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TOWARDS AN ONTOLOGY OF INNOVATION

On the New, the Political-Economic Dimension and the Intrinsic Risks Involved in Innovation Processes

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20.1. Introduction

Innovation is often uncritically seen as a good thing (Rogers 1976) and considered as a panacea for all kinds of socioeconomic challenges (Godin 2015). For institutions like the Organization for Economic Co-operation and Development (OECD) and the European Union (EU), it is for instance self-evident that "most current social, economic and environmental challenges require creative solutions based on innovation and technological advance" (OECD 2010: 30; cf. European Commission 2010). At the same time, the notion of innovation itself remains undefined in these policy documents, while its meaning seems to be taken for granted in the scientific literature.

This is also the case in the context of philosophy of engineering and technology, where the concept of innovation is relatively new. Because it is often self-evidently associated with technology as *technological innovation*, it solely appears within the context of technology (Godin 2015; Bontems 2014). Although in recent years, the concept of innovation seems to attract particular attention with the emergence of the concept of 'Responsible Innovation' in the European policy context, the self-evident association with technology remains prevalent (Timmermans and Blok 2018).

What is more, innovation is associated not only with the exploration of new technologies, but also with the commercial exploitation of these new technologies (Blok and Lemmens 2015; Schomberg and Blok 2018). This becomes for instance clear in management and economics of innovation textbooks. In these textbooks, innovation is defined as "the first commercial application or production of a new process or product" (Freeman and Soete 1997: 1). And although the innovation management literature acknowledges that innovation can also take place in new services, it self-evidently associates innovation with a *technological* invention—the technology behind Facebook's or Amazon's services—which enables the company to provide new services like social media and online bookstores:

> Hence innovation embraces both a technological and a creative dimension, that we normally refer to as invention, together with a commercial dimension that involves the exploitation of the invention to turn it from a model or prototype into something that is available in the market for consumers to purchase. This latter aspect is much less heroic and less glamorous then invention, but it is crucial. Without it an invention is little more than a

> great idea, and all too often this is an element of innovation that is neglected, with disappointed consumers the result. Only when both aspects have been effectively handled does one have an innovation.
>
> *(Smith 2006: 6)*

Even if we accept the 'innovation imperative' that is dominant in engineering and business schools (Bessant and Tidd 2007), it remains unclear what the philosophical underpinnings of this notion of innovation are in contrast to related terms like 'invention' and 'imitation'. Why is innovation nowadays self-evidently associated with economic growth and the solution of societal challenges? What does it mean that the ideal of innovation is extended to all aspects of social life, ranging from innovation in healthcare to innovation in politics? (Blok 2018). While researchers in the domain of engineering ethics and science and technology studies (STS) primarily focus on the governance of the outcomes of technological innovations, for instance by engaging stakeholders during the innovation process, in this chapter we reflect on the nature of innovation itself.

Philosophical reflection on basic concepts like innovation is important, because they structure the way we understand the world around us. If we for instance understand innovation as technological innovation which is primarily executed by engineers in private R&D departments and laboratories, then we miss the whole potential of contemporary phenomena that can be associated with system innovation (for instance, agro-ecological innovations), social innovations (for instance, political innovations like online petition websites) or attitudinal innovations (for instance, prevention or lifestyle interventions), as well as the part of the innovation process that can be associated with the diffusion of innovations. Philosophical reflection on innovation can also help to assess whether phenomena fall under the concept or not; for instance, the new paradigm of technological developments and engineering practices which can be associated with *biomimicry*, i.e., with the imitation of natural processes in technological design (Blok and Gremmen 2016). Finally, philosophical reflection can help to develop a critical attitude towards the self-evident use of the concept of innovation, to highlight contradictions and tensions in its use, and to raise questions regarding the limitations of its use and the conditions of *responsible* innovation. Is innovation good *per se* (Rogers 1976), or should we reflect on its consequences in relation to the problems it intends to solve, the risks involved as well as the potential negative side effects?

One way to open up the concept of innovation for philosophical reflection is by tracing the different meanings it has in history. Historical analysis can help to question the self-evidence of the association between innovation and technology and commercialization, to deconstruct the presupposed concepts that always already structure our understanding of the world, and to explore the sedimentary conceptual structures which show themselves in the words and notions we self-evidently use in our dealings with the world (Blok 2020). In this, we are indebted to the valuable work by Benoit Godin, who wrote an intellectual history of the concept of innovation (2008, 2015). While his main contribution can be placed in the domain of the history of science and technology without the ambition to *theorize* about the concept (Godin 2015: 4), our objective in this chapter is precisely to philosophically reflect on the sources his studies brought forth.

In order to grasp the roots from which the self-evident conceptualization of innovation as technological and commercial innovation stems, in Section 2 we consult the work of the economist Joseph Schumpeter. In Section 3, based on findings in the history of innovation, we open up the concept by reflecting on two aspects of Schumpeter's conceptualization of innovation, namely its destructive (Xenophon and Plato) and its constructive aspect (Machiavelli and Bacon). In Section 4, we synthesize our findings and propose an ontic-ontological conceptualization of innovation as ontogenetic process and outcome with six dimensions—newness, political dimension, economic dimension, temporal dimension, human dimension and risk—that moves beyond its technological and commercial orientation.

20.2. Schumpeter as Founding Father of Innovation as Technological and Commercial Innovation

The founding father of our understanding of innovation and its intrinsic relation to technology and economy is the economist Joseph Schumpeter (1883–1950). According to Schumpeter, "capitalist enterprise" and "technological progress" are "essentially one and the same thing" (Schumpeter 1943: 110). The entrepreneur is always looking for new business opportunities. By doing things differently than others, i.e., by the introduction of innovative technologies, the entrepreneur enhances and secures his competitive advantage over competitors. Because large competitors will try to copy the entrepreneur's innovation to secure the market for themselves, and because large firms have an advantage over small firms according to Schumpeter, the entrepreneur has to make the difference anew and explore new innovative business ideas, etc. This cycle of entrepreneurs exploring and exploiting innovations to achieve a temporary monopoly, which are then copied by large firms and call for new innovations by the entrepreneur etc., is what is driving the economy, according to Schumpeter (Schumpeter 1943).

For Schumpeter, innovation not only concerns an invention at the product or service level but also relates to economic waves. Following the initial work by the Russian economist Nikolai Kondratieff (1892–1938), Schumpeter studied long economic waves that were driven by particular clusters of industries and can be associated with technological shifts; for instance, the wave starting around 1845 associated with steam power and innovations in the railway industry, or the wave starting around 1900 associated with electricity and innovations like the internal combustion engine (Schumpeter 1983). For Schumpeter, it is therefore *technological* innovation that plays a key role in economic development.[1]

So far, we recognize our contemporary notion of innovation as technological and commercial innovation in Schumpeter's conceptualization of the term. Yet, he already differs from our ordinary understanding when he talks about *waves* and not about an endless economic progress. Entrepreneurs disrupt the status quo or economic equilibrium with their innovations. These disruptive innovations will lead to economic growth (upswing), which will in the end decline because a new economic equilibrium is reached which is dominated by large firms, and in which there is no role for the entrepreneur anymore. The periodical economic decline or depression is explained by two factors: (1) the capitalist concentration of power and capital by large firms and corporate groups, in which no place is left for entrepreneurial behaviour; (2) by the intellectual class that on the one hand emerges as a result of economic growth but holds social democratic values that are hostile to capitalism on the other. Although we currently do not experience such an economic decline, we can recognize Schumpeter's ideas in our current society, where competition is crushed by technology giants like Google and Amazon, and where it becomes difficult for new entrants to enter the market, while social democratic movements against Transatlantic Trade and Investment Partnership (TTIP), for instance, are hostile to capitalism. This intrinsic tendency towards power concentration by large corporations is inherent in capitalism, according to Schumpeter—in this respect, he is pessimistic about

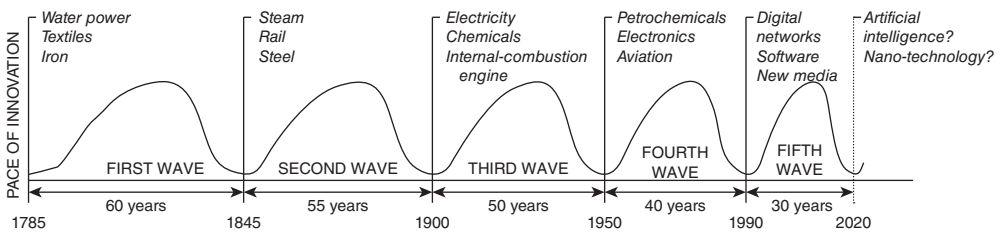

Figure 20.1 Schumpeter's business cycles

the abilities of capitalism to serve economic progress—and can only be disrupted by innovations that prevent the collapse of the capitalist system.

The role of innovation in the upswing of economic cycles becomes clear in Schumpeter's notion of creative destruction, which he borrowed from Marx. According to Schumpeter,

> Capitalism . . . is by nature a form or method of economic change and not only never is but never can be stationary. . . . The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates. . . . The opening up of new markets, foreign or domestic, and the organizational development from the craft shop and factory to such concerns as U.S. Steel illustrate the same process of industrial mutation . . . that incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has got to live in.
>
> *(Schumpeter 1943: 82–83)*

The innovation of the diesel engine in locomotives, for instance, was not just the creation of a new technology but destructed at the same time the existing industry in steam engines, just like the innovation of the compact disc destructed the industry of cassette tapes and vinyl and is now replaced by MP3 and streaming services.

This brief consultation of the origin of our taken-for-granted understanding of innovation as technological and as commercial innovation shows that Schumpeter can on the one hand legitimately be seen as the founding father of our current understanding of innovation. At the same time, our initial reflections show a clear difference between Schumpeter's conceptualization of innovation and the contemporary taken-for-granted notion. While innovation is nowadays seen as contributing to economic growth *per se*, and as a *panacea* for all kinds of societal challenges, Schumpeter's notion of economic *waves* and creative *destruction* already enables us to question the unilateral progressive and constructive connotation of the concept.

Even if we do not agree completely with Schumpeter's diagnosis—the idea that large firms are better able to foster innovation, for instance, is challenged in the literature (cf. Deakins and Freel 2009)—the idea that economic decline follows every upswing of the economic cycle based on new technologies makes clear that innovation may be a necessary but not sufficient condition for economic growth; innovation may account for the upswing of the economic cycle but is in need of additional and maybe even non-economic interventions to prevent its decline. We may even argue that innovation, despite its contribution to the upswing of the economic cycle, is itself non-economical, to the extent that innovation *limits* the tendency to power and capital concentration in the capitalist economy, which would collapse without its temporary disruption by innovations. If innovation prevents the collapse of the capitalist system, then we can formally conclude that innovation itself doesn't belong to the capitalist economic system but constitutes its limit. Furthermore, the idea that every upswing of the economic cycle involves the construction of new and innovative solutions *and* the destruction of existing markets, industries and firms, i.e. the idea that the positive impact of innovation is accompanied by negative impacts elsewhere, makes clear that innovation may be a necessary but not sufficient condition for the solution of the societal challenges we face today; innovations that address societal challenges are accompanied with negative impacts elsewhere, and therefore raise new societal challenges. This intrinsic *Faustian* aspect of innovation is largely ignored in the policy documents dedicated to innovation (Blok and Lemmens 2015). In other words, our brief reflection on Schumpeter's notion of innovation puts the presupposed notion of innovation as economic progressive *per se* and as solution of societal challenges between brackets and raises questions about the

extra-economical conditions that must be fulfilled to enable innovation to contribute to economic growth and to the solution of societal problems.

20.3. Philosophical Reflections on Creative Destruction as Characteristic of the Ontogenesis of Innovation

Schumpeter's thoughts can also provide a first grip for our philosophical reflection on the concept of innovation. It is clear, for instance, that innovation can both be seen as a process—i.e. the innovation process—and as the result of this process—i.e. the innovative product or service as an outcome of the process. Although according to Schumpeter it is ultimately the innovative product or service that provides competitive advantage, his reflections focus primarily on the process of innovation; creative destruction is not a characteristic of the innovative product or service, but of the innovation process.

If we consider the outcome of the innovation process as a concrete *individual* product or service, the innovation process itself can be conceived as the *pre*-individual. This reality of the innovation process *before* its individuation in a concrete innovation outcome can be conceived as the *ontogenesis* of this outcome. This ontogenetic process of innovation is missed in many typologies of innovation in the literature, like incremental versus radical innovation (Freeman and Soete 1997) and architectural versus modular innovations (Henderson and Clark 1990), which all take the outcome of the innovation process—concrete individual products or services, its components or the assemblage of these components—as point of departure. This focus on the innovation outcome may be explained by what is called the 'culture of things' or material culture: "The origin of this culture goes back to the Renaissance: due to commercial exchanges, exploration and travel, natural and artificial objects have been what is valued in arts, science, and real life" (Godin 2008: 21). But if innovation concerns both the process *and* the outcome of the process, a philosophical reflection on the innovation process as a distinct but integral part of the phenomenon of innovation can no longer be avoided. In this section, therefore, we focus on the innovation process of creation and destruction.

In order to explore the creative and destructive aspect of the innovation process, we consult the history of the innovation concept. In his history of the concept of innovation, Godin shows that while the study of innovation started in the late nineteenth century and the beginning of the twentieth century (Gabriel Tarde, Joseph Schumpeter) and accelerated in the 1960s with a variety of approaches, by the mid-1970s this variety of approaches was replaced by one dominant representation based on Schumpeter's work, namely as technological innovation and as commercial innovation (Godin 2015). While many scholars in the field of innovation studies uncritically adopt this progressive history of the origin of technological innovation, starting with Schumpeter, Godin points to the fact that they neglect the broader history of the concept, by for instance disregarding the literature on technological change and the religious and political connotations of the concept. Without neglecting the significant role of Schumpeter's conceptualization for our contemporary understanding of innovation, this broader history of the concept may provide a further grip for our philosophical reflections on the concept of the process of creative destruction as ontogenesis of innovation.

20.3.1 The Destructive Aspect of Innovation: The Ontological Level of the Ontogenesis of Innovation

In this subsection, we focus on the destructive aspect of innovation on the basis of mainly Plato's work. The concept of innovation originates from Ancient Greece, where it is named *kainotomia*. *Kainotomia* means change or the introduction of something new. It comes from *kainon* (new) and *tom* (cut, cutting) and originally meant 'cutting fresh into'. It was originally used in the context of the opening of new mines (Godin 2015: 19). Even though it is hard to argue that innovation is established as a theoretical concept in Greek philosophy, we can consider it as a proto-concept that

can provide useful insights and form our understanding of the creative and destructive aspects of the innovation process.

It is in this context that Xenophon (430–355 BC) used the term in his *Ways and Means*. In a chapter on mines, Xenophon indicates a problem with the exploration of silver mines:

> Well then, it may be asked, why is it that there is not the same rush to makes new cuttings now as in former times? The answer is, because the people concerned with the mines are poorer nowadays. The attempt to restart operations, renew plant, etc., is of recent date, and any one who ventures to open up a new area runs a considerable risk. Supposing he hits upon a productive field, he becomes a rich man, but supposing he draws a blank, he loses the whole of his outlay; and that is a danger which people of the present time are shy of facing.
>
> *(Xenophon 2014: IV 27–30)*

His proposal is that the state of Athens should possess public slaves and make them available for hire to businesses that want to explore the mines. The state can cover the enormous investment costs needed to hire this labour force, and because of the spreading of the investment over various explorations of new galleries, the risks of failure and success are better balanced. For this reason, Xenophon calls for a *gradual* introduction of his innovation, instead of an introduction at once:

> If we proceed tentatively, as we find ourselves able, we can complete any well-devised attempt at our leisure, and, in case of any obvious failure, take warning and not repeat it. Again, if everything were to be carried out at once, it is we, sirs, who must make the whole provision at our expense. Whereas, if part were proceeded with and part stood over, the portion of revenue in hand will help to furnish what is necessary to go on with. But to come now to what every one probably will regard as a really grave danger, lest the state may become possessed of an over large number of slaves, with the result that the works will be overstocked. That again is an apprehension which we may escape if we are careful not to put into the works more hands from year to year than the works themselves demand.
>
> *(Xenophon 2014: 36)*

By taking over this responsibility, the state can reduce the risks of individual mining companies significantly and contribute to local business development. In return, the state can raise revenues.

It is interesting to see that 'innovation' in the literal sense of the word *kainotomia*, namely as the making of new cuttings and opening of new galleries in the silver mines, is a phenomenon that Xenophon not only describes in *Ways and Means*, but characterizes at the same time his own efforts in this book:

> And given that my proposal were carried into effect, the only *novelty* in it is that, just as the individual in acquiring the ownership of a gang of slaves finds himself at once provided with a permanent source of income, so the state, in like fashion, should possess herself of a body of public slaves, to the number, say, of three for every Athenian citizen.
>
> *(Xenophon 2014: IV 17)*

It is primarily his proposal for the state to own and possess slaves that is considered innovative.

Three characteristics of an ancient concept of innovation can be derived from Xenophon's notion of *kainotomia:* (1) innovation concerns something new in the literal sense of the word; (2) innovation is performed by the state; (3) innovation is a risky business (Godin 2015: 22). Although Godin stresses the political dimension of Xenophon's concept of innovation, we must acknowledge that the

intrinsic economic orientation of innovation is at work as well already in case of Xenophon. This is confirmed by Aristotle, who argues that the introduction of innovations is often connected with private interests and therefore requires political authority to safeguard the political order (Aristotle 1944: 1308b20–25).[2] Nonetheless, despite this economic orientation, it is true that the juridico-political connotation of innovation becomes central in the ancient concept of innovation.

In his *Laws*, for instance, Plato introduces the concept of innovation in the context of the political order. He argues that novelty and innovation should be excluded from education:

> They fail to reflect that those children who innovate [*neotherizein*] in their games grow up into men different from their fathers; and being thus different themselves, they seek a different mode of life, and having sought this, they come to desire other institutions and laws; and none of them dreads the consequent approach of that result which we described just now as the greatest of all banes.
>
> *(Plato 1967: 798c)*

Children love innovations (new games, new toys, new devices), but that will lead them to despise old habits and traditions and embrace the new (Plato 1967: 797b), which will in the end lead to political instability. The same holds for Aristotle, who argues that the best possible political order is already discovered and that any change in it will make it worse (Aristotle 1944: 1264a20–25). Innovation concerns the introduction of change in the established political order, and the Greek philosophers are negative about innovation just because it can disrupt the political order and can lead to revolution. In light of this, we receive a first indication of the destructive aspect of the innovation process. While in current society, disruptive innovations like the Internet destruct the established *economic* order, in the ancient notion of innovation, it is primarily the *political* order which is destructed.

With regard to the question concerning what aspect of the political order is destructed by innovation according to Plato, a possible answer is found in his connection of innovation with the introduction of something new that threatens the established political order. It is important to consider that according to philosophers like Plato, the destructive aspect of innovation is not so much found in the destruction of *things* in the world, such as for instance the natural environment, but rather in the destruction of the political *order* of the world. The nature of this destruction becomes clear if we ask for the measure or unity of the order of the world. The philosophical tradition starting with Plato finds this measure or unity in the ontological characteristic of the being of beings, i.e. in the transcendental horizon of the Platonic *idea*. The *idea* is a fixed category or measure, within which the world appears as an ordered whole that makes sense. In light of the *idea* 'human being' for instance, various people appear *as* human being and we can understand this variety of humans *as* human beings. The *idea* human being is itself not a human being, but concerns a given measure, category or value within which the variety of people appears *as* unity. In the philosophical tradition there is a fundamental difference between the *idea*, category or value that establishes the order of beings in the world, and these beings themselves, which can be perceived and understood only in light of the *idea*. What is destructed by innovation, according to Plato, has to be sought at the ontological level of the *idea* as measure for the established political order, and not at the ontic level of things in the world.

This also becomes clear in Plato's *Republic*. Here, Plato argues that the state should be ruled by the philosopher king, who has the necessary training and education that enables him to intellectually grasp ethical notions such as the *idea* of justice, and who has the insights that are required to safeguard the political order. Here the problem with innovation becomes clear. If innovation transgresses the established political *order* of the world, it primarily intervenes at the level of the *ideai*, categories or values within which the world functions as *order*. Innovations are primarily disrupting the existing *ideai*, and consist in the human construction and introduction of new *ideai*. This means that the

destructive aspect of innovation does not concern primarily the ontic level of things in the world, but the ontological level of the *ideai*, categories or values that establish and safeguard a world *order*. The idea that innovation primarily intervenes at the ontological level of the world *order* is also confirmed by a later writer on innovation, Francis Bacon, who argues that innovations "have altered the whole face and state of things right across the globe" (cited in Godin 2015: 182).

Although Plato rejects innovation because it intervenes at the ontological level and destructs the established order, he also has a second reason to reject innovation. The idea that innovation intervenes at the ontological level and destructs the established order testifies namely to the human ability to construct a new *idea*, category or value that establishes a new political-economic order. Two aspects are therefore important to consider in Plato's rejection of innovation. First, the human construction of a new *idea* should be rejected from the perspective that the transcendent world of the *ideai* is fixed and eternal according to Plato and can cannot be replaced by new ones. This is consistent with Aristotle's idea that the ideal political order is already established. Second, he would object to the idea that the role of the human being is to innovate and construct such a new *idea*. The philosopher king shouldn't be educated in innovation (we can associate this with the *vita activa*) but should be enabled to *grasp* the eternal idea of justice to safeguard the political order in light of this *idea* (we can associate this with the *vita contemplativa*). For Plato, innovation should be rejected therefore for two reasons: the innovator is primarily *guilty* of denying the eternal truth of the transcendental horizon of the *ideai*, categories or values that establish the world order by his effort to introduce a new one; but with this, secondly, he denies the nature of the human being who should primarily grasp and contemplate these pre-given ideas, categories or values in which he or she can live the good life as a political actor, instead of *producing* new ones.[3]

We leave this discussion of the human role in innovation for a moment and return to the difference between the ontic and ontological level of innovation, because it provides a second indication of the ontogenetic process of innovation, reflected in innovations such as the steam engine. To be sure, the steam engine does not only concern the ontogenesis of the engine at an ontic level. It also concerns the ontogenesis of the economic order of the world associated with steam at the ontological level, in which the steam engine can emerge, can be applied in various automated machines in factories like the spinning mill and is adopted and used by humans.[4] This distinction between the ontic and the ontological level of innovation provides a new perspective on Schumpeter's conceptualization of innovation as creative destruction. Innovations like the steam engine are definitely innovations at the ontic level of the creation of a new thing or artefact—the first engine, for instance—but their destructive character consists in the fact that they change 'the rules of the game'; they destruct the economic order of the world that is associated with water in which the water mill was embedded, applied and adopted by humans (in the textile industry, for instance), and give rise to a new world order associated with steam (see Figure 20.1). Likewise, the innovation of streaming services didn't destruct the CD in the literal sense of the word—there are still CDs in the world—but it changed the way value is created and captured via markets in the economic order associated with digital networks like the Internet.

What we have learned so far from our reflection on the history of innovation is that innovation primarily concerns the ontogenesis of innovation at an ontological level, namely the destruction of the *ideai*, categories or values that establish a world order. The other lesson we learned is that the economic orientation of the contemporary notion of innovation is not self-evident and could be extended to the political domain. Although it is clear that economists like Schumpeter focus on the impact of innovation on the *economic* order and assume that the articulation of a new world order is often established via markets,[5] the ancient notion of innovation makes us sensitive to the need to extend the ontogenesis of innovation to the political-economic domain, and maybe even to the domain of religion and art, as Godin shows in his history of the concept of innovation (Godin 2015).

In the next section, we continue our analysis by elaborating on the creative aspect of innovation and the creation of the *idea*, category or value. To this end, we focus on later writings regarding the concept of innovation.

20.3.2 The Creative Aspect of Innovation: On the New

The juridico-political connotation of innovation is continued in the Christian and Roman political writings up to the Renaissance. *In-novare* means the *introduction* of something *new*. Like in ancient Greece, in the Bible it is used in the political sense of the word, for instance, in the book of Samuel where Saul is called to renew the monarchy after his victory against the Ammonites (cf. Godin 2015).

Innovare also occurs in the work of Machiavelli (1469–1527) in the juridico-political context, namely in his reflections on *The Prince*. Here, Machiavelli discusses how the prince can break with established habits and customs and can take initiatives to renew them. According to Machiavelli, the prince can act either innovatively, by suddenly reforming customs and habits, or in a more cautious way, by acting safely without upsetting habits. Machiavelli shows that both attitudes have their advantages and disadvantages and are suitable in different situations. While the introduction of new rules and regulations may be needed in case of a political crisis, it becomes counterproductive in case the prince wants to stabilize the established new order. In such a case, the cautious way of acting would be more appropriate according to Machiavelli. For Machiavelli, just as for Plato, innovation—as introduction of new rules and regulations—serves the establishment of the political order on the ontological level, but it also involves the introduction of new institutions and new practices at the ontic level (cf. Godin 2015: 66). This more positive connotation of innovation in the case of Machiavelli may be explained by the fact that he experienced the world as continuously changing and even regressing, which then calls for the stabilization and founding of a new political order:

> One innovates because there is a changing situation that requires new ways of doing things or new things to do. One innovates when, in the face of changes, he himself changes things by introducing something new to stabilize a turbulent environment.
>
> *(Godin 2015: 65)*

For Machiavelli, the starting point of innovation is found in the absence of an *idea*, category or value that establishes the political order—a political crisis or chaos—and it is this absence of the political order that stimulates innovation as the introduction of a new *idea*, category or value to establish and safeguard the political order again.

In Machiavelli, the creative aspect of the innovation process is not necessarily found in the creation of something completely new to the world by the prince as creative actor. Machiavelli, for instance, argues for the return to the original political order that is corrupted over time (Godin 2015: 58). For this reason, we have to put 'newness' between brackets because in the first instance, and in line with the ancient idea that the *idea* or *morphe* (form) is eternal according to the Greek philosophers, the newness of *innovare* is understood as *renewal* or reformation of the original *idea*, category or value of beings; *re*-newal stresses newness as a *return* to or as a taking back into an original situation. This shows that innovation is in the first instance not something completely new to the world without any predecessor, as is sometimes said in case of disruptive innovations like the Internet and the combustion engine. Innovation is the product of a historical process of renewal, in which the new *idea*, category or value emerges out of a previous one and remains connected to it. This historical process of renewal can be associated with a return to an original starting position—such 'innovations' are associated with the renewal of the skin of the snake as renewal of their strength, or with the Phoenix which is reborn from its ashes in the ancient notion of innovation (Godin 2015: 49–50)—and therefore concerns nothing 'new' in the strict sense of the word. But this historical process can

also result in something completely new, such as for instance the trans*form*ation toward a new form (*idea*, category, value), which is the case with the transformation of a larva to a butterfly. Innovation may therefore consist in a repetition of an original state, or in the transformation of the current state (renovation) or in the renewal in a completely new state.

The history of innovation teaches us that the new does not have to be found in a unique characteristic of the product or service that did not exist before and cannot be associated with something that was originally already there. Seen from the perspective of our reflection on the innovation process, the new concerns the process of ontogenesis from pre-individual to individual, which remains embedded in the temporal dimension of past, present and future. On the one hand, innovation is a break with the past (discontinuity). On the other hand, it remains embedded in the history it emerges from. Innovation is therefore characterized by iterability (cf. Derrida 1982), i.e. by the paradoxical simultaneity of sameness and otherness. Framed in terms of the ontogenetic process: to the extent that innovations always remain embedded in the history they emerge from, the 'new' of innovation is always less than itself (pre-individual), and to the extent that the 'new' of innovation always breaks with this past and is on its way to a possible future, it is always more than itself (post-individual). The innovation process itself is primarily characterized by temporal renewal, renovation, etc., in which human existence is involved without being the subject of innovation, and this may explain why in the ancient and medieval notion of innovation, the human actor is not yet necessarily seen as the *origin* and *creator* of innovation (cf. Godin 2015: 66).

The creation of the new is also important to consider in light of the connection between innovation and risk (cf. §3.1). The tendency to conceive innovation as something good in itself becomes questionable if we consider the *Faustian* aspect of innovation (cf. §2). According to the ancient and medieval notion of the concept, innovation is intrinsically a risky business because it can undermine the established order. Machiavelli, for instance, argues:

> And it ought to be remembered that there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, then to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new.
>
> *(Machiavelli 2017: IV)*

According to Francis Bacon, all innovation is ill-shapen:

> As the births of living creatures, at first are ill-shapen, so are all innovations, which are the births of time. Yet notwithstanding, as those that first bring honour into their family, are commonly more worthy than most that succeed, so the first precedent (if it be good) is seldom attained by imitation. For ill, to man's nature, as it stands perverted, hath a natural motion, strongest in continuance; but good, as a forced motion, strongest at first.
>
> *(cited in Bontems 2014: 43)*

While for Machiavelli this risk implies that innovation should be introduced radically because people will forget the innovation with time and get accustomed to the changes involved (Godin 2015: 68), Bacon argues that we should only engage in innovation in case we see a clear need or a clear advantage, and that we should implement innovations gradually and take time to reflect on their implementation in practice (Bontems 2014: 44).

With regard to the creative aspect of innovation, we may conclude that innovation is not ethically neutral and does not only become morally good or bad in the hands of men. Innovation is intrinsically a risky business that calls for ethical considerations. The intrinsicality of the ethical

dimension of innovation can already be considered in the context of the original meaning of the term. If *kainotomia* is understood as the opening of new mines, the inherent risk involved is the risk that the new mine collapses. We could argue, with Xenophon, that the state should take this risk, but we could also argue that the opening of new mines (innovation in the literal sense of the word) should be accompanied with efforts to shore up the mine to prevent its collapse if we move on cutting. This idea, that innovation should be accompanied with supporting activities to prevent its collapse, can be associated with Bacon's call for radical gradualism, but also with more contemporary calls for radical incrementality in innovation to prevent lock-in effects (Collingridge 1981). In geoengineering, for instance, engineers make decisions under ignorance, which requires additional supportive actions.

20.4. Conclusions

In this chapter, we reflected philosophically on the concept of innovation presupposed as technological and commercial innovation in both the policy and scientific literature. As a first step, we consulted Schumpeter's conceptualization of innovation, who is often seen as the founding father of the contemporary notion of innovation. We saw that on the one hand, Schumpeter can legitimately be seen as the founding father of the techno-economic paradigm of innovation. On the other hand, it became clear that Schumpeter's conceptualization of innovation already differentiates from the contemporary notion in two important respects: (1) innovation doesn't contribute to economic growth *per se*; (2) innovation doesn't contribute to the solution of societal problems *per se*. As a second step, we consulted the history of the notion of innovation and found several grounds to open up the presupposed notion of technological and commercial innovation, and to reflect on the ontic and ontological dimension of innovation as an ontogenetic process and outcome. Our findings are summarized in Table 20.1.

Table 20.1 Differences between the contemporary, Schumpeterian and ontological concepts of innovation

Contemporary self-evident understanding of innovation	*Schumpeter's concept of Innovation*	*Proposed Dimensions of an Ontological Concept of Innovation*
1. Newness (product, process, marketing method, organizational method, workplace organization (OECD)), ranging from new to the firm to new to the world	1. New to the World (good, process, market, source of supply, industrial organization)	1. Newness (*idea*, category, value), ranging from re-newal and re-novation to new to the world.
2. *Technological* Innovation	2. *Technological* Innovation	2. *Political* dimension of Innovation
3. Serves economic progress *per se*	3. Serves economic cycles with temporary progression *and* depression	3. Serves the economy
4. Primacy of the innovation outcome (culture of things)	4. Primacy of the innovation process (creative destruction)	4. Primacy of the temporal dimension of the innovation process (ontic-ontological level)
5. Human actor (businessman) as subject of innovation	5. Human actor (entrepreneur) as subject of innovation	5. Human existence involved in the innovation process (but not as primary subject of innovation)
6. Conceived as good in itself and as solution for societal challenges	6. Faustian aspect of all Innovation acknowledged	6. Intrinsicality of Risk

We do not yet intend to draw conclusions about the nature of innovation based on our philosophical reflection on the history of the concept yet. Our primary aim is to open up the self-evident notion of innovation for future philosophical reflection on the concept (Blok 2018).

First, the distinction between the current presupposed concept of innovation and conceptualizations that can be found in history enables us to question the *self-evidence* of the techno-economic paradigm of innovation. Second, we experienced several tensions between the current concept of innovation and this techno-economic paradigm. An example is that the dominance of large corporate actors hampers innovation instead of stimulating it. Another example is that the dominant political-economic system limits the development of more *responsible* innovations and calls for reconsidering the currently dominant economic growth paradigm (Blok and Lemmens 2015). In the case of such tensions, philosophical reflection on historical conceptualizations of innovation can help to articulate these problems and find possible building blocks for its solution (Blok 2021). If the ancient concept of innovation highlights its establishment of a political-economic order of the world, it can inspire us to acknowledge the political dimension of all innovation and engineering practices. This is highly relevant in contemporary debates about innovation and engineering *for* society. If the ancient concept of innovation highlights the temporal process of innovation, it can inspire us to shift our perspective from the new at the product or service level to the process level of renewal and renovation. This is highly relevant in contemporary discussions about, for example, the bio-based or circular economy, that is currently mainly focusing on re-cycling practices, but should shift to re-pair and reuse of material as well to achieve its aspiration of a zero-waste economy (Zwier et al. 2015). If the ancient concept of innovation highlights the intrinsic risks involved in innovation, it can inspire us to acknowledge the necessity of the ethical dimension of innovation and engineering practices. This is highly relevant in contemporary policy debates about mainstreaming *responsible* research and innovation. Third, by reflecting on historical conceptualizations of innovation, we can find building blocks and dimensions of *another, possible* and *future* concept of innovation that is in fact able to address the grand challenges of our time.

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Related Chapters

Chapter 9: Engineering as Art and the Art of Engineering (Lara Schrijver)
Chapter 10: Creativity and Discovery (David H. Cropley)
Chapter 19: Emergence in Engineering (Peter Simons)

Notes

1. In this respect, we disagree with Godin's suggestion that "technological innovation" is a phrase that appeared only after World War II, and that Schumpeter uses the phrase only sporadically in his work (Godin 2015: 250). Even if this is the case, the idea of economic cycles that are associated with technology makes clear that for Schumpeter, innovation is primarily technological.
2. Plato and Aristotle use the word *neotherizein,* which has a comparable meaning as *kainotomia* (Godin 2015).
3. In this respect, we can argue that innovation operates here as an example of Nietzsche's revaluation of all values *avant la lettre.* This revaluation consists not only in the devaluation of the Platonic *idea* if innovation is heralded; the *nihil* of the Platonic *idea* in nihilism. These values (*ideai* or categories) are not only replaced by new ones in this revaluation, but the second aspect of the revaluation is, according to Nietzsche, that humans now become the source of newly constructed values (*ideai* or categories). Based on our findings in

this subsection, we can conclude that innovation concerns precisely these two aspects of revaluation, which provide the two reasons why it is rejected by Plato.

4. According to Simondon, the emergence of the steam engine changes the human-technology relation as a whole: "The factory uses true technical individuals, whereas, in the workshop, it is man who lends his individuality to the accomplishment of technical actions" (Simondon 2017: 131).
5. A similar idea can be found in Rogers's idea that "the adoption of a new idea almost always entails the sale of a new product" (Rogers 1962: 261).

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