.);

• conscience, and its role as an instance *vis-à-vis* responsibility, is limited, given *inter alia* the partial nature of direct perpetration or authorship of action, the temporal and spatial separation of actions from their consequences, and the intermediation in activity that technology provides.

These limitations on the traditional way responsibility has been conceived of ensure that attempts to distinguish between responsibility and authorship/perpetration are making their appearance. Indeed, the issue of the linkage between responsibility and authorship/perpetration gains partial resolution in the concept of *ex ante* preventative responsibility of the type referred to by Hans Jonas (Jonas 1996, 170). The subject of responsibility is then not only what has been done (or perpetrated), but also – first and foremost – what might conceivably be done (or perpetrated).

However, Jonas's concept still refers to individual objects or entities, not taking account of the role of institutionally-organised activity. The problem of institutional responsibility – dubbed corporate – was *inter alia* a subject of different discussions relating to business ethics (*Etyka biznesu* 1997). However, the matter emerged as not readily resolvable, with the result that – through to today, in spite of many attempts – we do not have an appropriate concept of responsibility to meet all indicated requirements.

As the dispute present on the theoretical side would currently seem non-resolvable, matters of responsibility have tended to be shifted in the direction of the practical – hence the appearance of this now-familiar manifestation of Corporate Social Responsibility, which is of a different nature, and largely inadequate (or at least of very limited value) when set against the upcoming prospect of *Industry 4.0*[1].

## *INDUSTRY 4.0* – THE ETHICS OF ROBOTS

In general, the *Industry 4.0* concept relates to changes in production and manufacturing processes, though its further consequences may also be felt in management, the ways given organisations operate, and relationships between different objects participating in economic processes. It is to be expected that changes will also encompass society and culture, not least because new requirements – for example as regards responsibility – will be making their appearance. At the heart of the concept is the development of ICT and AI, as well as the possibilities for these to be made use of in the management process. What is involved here as a result is optimised activity on the part of various organisations, albeit of such a kind as will be all-embracing in its nature. For today's

[1] The term applied in Germany is *Industrie 4.0*, while American references are to the "Smart Manufacturing Leadership Consortium" or the "Smart factory". Initially, the idea related to manufacturing processes, and thus far the relevant discussion has been dominated by matters of a technical or technological (also obviously ICT-related) nature. However, any possible changes will probably not be confined to these dimensions, but rather assume much broader characteristics.

optimisation takes place sector by sector, leaving it quite difficult to even arrive at an appropriate summary of what is happening.

In consequence, the flexibility of the organisation so taken for granted in fact proves to be of limited practical significance, often being stuck at the level of declarations. The idea of *Industry 4.0* (Maślanka 2014) assumes the possibility of a permanent and ongoing optimisation taking place in real time, with the result that the aforesaid organisational felexibility really does reach a very high level. Optimisation of activity (as conceived of broadly) is in fact a core objective associated with pursuit of the *Industry 4.0* concept. Key tools underpinning achievement of the objective are of course programmes linked with the development of modern ICT, not least through cloud computing, Big Data, the "Internet of things", and so on. Another basis here is the development of smart technologies that allows systems to become self-correcting and self-steering in their operations. This in turn provides for various kinds of optimising activity to be engaged in real time, with the further consequence that the real and virtual worlds will become less and less distinct. Furthermore, the change is of such a kind that its introduction will no longer require some kind of "critical mass" to be exceeded.

From this point of view, *Industry 4.0* can be viewed as an element of the contemporary culture dubbed "real virtuality" (i.e. no longer as virtual reality) by M. Castells, given that that which is real and that which is virtual is now so intermingled that the process of mutual separation and distinction ceases to be possible (Castells 2007, 378 *et seq*.).

The result or outcome if the goals assumed for the *Industry 4.0* idea are achieved would or should be the construction of such an organisation as will possess certain unique or characteristic features. This is to say that:

- an intelligent organisation (smart factory) should arise, which not only operates automatically, but is also capable of self-optimisation, i.e. rapid adaptation to change and a response to signals inputting from the (closer and wider) surroundings;
- the organisation should also have the capacity – and be given the opportunity – to engage in constant monitoring of its own product, with correction possible, as well as adaptation to the individual needs of particular customers;
- the whole system – given effect to on the basis of ICT (including of a mobile nature) – will be based around communication between different participants, not only in the processes whereby defined products are generated, but also in those by which the said products are disseminated and utilised;
- the intelligent system or network put in place will be a holistic entity at once real and virtual, with the world of "real virtuality" it gives rise to being a link-up between the objective and the subjective;
- the system/network will consequently be sensitive to defined values and changes therein, albeit with the *modus operandi* not merely dependent on appropriately linearly-structured knowledge, but also open to the possibility of impact from various different impulses and factors, with the result that states emerging in real time will reflect more than just straightforward cause-effect determinations.

While the features characteristic for the *Industry 4.0* concept presented here may still seem something unreal as of today, many of the solutions referred to here are in fact possible in the here and now, on account of the already-extant ICT-related and general technological possibilities. And as the *Industry 4.0* concept becomes a reality, "society 4.0" will be taking shape, side by side with its promotion and propagation in this way of the culture of real virtuality.

At times, *Industry 4.0* is in fact defined as a further (now 4th) Industrial Revolution, following on from:

•   the steam engine and the appearance of the first factories;
•   mass production *inter alia* achieved thanks to the conveyer belt and assembly line;
•   preliminary processes of the automation of labour and introduction of ICT systems.

The opportunities are now provided by the introduction of robots into – and hence the automation of – manufacturing processes. Particular robots will be taking on more and more functions traditionally linked with human activity – and not only of a physical nature, but also intellectual. Given the possibilities for programming and reprogramming, these will be flexible in their way, making their deployment in the manufacture of a range of products possible. This may also be facilitated by the use of 3D printers.

However, the road to the development of *Industry 4.0* is not only dependent on the possibilities for defined technologies to be deployed, given that the changes induced by this form of management will go wider, to also involve the social and cultural spheres. In this context, this will leave the development of *Industry 4.0* as a challenge relating to various different dimensions to sustainable development, albeit confined in this paper to matters relating to responsibility.

*Industry 4.0* and the associated processes of automation and increased reliance on robots raise ethical questions, not only for the human being as the object of particular activity, but also for the robots themselves, whose functioning should be constrained by certain ethical standards. In connection with this, a question arising concerns the sense in which, and the extent to which, the status of object can also be assigned to robots, with this also denoting their being granted the status of ethical entities. In the case of intelligent robots this may in fact be an unavoidable necessity, given the way these have a defined range of freedom, and an associated requirement that they make right and relevant choices. And that indeed denotes a certain kind of status as objects needing to be ascribed to them.

The matter of ethics in robots was of course taken up by scientist and science-fiction writer Isaac Asimov, who even developed his "Three Laws of Robotics" (Asimov 2013, 25), which were to regulate the relationships between robots and human beings in circumstances of an ongoing process whereby the world of machines and technologies became increasingly autonomous. From the sustainable-development point of view, Asimov's "Laws" look overly anthropocentric, though – having said that – the development of *Industry 4.0* will indeed increase the significance of human-technology

(i.e. human-robot) relationships, as trust in technology will be one of the aspects making joint action possible.

In some degree, robots will also have to be fitted out with appropriate normative systems. However, these will now go beyond anthropocentrism (the safeguarding of the human being), to take account of the wider systems of values and standards that make up sustainable development. This is all the more true given the dose of responsibility-cum-accountability that may be assigned to robots. As the sci-fi writers noted, the quantitative and qualitative development of the world of robots may also pose certain threats to humankind; and that ensures our approach to the preventative ethics formulated by Hans Jonas, for whom: "Never must the existence or the essence of man as a whole be made a stake in the hazards of action" (Jonas 1996, 81).

## FROM RESPONSIBILITY TO CO-RESPONSIBILITY

The *Industry 4.0* concept assumes the need for joint action – in decisionmaking processes and relevant choices and activities – of many objects that have been largely independent of one another hitherto. What are therefore to be limited here – quite specifically – are the different traditional ways in which responsibility (including corporate social responsibility, or CSR) is conceptualised. The idea of social responsibility is currently regarded – both theoretically and practically – as among the key concepts by which sustainable development can be made a reality. However, there are several limitations to this, of which a key one concerns the object thereof, given that this may not solely be whatever it is that the direct goal of a given institution represents. For the subject of social responsibility may be everything that results from the commitments objects take on voluntarily.

That said, a problem arising here is that harm done by some activity can no longer be fully compensated for by others. There thus appears a normative and axiological problem associated with the lack of capacity for some values to be substituted by others. In a procedural sense, social responsibility may be seen as linked up with the principles of distributive justice. However, in the normative dimension it loses its regulatory character, at least to some extent.

The *Industry 4.0* idea addresses responsibility and its requirements, linking up with a defined level of trust in relevant technical (ICT) systems. It functions in a relatively autonomous manner, hence the introduction of defined and intentionally motivated impulses may evoke processes throughout the system that are not fully foreseeable, even though their outcomes will need accepting by defined objects. These outcomes – or more broadly these consequences – of appropriate activity and choices, will be linked with limited knowledge on the part of particular objects, hence the need for trust, in order that the whole system might be in a position to operate optimally – as guaranteed by technical factors and defined ICT systems. In this regard, it is necessary to assume,

at least on the basis of the knowledge existing currently, that the vulnerability and flexibility of relevant systems will not be unlimited.

The intended actions of relevant objects will here be coming up against barriers, as well as a particular kind of vulnerability characteristic of the relevant systems. Here, trust therefore embraces, not only references to technologies and the ways in which they function to ensure an ultimately-suitable optimisation of activity on the part of the whole; but also other entities. It must be assumed that the intentions which lead and guide it are right and good, and if the opposite is the case, then these will be suitably blocked, at least to some extent, by the technical (ICT) system. The role of trust, in relation to both other objects and technical systems is thus seen to manifest itself in consequences, given the way in which:

- it is based solely upon limited knowledge, meaning as a result that it is built on an awareness, not only of knowledge, but also of a defined level and type of ignorance;
- it is one of the factors setting a limit on the complexity of a situation that confounds different objects, operating, not in the sphere of knowledge and certainty, but rather in that of a defined non-transparency, ignorance and uncertainty (Giddens 2001, 184 *et seq.*; Giddens 2008, 57 *et seq.*).

In this case, we are dealing with another environment for, and conditioning of, responsibility, as what starts to assume greater significance in this process is ignorance, and not merely the knowledge and awareness we have been dealing with up to now, when it comes to the requirements associated with responsibility. The building of trust is linked, not only with the possibility for different objects to participate in implementation and decisionmaking processes, but also – of necessity – with a requirement that appropriate communication between objects be engaged in. Ignorance is also that which is subject to relevant differentiation (Zimmerli 1987, 92 *et seq.*). The area of co-responsibility thus goes beyond what human beings know, into what they do not know. Ignorance, and the awareness of ignorance, may here be of different subject and scope, and can thus be linked with defined and varied commitments. Knowledge and ignorance permeate into one another, and so it is not in line with their separation and some indication of the boundaries of knowledge that we may at the same time set the limits of co-responsibility of different objects. Rather, in this case, the scope of co-responsibility extends beyond the intentions of jointly acting objects, as it must also include the sphere of what is not intentional.

The latter area should encompass: a) consequences generated intentionally by other objects co-participating in defined processes, and b) consequences arising out of functioning of defined technical (ICT) systems that is independent of these objects. In both areas, we are dealing with the co-existence and special kind of attrition pertaining between knowledge and ignorance, as well as that which is intentional and that which is unintentional. The possibility of regulation and control being exercised over processes as complex as those that *Industry 4.0* will entail, will be a matter for the human being

as active participant, but will also have in part to be built into the means of functioning of relevant technical systems (Campa 2011, 69). This requires the formulation of appropriate ethical principles for those constructing and developing robots and for they themselves. It is also in this context that principles as follows are formulated, i.e.:

- a robot must be controlled by a human being;
- the improper or illegal use of robots needs to be prevented;
- data preserved by a robot need to be protected;
- each robot's activity should be the subject of monitoring;
- each robot should be equipped with a unique identifier (Campa 2011, 69)[2].

In this case, the emphasis is on proper use being made of robots, with this needing to incline everyone to augment formulated principles with standards and values linked to sustainable development in its basic ecological, economic and social dimensions. The responsibility of particular objects will not be located solely within the scope designated by an intentional and consciously generated set of consequences; but nor will this be a divided responsibility appropriately subordinated to a defined object. Rather, in this case everybody takes responsibility for everything, and in this way also the subject of responsibility remains the same for all objects. However, this may not be determined top-down, unambiguously, on account of the aforementioned flexibility and openness of the technical system, within which the actions and decisions of particular objects will be interwoven. They must remain related to techniques and technologies, while being interrelated within a situation of trust shaped appropriately, as well as simultaneous mutual communication. In this regard, communication will be one of the main bases upon which co-responsibility is shaped as an important tool of regulation in the case of *Industry 4.0*. Contemporary media technologies allow for this communication, and hence, within the framework of *Industry 4.0*, the role will be a dual one. On the one hand, this will be one of the bases upon which the main forms of digital management will appear and grow up; while on the other it will also represent an important basis upon which to develop relevant linkages and relationships in society, including those associated with making co-responsibility a reality.

Co-responsibility was formerly associated with a situation of assuming responsibility, but in this case it is a matter, not just of a subjective decision associated with taking on responsibility, but of actually being responsible for something jointly. The conditions associated with this are *inter alia* indicated by representatives of the psychology of morality. In this case, if appropriate forms of communication between different objects become important, the rationality of the process may be linked with two ways of thinking, namely:

- exploratory thinking, whereby the effort is focused on different – even opposing – standpoints and points of view being taken account of;

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[2] Here, the autor is referring to the Code of the so-called EURON (European Robotics Research Network).

- confirmatory thinking, as based around a desire to arrive at an arbitrary, particular and unilateral justification of an appropriate standpoint.

In the case of co-responsibility, we anticipate that the thinking of participants in the societal game being played around responsibility will rather be in the nature of exploratory thinking. J. Haidt was of the view that responsibility might be underpinned by such exploratory thinking, though this would require the meeting of relevant conditions in this case associated with responsibility – indeed accountability – being made a reality via a process of communication. In any case, those taking decisions had to be aware of the need for them to be accounted for an justified before people of unknown views or levels of knowledge, albeit with the assumption being that some knowledge is possessed, and that a desire to know the truth is also present (Haidt 2012, 113–114).

In practice, these conditions are not complied with readily, if compliance is indeed possible at all. For decisionmakers very often seek to avoid explaining their own stance, moreover assuming that those on the receiving end are not at all well-informed. In line with this, the communication we have to deal with is often nothing more than superficial in nature, with reference to formulated truths being purely declarative. Difficulties with actually meeting the conditions set for exploratory thinking – which arise very often – ensure that still-greater significance is assumed by confirmatory thinking, with impressions given that someone is right being replaced in this way by genuine rectitude (Haidt 2012, 114).

This conveying of an impression of rectitude is not just a type of persuasion, but also a means of justifying to oneself with a view to achieving a feeling of conviction. Notwithstanding these indicated difficulties with making co-responsibility a reality, the expectations associated with it must be achieved to at least some degree, as this will be forced through by the signalled changes associated with the dissemination and propagation of forms of *Industry 4.0*.

And, as already indicated, technical and economic changes will be overlain by ones of a social and cultural nature. The changes we will be dealing with are linked with an evolution from responsibility to co-responsibility. An intermittent stage in these changes may be considered to be the CSR (corporate social responsibility) concept, or else the concept of *ex ante* preventative responsibility after H. Jonas. The first case may be associated with the principle of compensation, the second with the principle of prevention. While the principle of prevention might – in the view of Jonas – have its place taken by the principle of compensation, this approach was rightly criticised by Ulrich Beck, who felt that risk would not be eliminated in this way, with indeed being a possibility of threats arising – perhaps even worse than the ones the preventative action had sought to eliminate in the first place (Beck 2012, 176).

This points to limitations on preventative responsibility in a situation of risk, which is currently inseparable from different human decisions and actions, and is – moreover – of a scope far wider than it once had. The changes as regards the evolution of responsibility requirements may be brought together in a table, as follows:

Table 1. From responsibility to co-responsibility

| Type of responsibility | Object | Subject | Instance | Basis |
|---|---|---|---|---|
| Traditional | The individual | Consequences of actions generated directly and in a conscious way | Conscience | Object's knowledge, will and awareness |
| CSR | Institutions | Selected commitment and obligations | Other institutions | Programmes, heeding of principles |
| Co-responsibility with *Industry 4.0* in prospect | All participants | The product and its impacts, consequence of dissemination | Conscience, others, systemic limitations | Trust in people and technology; awareness of ignorance |

## FINAL REMARKS

When it comes to the area of co-responsibility it is not possible to arrive at an unambiguous definition, or to decree what the scope of responsibility of different entities might be. This will be designated by and dependent upon the joint action engaged in in practice by the entities in question. The expectations as regards these will concern readiness to accept responsibility – to be held accountable for – something not caused by them directly. Co-responsibility remains something open, and this is a reflection of procedural conditioning attendant upon realisation and enforcement, while also relating to the axiological content that will determine its subject and means of functioning. In the case of *Industry 4.0* we are dealing with the individualisation of that process, but at the same time with its conferment upon society, as co-responsibility is taken on. The processes of generation will then be less completely separated from the processes of the utilisation, as well as the distribution and dissemination, of defined goods in society. The *Society 4.0* shaped in consequence will determine how to judge the new quality defined in relation to processes of generation and production, but also more broadly by reference to the human being as the object of other activity. In this way also, joint action and the attendant co-responsibility will represent one of the bases upon which principles of sustainable development can be made a reality. At the same time, this will be its own unique kind of contribution and foundation, from which further decisions and choices might arise, allowing the sustainable-development concept to take the form of real practice in defined social, cultural, political and economic situations, and both locally and globally.

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