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Towards a dynamic concept of competition that includes innovation – Note by Wolfgang Kerber

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Towards a dynamic concept of competition that includes innovation

by Wolfgang Kerber (University of Marburg)

1. Competition and innovation: The need for a new and more integrated dynamic competition approach

1.1. Introduction

1. The digital revolution has dramatically increased the awareness about the key role of innovations, and the relevance of Schumpeter's "Theory of economic development" with its emphasis on the crucial role of innovations and entrepreneurship, leading to dynamic endogenous change with new products, new markets, and new business models, and the evolution of the entire structure of the economy (Schumpeter, 1934/1911, 1942)

2. Since innovation can be seen as the "successful development and application of new knowledge" (OECD, 2006), innovation processes through firms on markets are – in addition to scientific and academic research – the key mechanism for generating new knowledge for solving problems for individual consumers, firms, and society. One of the important questions is what the role of competition and competition policy is for enabling and incentivizing innovation processes, and how competition policy can and should take into account innovation.

3. From that perspective, the relationship of competition and innovation can be seen as a key question for clarifying to what extent markets are sufficiently capable for generating innovations, and to what extent regulatory solutions and other additional policies are necessary.

4. The question of the relationship of competition and innovation is very complex and can be addressed differently. One framework for analyzing this relationship is to separate competition and innovation, and then ask about the effects of competition on innovation, and, vice versa, the effects of innovation on competition. Much of what we know theoretically and empirically about those effects, we can try to sort into such a framework, which can help our understanding to some extent. However, we also know that causal effects exist in both directions, leading to a very complex (and so far not understood) interplay between competition and innovation.

5. This relationship can, however, also be addressed as a conceptual question, namely about a suitable concept of competition. Since Adam Smith's "Wealth of Nations" very different concepts of competition have been discussed. What concept of competition would fit well to our fast-changing world with ubiquitous complex innovation processes on many markets?

6. Schumpeter and Hayek have developed important key ideas, which led to the early development of dynamic concepts of competition, which view innovation and the generation (and spreading) of new knowledge as an essential part of the concept of competition. Important are two characteristics: (a) Competition is a dynamic process, esp. with rivalrous behavior between competing firms, and (b) the generation of new knowledge about what problems customers have, and how to find better solutions for these problems (creating new value) is an essential part of those competition processes. Such a concept of

competition would not separate innovation from competition but would integrate innovation into such a dynamic concept of competition.

7. This paper has the objective to sketch basic ideas of such a concept of dynamic competition, and to ask about implications for a more innovation-oriented competition policy (and application of competition law).[1]

1.2. Main thesis I: A dynamic concept of competition is needed

8. The first main thesis of this paper is that it is necessary to develop a (new) broad and comprehensive concept of dynamic competition, which integrates the "successful development and application of new knowledge" into the concept of competition and can therefore deal much better with today's challenges of innovative markets than our current static concept of competition. The latter might fit well for price competition but not for dynamic innovation competition.

9. Despite the existence of older and more recent concepts of dynamic competition, it is necessary to develop a broader and more comprehensive framework, which is capable of integrating the ideas, insights, and results of theoretical and empirical research from different fields of research about innovation and competition. This paper claims that in addition to current competition economics and older Schumpeterian and Hayekian concepts of competition, innovation research, evolutionary and complexity economics, and strategic management theory (e.g., resource-based view of the firm, "dynamic capabilities" approach) might be particularly important in that respect. This also implies the application of different theoretical approaches, and a wide range of different methods from these fields of research.

10. After an analysis of the limitations of the current static approach of competition with regard to innovation, section 2 will offer a brief overview about important key insights that these different fields of research can contribute to such a broader concept of dynamic competition. Most important will be their contributions to the generation of knowledge and the role of capabilities in dynamic competition processes.

1.3. Main thesis II: More innovation-specific assessment concepts are needed

11. The second main thesis of this paper is that our current assessment concepts for the application of competition law are not sufficiently capable for dealing with innovation, partly due to the dominance of static concepts. Therefore, much more innovation-specific assessment concepts and methods are needed that fit better to the dynamic and innovative character of competition processes. Section 3 will discuss this issue, using, inter alia, the example of innovation-specific concepts for identifying innovation competitors (market definition). This will place the analysis of knowledge, capabilities, and necessary resources for innovation into the main focus of assessments.

1.4. Interplay with other policies: the example of data policy

12. To answer the question what the role of competition policy is with regard to innovation, and how innovation should be taken into account in competition law, it is also necessary to view competition policy as part of the entire institutional framework for

[1] This position paper is based upon previous research (Kerber, 2011, 2018; Kern, Dewenter, and Kerber, 2016; Kerber and Vezzoso, 2019). I would like to thank Martina Eckardt for very helpful critique and comments.

markets ("rules of the game"), which influence competition and innovation processes. In addition, one also has to take into account the interplay with other policies. These can be policies that focus directly on innovation, in particular, IP law and state subsidies for R&D. There are, however, also many other policies that can have a profound influence on innovation processes on markets like, e.g., data protection law, standardisation policy, and manifold specific regulations.

13. In section 4, this paper will briefly analyze the new EU data policy, which explicitly aims at fostering data-driven innovation in the digital economy through "unlocking" data by enabling more access and sharing of data. In that respect, the example of the current EU Data Act proposal will be discussed, and why it can be expected to fail with respect to IoT data sharing.

2. Towards a broader, dynamic concept of competition that includes the generation of new knowledge

2.1. The problems of static concepts in competition law and economics

14. Competition economics is based upon neoclassical microeconomic theory. It still starts from the static model of "perfect competition", which leads to static economic efficiency in general equilibrium theory (efficient allocation, defined on a given set of products / technologies). Deviations from this model, e.g. in monopoly and oligopoly settings, lead to static inefficiencies (dead weight losses) through market power with too high prices and too low quantities (with price-cost ratios as measures for market power). In microeconomic theory, competition is not seen and analyzed as a process but only with static equilibrium models (comparative statics). Innovation (as a change of this set of products / technologies) is not integrated into general equilibrium theory and the concept of (static) economic efficiency.[2] As a consequence, innovation as the development of new knowledge does theoretically not fit into this static concept of competition.[3] This has several implications.

15. The dominance of this static concept of competition in competition economics with its main focus on price competition has led to a still-existing strong bias to focus in the application of competition law mostly on the effects on prices and consumer welfare (as defined in traditional microeconomics) instead on the effects on innovations and their benefits for consumers and society.

16. In addition, static concepts play a much too large role in the assessment concepts of competition law. A good example is the definition of "product markets": The hypothetical monopoly test (SSNIP test) for the definition of product markets is a price-centric concept, which can include only the existing products of firms and not the

[2] The term "dynamic efficiency" is misleading, because it does not relate to the theoretically in microeconomics clearly defined concept of "economic efficiency". This term is mostly used only as a synonym for innovation.

[3] Instead the question of market failures regarding innovation and new knowledge has been analyzed in neoclassical economics primarily from the perspective of a potential public good problem or knowledge spillovers (externalities) to other (imitating) firms, which leads to the danger of under-investment in R&D through a too low level of appropriability for the innovator. The recommended policy responses are temporary exclusive IPRs and/or state subsidies as the main instruments of innovation policy. Therefore, in mainstream neoclassical economics competition and innovation tend to be seen as two separate issue, whose problems need to be solved by different policies.

development of new products. It therefore leads to a static concept of "product markets", through which the relevant competitors can be identified, and which runs into large problems with regard to the analysis of innovation competition (see section 3.2).

17. Although innovation does not fit into this static concept of competition, competition economists have done much valuable research about competition and innovation, both theoretically and empirically. Most of this research has focused on the question of the effects of the market structure on innovation, which fitted well into the traditional S-C-P paradigm, and was stimulated by Schumpeter's hypotheses about positive relationships between firm concentration (and firm size) on innovation (Schumpeter, 1942).

18. This led to much research whose results are usually discussed within the "Schumpeter vs. Arrow framework". On the one hand, however, in general, no innovation-optimal firm size or firm concentration could be found across industries (despite the interesting inverted U-turn hypothesis, Aghion, 2005). On the other hand, depending on a number of different assumptions (whether pre-innovation product markets are taken into account or not, specific appropriability conditions, entry barriers, process or product innovations, etc.) different valuable insights about the effects on innovation incentives could be derived from theoretical models. Particularly valuable is the contribution of Shapiro (2012), who emphasized the importance of contestability, appropriability, and synergies. In recent years also new models have been developed, which directly try to address the possible effects of mergers on the innovation incentives of firms (see, e.g., for the "business-stealing effect" Federico, Scott Morton, and Shapiro, 2020).[4]

19. Despite its valuable insights this research has several important limitations:

1. It is still mostly research about the effects of market structure on innovation, and does not analyze the dynamic interplay between market structure and innovation. This is also the reason why the Schumpeter vs. Arrow framework is not a suitable general framework for analyzing the relationship between competition and innovation (Petit and Teece, 2021).
2. Most of the theoretical research is based upon static equilibrium models and focuses only on the question of innovation incentives (primarily on the incentives to invest in R&D). Often these models are not specifically about innovation, e.g., by using a direct analogy to models about price competition (e.g., regarding unilateral effects of mergers).
3. Although such an analytical approach is consistent with static microeconomic theory, it is very doubtful, whether this a suitable approach for analyzing the complex phenomena of real-world innovation processes on markets, which take place in dynamic, rivalrous competition processes.

20. The problem is that innovation as "successful generation and application of new knowledge" has very specific own characteristics, which cannot be analyzed well by standard static microeconomic theory (with perfectly rational agents etc.). This is the reason, why in innovation research other approaches, like, e.g., evolutionary economics or "dynamic capabilities", play such an important role (see section 2.5 and 2.6).

21. The limitations and large problems of the static concepts in competition policy with regard to innovation have been criticized for a long time with demands for using much more the insights of additional other approaches with respect to innovation and innovation

[4] For overviews about this broad literature see Gilbert, 2006; Katz and Shelanski, 2007; Cohen, 2010; Kerber and Kern, 2014; OECD, 2018; Puccioni de Oliveira Lyra and Cabral Pires-Alves, 2022.

competition (e.g., Katz and Shelanski, 2007; Evans and Hylton, 2008; Budzinski, 2008; Sidak and Teece, 2009; Curzon-Prize and Walker, 2016; Kerber, 2018; Petit and Teece, 2021; Puccioni de Oliveira Lyra and Cabral Pires-Alves, 2022). The next sections will present selected key insights from these approaches that can contribute to a dynamic concept of competition.

2.2. Important: Taking innovation and innovation research seriously

22. Very important for adequately dealing with innovation processes in competition law & economics is a much better understanding of the complexity and specific characteristics of innovation processes in the economy. Therefore, it is necessary to go deep into the broad and manifold literature on innovation, and try to integrate the insights from this research into such a dynamic concept of competition.

23. Some key insights are:

1. Innovation processes often work very differently in different industries and regarding different technologies. Therefore, specific empirical research (often industry studies) is very important, e.g. about the determinants of innovation.
2. Firms have different firm-specific capabilities, skills, resources, i.e. they are usually heterogeneous with respect to their knowledge.
3. Different innovation processes are often related to each other (e.g., in a complementary way), as well as often (different forms of) collaboration of firms for developing new innovations is very important (complex innovation networks of firms).
4. It is therefore not surprising that also the appropriability of the benefits of innovation can be very complex. It depends on many circumstances, leading to difficult questions about innovation incentives (see, e.g., Teece, 2018).
5. Innovation processes are characterized by high risks and often "true uncertainty" (Knight). This implies that decisions have to be made in "ill-defined" situations that require "judgment calls", because it cannot be defined any more what the optimal decision is, e.g. about the best research path for a R&D project.
6. This implies that innovation processes have often the character of "trial-and-error" processes (with complex feedback loops).

24. An important conclusion from this literature is that market structure (firm concentration) is often only one of many determinants for innovation.

2.3. Schumpeterian concepts of dynamic competition

25. The terms "dynamic competition", "Schumpeterian competition", and innovation competition are often used as (quasi-)synonyms, but they are partly also understood very differently. This cannot be discussed here. But in my view, the valuable contribution of Schumpeter is less his late thesis about the potential advantages of large and/or monopolistic firms for innovation (Schumpeter, 1942) but rather his early much more theoretical approach in his "Theory of economic development" (with the key role of entrepreneurs, innovations, and dynamics; Schumpeter 1934/1911). The large firm / monopoly hypothesis can be integrated in such a dynamic concept (Ellig and Lin, 2001), but Schumpeterian thinking should not be reduced to this hypothesis.

26. This leads to Schumpeterian concepts that view competition as a rivalrous dynamic process of the innovation and imitation of product and process innovations, in which firms

advance with new innovations, others follow by imitation and/or catch up to or overtake them through their own innovations, leading to an ongoing dynamic process of innovation and imitation. In Germany such a Schumpeterian concept of dynamic competition was developed since the 1950s and was wide-spread and well-established until the 1980s (Arndt, 1952; Heuss, 1965; Hoppmann, 1977). Important implications were that market power through innovations is not a problem (and has instead important innovation incentive effects), as long as it is only temporary, and other competitors are eliminating it again through imitation or innovation in this dynamic process. Also, the effects of innovation on the (endogenous) market structure were seen clearly.

27. In these Schumpeterian concepts the generation and spreading of new knowledge (and its dynamic character) have been essential elements of the concept of competition, as well as the role of Schumpeterean entrepreneurs with their specific cognitive and motivational characteristics and the notion of "creative destruction".

2.4. Hayek's concept "competition as a discovery procedure"

28. Hayek's concept of competition as a discovery procedure (and Austrian "market process theory"; Kirzner 1973) is complementary to Schumpeterian competition concepts but leads to very important additional insights (Hayek, 1948, 1978). With Hayek's critique of the perfect knowledge assumptions in the model of perfect competition, he clarifies first that firms always have knowledge problems regarding what consumers want, which products fulfill their preferences best, and what the best production functions are. Hayek views therefore competition as a process on markets, through which knowledge about consumer preferences, new and better products (and production technologies) is generated. Firms do not know what is optimal but learn in a trial-and-error process (esp. also through the feedback from the market), which new problem solutions are the better ones. Therefore, it is the generation (and application) of new knowledge (and therefore innovation), which is essential in his concept of competition.

29. What we can learn from Hayek is that competition should be seen as a process of (parallel) experimentation on markets, through which new knowledge is generated, which would not exist without this competition process, and which also leads to an ongoing evolution of the knowledge of the competing firms.

2.5. Evolutionary innovation economics and complexity economics

30. Although Schumpeter and Hayek are seen as key figures in evolutionary economics, they have not used explicitly an evolutionary (variation-selection-retention) approach with regard to innovations and technological change. However, this has been done by evolutionary approaches in innovation economics that have contributed many important insights, which can be very useful for a new concept of dynamic (and evolutionary) competition (for an overview: Nelson et al, 2018).

31. Particularly important is the work of Nelson and Winter, who since the 1970s have developed evolutionary models of technological change (Nelson and Winter, 1982). These are theoretically based upon a combination of Schumpeterian ideas about dynamic processes of innovation and imitation, the behavioral theory of the firm (with routines that represent the knowledge of the firms), and an explicit evolutionary variation-selection mechanism (with innovation and imitation on markets), which drives technological development (leading to a technological trajectory) and the evolution of the knowledge of the competing firms.

32. In this field of evolutionary innovation economics, many new theoretical models and methods have been developed, e.g. evolutionary search models for modelling trial and error processes regarding innovation ("fitness landscape models", Frenken, 2006) or replicator dynamics models for modelling technological progress as a result of a pure selection process (Metcalfe, 1998). Other relevant new methods are agent-based simulation models.

33. A particularly important insight from this evolutionary approach is that heterogeneity between firms (regarding knowledge and capabilities) and the emergence of new variety (diversity) is an essential determinant for the effectiveness of the knowledge-generating character of competition as a process of parallel experimentation (Metcalfe, 1998; Kerber, 2011). A larger number of parallel experiments with different innovations can be expected to lead to more experience from these trials, and therefore to the generation of more new knowledge and a faster process of technological progress. Therefore, the heterogeneity between firms (diversity), which is a market imperfection from a static concept of competition, is a valuable positive factor that favors innovation and the generation of new knowledge.

34. The importance of diversity for competition has been emphasized regularly in the competition literature (Rubinfeld and Hoven, 2001; Farrell, 2006; Linge (2008); Kerber, 2011; Shapiro, 2012; Gilbert, 2019). It is also important with regard to parallel R&D projects. Therefore, from this evolutionary perspective, another so far not considered potential negative effect of mergers on innovation can be derived: The reduction of the number of firms that experiment in parallel with new innovations can lead to a lower level of generating new knowledge in such evolutionary competition processes (Farrell, 2006; Kerber, 2011). This leads to an additional theory of harm with regard to mergers.[5] These effects on the generation of knowledge can also be used as a rationale why maintaining a minimum number of firms (or parallel R&D projects) on markets (or diversity), e.g. through merger control, might be important for effective and sustainable processes of developing new knowledge (Kerber, 2011).

35. Another group of relevant contributions from very different backgrounds stresses manifold directly dynamic effects, which often can be interpreted also as path-dependency effects. They can be seen as part of an evolutionary approach but also as part of what has been called more recently "complexity economics" (Arthur, 2021; Petit and Schrepel, 2023).

1. One type are dominant designs or technological paradigms, which lead to certain patterns of technological development (and that can also be linked to "industry cycles").
2. Well-known are various forms of "first-mover advantages", e.g. through "learning by doing" (dynamic economies of scale) or network / "critical mass" effects, with the possibility that the first innovating firm gets a (durable) competitive advantage.
3. This is also linked to the recent digital platform discussions, where direct and indirect network effects can lead to the phenomenon of "tipping" of a market into a quasi-monopolistic structure (and the phenomena of feedback loops (e.g. with respect to data or monetisation).
4. Increasingly discussed are also various types of "lock-in" problems (caused by dynamic / path-dependent effects). For example, competition between

[5] See also the results of a simulation model with regard to an Hayekian competition process with parallel experimentation (Kerber and Saam, 2001).

technological standards often does not work well, leading to problems that a market might remain "locked-in" with an old inefficient technological standard (instead of replacing it for a new better standard).

5. Due to path dependency effects, market competition might have problems regarding the selection of superior technologies.

36. Therefore, it is Important that a dynamic concept of competition is capable of taking into account such dynamic effects.

2.6. Contributions from business & management research

37. A particularly rich and potentially very helpful literature about innovation on markets and their relationship to competition can be found in the various strands of the business & management literature. I focus here on the resource-based theories of the firm and the strategic management literature, and, in particular, on the concept of "dynamic capabilities" (as overview: Duhaime et al, 2021). One of the key questions from a strategic management perspective is, what a firm can do to achieve a long-term competitive advantage vis-a-vis its competitors to realize high profits.

38. The resource-based view of the firm (RBV) sees the firm as a "bundle of resources", which can consist of tangible and intangible resources, especially knowledge resources like capabilities and skills (Barney, 1991; Wójcik, 2015; Helfat, 2021). For ensuring a durable competitive advantage, the RBV has developed the VRIN strategy, i.e. that a firm should focus on getting control over **V**aluable, **R**are, **I**nimitable and **N**on-substitutable resources. An important part of this theory is the assumption that knowledge, skills, and capabilities are often firm-specific, immobile between firms, and cannot easily be bought on markets. This corresponds to the empirically observed heterogeneity of the (knowledge of the) firms. It is also theoretically compatible with the evolutionary approaches to innovation and competition.

39. Although the resource-based view focuses on knowledge resources, it has been more a static than a dynamic approach. It was Teece who introduced his concept of "dynamic capabilities as the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments ... [and] achieve new and innovative forms of competitive advantage ...." (Teece, Pisano and Shuen, 1997, 516). The capabilities view (Teece, 2007) has found broad acceptance in the strategic management literature. From these "dynamic capabilities" "ordinary capabilities" can be distinguished that refer to "the production and sale of a defined, but static, set of products and services" (Teece, 2020, 1079).

40. In contrast, "dynamic capabilities are high-level *sensing*, *seizing*, and *transforming* skills that enable firms to identify, develop, market, and sell innovative products" (Petit and Teece 2021, 1177). In the context of the digital economy such dynamic capabilities are also seen as crucial for orchestrating the evolution of entire ecosystems with many complementing firms (Petit and Teece, 2020). Based upon this approach Petit and Teece have recently developed some basic ideas about a new dynamic concept of competition and its application to competition policy (Teece, 2020; Petit and Teece, 2020; Petit and Teece, 2021; see also Petit and Schrepel, 2023).

2.7. Conclusions

41. The discussion in the last sections showed that despite its very different backgrounds a lot of research and insights exists that might allow for the development of a consistent concept of dynamic competition which views the generation and application of

knowledge as key activity in competition on markets. However, so far, a well-elaborated and comprehensive concept of dynamic competition does not exist (for an interesting overview: Ellig and Lin, 2001). Both the older and more recent concepts are still not well-developed and/or focus too narrowly only on specific aspects. Also, the conclusions for competition policy might differ widely. Due to the importance of innovation, making progress with respect to developing such a dynamic approach to competition is necessary and urgent.

42. The following insights from the above discussion might be particularly important for this task:

1. Competition should be seen and analyzed as a "process", which is itself dynamic but also takes place in an ever-changing dynamic environment (with the need for fast adaptation and innovative responses to new challenges).
2. Due to uncertainty, innovation processes should be seen as search and experimental processes for finding new and better problem solutions, leading to competition as processes of parallel experimentation by different firms with feedback (trial and error) from markets and learning from others (spreading of knowledge). This also implies the need for opening markets for enabling more innovative experimental processes.
3. The heterogeneity of firms, especially through different firm-specific sets of knowledge, capabilities and resources, is an important element of such a theory, also for generating variety through new creative ideas and entrepreneurial capabilities.
4. Innovation incentives (and therefore appropriability problems) are very important. Due to their complexity, e.g. through synergies with complementary assets, they require careful analysis.
5. However, it would be a serious mistake, if competition analysis focuses only on innovation incentives, because decisive are the "effects" on innovation, which can also be influenced by creative ideas, firm-specific knowledge, the innovative capabilities of heterogeneous firms, and the feedback of markets.
6. Neoclassical microeconomics and theoretical industrial economics (including its methods) will still play a valuable role, but such a dynamic concept of competition needs a much broader theoretical and methodological basis. It is necessary to develop a framework that can also include the insights and methods of other approaches (like those discussed in this section 2).
7. A dynamic concept of competition is still compatible with the normative objective of consumer welfare. However, we need a discussion about how a more sophisticated and flexible concept of consumer welfare (beyond the narrowly defined microeconomic concept) should look like.
8. Competition law is not an impediment for a dynamic concept of competition. On the contrary, competition lawyers are often much more open for a concept that focusses more on the "competitive process" and on innovation competition.

43. This is only a brief selection of key elements for such an approach that are important from my view. It is clear that many others are missing. It is a huge task that needs time, much research, and the collaboration of many open-minded scholars and practitioners for developing such a broader dynamic concept of competition that includes innovation processes. However, it is not necessary to wait for the development of such a concept. It is

also possible to develop step-by-step a more innovation-oriented competition policy along basic ideas of such a dynamic approach. The following section 3 tries to offer a few ideas.

3. Implications for competition policy: Importance of innovation-specific assessment approaches

3.1. Some fundamental questions

44. Using a dynamic concept of competition that includes innovation but also acknowledges the potentially large uncertainty and unpredictability regarding innovations raises some fundamental methodological questions for competition policy.

45. The possibility that also new radical innovations can emerge in the future, which might be capable of breaking up also entrenched market positions, e.g., of the large tech firms, and lead to new opportunities for competition and innovation, is an important implication of such a concept. However, such possibilities should not mislead to the policy conclusion that we can rely on such a possibility, and need simply to wait for such radical innovations. It is entirely unpredictable whether, when and in what way such innovations will occur, and whether incumbent firms might not be capable of stopping them or getting early control over them, and then neutralize the potential disruptive effects on their entrenched positions. The possibility of radical innovations cannot replace the task of competition policy to enable and protect dynamic competition, but it might have implications how to fulfill this task.

46. Much more important is that any decisions in competition policy face the well-known problem, whether we have enough knowledge about the effects of these decisions to ensure that, at least on average, such decisions lead to more positive than negative effects. In the past this has led to the wide-spread opinion that due to our limited knowledge about innovation we should be cautious about including innovation considerations in the application of competition law. In the meantime, we have understood that innovation processes are much too important to ignore them in competition policy. However, this knowledge problem exists and has to be taken into account.[6]

47. This paper claims that if we would use and apply the broad knowledge from the manifold theoretical and empirical research that already exists about innovation in the (above-mentioned) different fields of research, then competition policy could make much better-informed decisions with regard to innovation and innovation competition. Particularly important is, however, that much more research should be done about these issues.[7] A main focus of such research should lie in the preconditions and determinants of innovations, especially also with regard to innovation capabilities and necessary resources, as well as on the dynamics of innovation competition.

48. This knowledge problem also leads to the question how competition authorities should make their decisions. Should they use deep case-specific analyses with the need to prove negative effects on innovation with respect to a certain behavior or merger, or a more rules-based approach, which, in particular, can also include presumptions? This question

[6] The same knowledge problem exists also for the broad range of instruments in innovation policy, e.g., technology policies with subsidies as well as for the optimal design of IP rights.

[7] If only 20% of the resources that have been spent in the last decades on research regarding static competition issues would be spent on dynamic processes of innovation competition, a much better knowledge base would exist for a more innovation-oriented competition policy.

cannot be answered in a general way. But the uncertainty about innovation processes suggests that for certain groups of cases it might be necessary to develop also suitable presumptions about possible innovation effects that can be applied in competition cases instead of trying to rely primarily on the results of case-specific assessments of the effects on innovation.[8]

49. Although case-specific investigations into innovation competition and innovation effects might be more or less deep (with a larger or smaller role of presumptions), the question arises how the basic assessment concepts in competition cases regarding innovation effects should look like. This paper claims that the well-established assessment concepts based upon a static concept of competition with its primary focus on price competition often do not fit to dynamic processes of innovation competition. Therefore, the development of new (and perhaps entirely different) innovation-specific assessment concepts (and methods) is necessary.

50. In the following section 3.2, the example of "market definition" with respect to innovation competition (based upon the EU Dow/DuPont merger case) is used for illustrating and explaining this thesis. This example also shows that competition authorities already experiment to some extent with new approaches and methods in their case analyses.

3.2. Example "market definition": Identifying the relevant innovation competitors

3.2.1. Introduction

51. In section 2.1, it was already shown that the current approach of product market definition with the price-centric hypothetical monopoly test is entirely static, and cannot deal with the innovation dimension of competition. A "product market" definition does not allow for a correct identification of innovation competitors, because there might be incumbent firms that do not innovate as well as innovating firms outside of this product market. Therefore, the set of innovation competitors might be very different from the set of firms that currently produce and/or sell the products on the market.[9] Thus, the question arises, how to identify the relevant innovation competitors.

52. The "Innovation Market Approach" (Gilbert and Sunshine, 1995) was an attempt to solve this problem by developing an innovation-specific approach. It is a pity that this approach has not been used and developed more, because it already entailed a number of very relevant aspects and was a big step into the right direction. The attempts of competition law, e.g. in the US and the EU, to avoid an innovation-specific concept by trying to cling to the product market concept (e.g., by using the concepts of "potential competition" or "future markets") do not fit well and are theoretically not convincing, because they do not address innovation competition itself.[10]

[8] The "rules vs. standard" approach in law & economics with its type 1 and type 2 error framework and its analysis of the role of presumptions can also help with respect to the analysis of innovation effects (Kaplow, 1992; Christiansen and Kerber, 2005).

[9] In addition, the market shares of incumbent firms on the product markets do not reflect the strengths of the firms regarding innovation.

[10] See, e.g., Kern, 2014; for an empirical analysis about the extent of the application of the innovation market approach in US merger cases, see Kern, Dewenter, and Kerber, 2016.

53. In their analyses of cases, however, competition authorities have gone further: The issue of an innovation-specific approach and what problems and questions can arise in that respect can be discussed well in the EU merger case Dow/DuPont.[11]

3.2.2. The EU Dow/DuPont merger case

54. In the EU merger case Dow/DuPont the Commission distinguished between four types of competition in the crop protection industry. In addition to price competition among existing products and competition between an existing product of an incumbent and a pipeline product (potential competition) also two different types of innovation competition were analyzed. The first type referred to competition among existing R&D projects regarding the development of new "active ingredients" ("AIs", e.g., pesticides) in so-called "innovation spaces", whereas the second type focused on innovation competition at the (crop protection) industry level, i.e. on the incentives to invest generally in innovation (including the starting of new R&D projects in this industry).

55. The analysis of the first type of innovation competition has many similarities to the standard approach that has emerged regarding pharma mergers. There, overlapping R&D projects of the merging firms are identified; then, it is analyzed which other firms have overlapping R&D projects, and finally - depending on the outcome of a competitive assessment – decided on necessary divestitures of R&D projects as a remedy for protecting innovation competition between R&D projects.

56. In regard to the second type of innovation competition it has been analyzed which firms have the resources and capabilities to carry out successful R&D projects in the crop protection industry. The Commission came to the conclusion that only five global R&D-integrated firms (Syngenta, Bayer, BASF, Dow and DuPont) are capable of doing this, and are therefore the relevant innovation competitors in this industry (leading to a 5:4 merger case). It is this second type of innovation competition at the industry level, which was very controversially discussed, because this type has not been addressed before in merger control (OECD, 2018; Petit, 2018; Kerber and Vezzoso, 2019).

3.2.3. Identification of the relevant innovation competitors: Methodology

57. How has the Commission done this identification of the relevant innovation competitors in both types of innovation competition? Very important is, firstly, that the Commission – very much in line with the insights from innovation research - analyzed very deeply how innovation processes in this crop protection industry are working.

58. For the second type of innovation competition, it analyzed the different stages of innovation processes, made an in-depth investigation into the capabilities and assets of the firms in that industry, before coming to the conclusion that only the above-mentioned five firms have the capabilities, assets, and scale to perform all the necessary stages of innovation (from discovery and development to regulatory compliance and route-to-market). Other active firms in this industry would not have all the necessary capabilities. In this context the Commission has also made a deep analysis of the patent portfolios of the firms and how successful they were in the past for developing and launching new "active ingredients".

59. With regard to the first type of innovation competition the Commission analyzed which firms have overlapping "lines of research" in certain innovation spaces, i.e. in certain areas of crop protection. Such "lines of research" are described as "the set of scientists,

[11] Decision in case M. 7932 Dow/DuPont, 27 March 2017. See for the following analysis Kerber and Vezzoso, 2019.

patents, assets, equipment and chemical class(es) which are dedicated to a given discovery target whose final output are successive pipeline AIs targeting a given innovation space" (Dow/Dupont, para.350). By using such innovation capabilities approach the Commission identified the relevant innovation competitors for both types of innovation competition.

60. Such a way of identifying the relevant innovation competitors is an entirely different approach than the concept (of identifying the relevant competitors through the definition) of product markets (hypothetical monopoly test). Instead, the Commission has used an approach that directly analyzes innovation activities and innovation capabilities. They encompass specific assets, IPRs, and a range of different capabilities, which are necessary for innovating in a certain area or an entire industry.

61. With this "market definition", the knowledge of the firms and their capabilities to develop new knowledge in certain areas (and apply it successfully) has gotten in the main focus of the process of identifying the relevant innovation competitors. This is entirely in line with the basic ideas for a dynamic concept of competition (as briefly sketched in section 2). Therefore, this approach of the Commission in the Dow/DuPont merger case can be seen as a part of an innovation-specific assessment framework for innovation competition.[12]

3.2.4. Critical discussion

62. What is missing, however, is a systematic analysis, especially also with regard to methodology, how such analyses about innovation activities, innovation capabilities, and necessary resources for innovation should be carried out.

63. With regard to the Dow/DuPont case many critical questions can be asked:

1. What are the relevant capabilities and resources that are necessary for innovation in a certain innovation space or at the industry level? Can these capabilities and resources be easily acquired (e.g., on markets), or how long would it take for a firm to develop certain necessary capabilities?
2. In addition, it can be very unclear what we mean by innovating in a specific "innovation space" or in an "industry". How do we delineate an innovation space or an industry? Is this driven more from the technological (supply) side or from the demand-side (i.e., what problems should be solved)? Since in economics no clear theoretical approach exists about the delineation of industries, it is an open question what innovation competition at the industry level means.

64. Although this innovation-specific approach for identifying the relevant innovation competitors is also used in other cases, in competition law & economics no general critical analysis, discussion and research about these issues seem to exist. Therefore, there is a need for much more research, especially also with regard to theoretical concepts and empirical methods how to define and identify necessary capabilities and resources for innovation.

65. From our discussion in section 2.6, it can be suggested that the broad and rich literature about the resource-based view of the firm, strategic management, and the "dynamic capabilities" approach (as well as other approaches that focus from a management perspective on the knowledge, technology, and innovation capabilities of firms; Furr, 2021), might be very helpful in that regard. They can be used for developing a clearer theoretical framework, getting manifold empirical insights, as well as helping to

[12] It should be noted that criteria about capabilities, resources, and innovation activities of firms have been used in certain contexts by competition authorities for a long time, e.g. for assessing entry barriers or the strength of competitors.

develop also empirical methods for analyzing necessary resources and capabilities for different types of innovation competition.[13]

66. As many sophisticated methods have been developed for defining product markets, it is also necessary to develop methods for identifying relevant competitors regarding innovation competition. It is a pity that innovation competition and its assessment is still only marginally addressed in guidelines (especially also this problem of "market definition" with respect to innovation competition).

67. In addition, the problem of a correct identification of necessary capabilities and resources for innovation is also very important for the exact definition of a divestiture remedy, e.g. with regard to R&D projects. Such divestitures require the selling of R&D projects with all capabilities and resources that are necessary for the success of these projects.

4. Access to resources as precondition for innovation and competition: The example of EU data policy and the EU Data Act

4.1. EU data policy

68. In general, access to certain sets of resources can be necessary for enabling innovation and innovation competition. However, through the digital revolution data has become a key resource and access to data a key driver for innovation and competition in the digital economy. Therefore, this brief section 4 will focus on the question of access to data, and on the EU data policy, which as an important new policy can influence – also in interplay with competition policy – innovation and dynamic competition in a significant way. I will not focus on the complex (and controversial) issue how EU data protection law (or, more generally, privacy laws) can affect innovation but limit the discussion here primarily to non-personal data.

69. Based upon the economic characteristic of non-rivalry in the use of data and the diagnosis that many firms do not use and share enough their data, the EU Commission has developed step-by-step a data policy that aims to make more data available for fostering data-driven innovation and economic growth (European Commission, 2017, 2020; see also OECD, 2015, 2019, 2020).

70. This data policy consists of a broad range of measures and regulatory approaches, which have first primarily focused on supporting voluntary data sharing, but which are increasingly entailing also mandatory rules regarding the governance of data, esp. with respect to data access, data sharing, and data portability:[14]

1. Opening public sector data for making much more data available for innovation in the digital economy.
2. Very important and with the explicit objective to promote innovation activities in the banking sector (Fintech) is the Second Payment Service Directive (PSD2), which has led to the emergence of a competitive innovative market for new

[13] For a recent analysis of the "capabilities" of car manufacturers regarding the innovation of electric vehicles, see, e.g., Murmann and Vogt, 2023.

[14] Whereas data access has so far not played a large role in traditional EU competition law, Germany has extended rights for data access in its last amendment of German competition law in 2021.

payment services through far-reaching regulations for mandatory opening of bank account data.

3. The recently enacted Data Governance Act (DGA) should help to create trustworthy data intermediaries for enabling more effective data markets for voluntary data sharing.
4. The Digital Markets Act has introduced some specific obligations for gatekeepers with respect to the combination of personal data, access and portability of data generated by business users or end users on platforms, and the horizontal sharing of search data with other search engines. At least partly, they should also help to enable more innovation.
5. An important project for sharing more data for innovation is the development of European data spaces. Particularly interesting might be the potentially far-reaching rules about making health data widely available for research and innovation.

4.2. The EU Data Act proposal: New Data access and sharing rights for IoT device users

71. Particularly important is the current proposal of the EU Data Act (DA), which has explicitly the task of "unlocking" IoT (Internet of Things) data for enabling more innovation, and more competition on IoT aftermarkets and other IoT-related secondary markets (European Commission 2022; Metzger and Schweitzer, 2023; Kerber, 2023). With respect to the governance of IoT data, the DA views as the main problem that the manufacturers of the IoT devices can get through their own technical design exclusive de facto control over all data generated by the users (i.e. usually the owners) of these devices. This would lead to not enough data access for the users and not enough sharing of this data with other firms for data-driven innovation, with negative effects on innovation, competition and the empowerment of users regarding their IoT data.

72. The Data Act does not question this exclusive de facto control position of the manufacturers (as data holders) over the IoT data, but it intends to mitigate these negative effects through the mandatory introduction of non-waivable rights of the users, (1) to access and use a narrowly defined set of (mostly raw) IoT data, and (2) to share this data with other firms for the development of new innovative services and for enabling competition on secondary markets, esp. repair and maintenance services. This data-sharing right of the users is combined with the requirement that the data recipients have to conclude a (licensing) contract with the data holders, who can claim "reasonable compensation" for the use of this data (under FRAND conditions).[15]

73. Since a very fast spreading of data-generating IoT devices is predicted, the DA (with these new user rights, and especially this new data sharing mechanism) seems to be a huge step for making a vast amount of IoT data available for more innovation (and also competition) in the data economy. However, a deeper analysis shows that the DA suffers from a considerable number of problems, serious flaws and contradictions in its architecture, and is not based upon a clear legal or economic concept. This cannot be discussed here in detail (Eckardt and Kerber, 2023).

74. Important for our discussion is the conclusion that the current design of the DA will not achieve its objectives of making much more IoT data available for innovation (and

[15] The second main instrument is the introduction of a rule that the data holders can only use the non-personal IoT data on the basis of a contract with the users of the device. For the personal IoT data, "consent" of the users according to the EU data protection law (GDPR) is necessary anyway.

competition). The main problem is that, in particular, this data sharing mechanism via individual rights of the users is riddled with so many requirements, restrictions, problems, and ensuing high transaction costs that it cannot be expected that much additional IoT data will be made available through the introduction of these new user rights (Kerber, 2023).[16] Also specific provisions that prohibit to use this data for developing a competing IoT product or to share this data with gatekeepers (as designated in the DMA) are discussed very critically for impeding innovations instead of enabling them (Metzger and Schweitzer, 2023; Martens, 2023).

75. What is the reason for the expected failing of the Data Act, i.e. why are the mechanisms for data sharing designed in a way that will render them widely ineffective? The main reason is that too much emphasis is laid on the interests of the manufacturers of IoT devices to get exclusive control over all data generated by the use of these devices (with the option of data monetisation), because it is erroneously assumed that a large incentive problem exists for investing in the development of IoT devices. Since the IoT devices are sold to the users with a price that can cover the investment costs, no general incentive problem does exist, which would justify the need for an exclusive de facto control over IoT, which is economically equivalent to an IP-like protection of non-personal data (Eckardt and Kerber, 2023).

76. The possibility of IoT device manufacturers to "capture" exclusively the IoT data through their technical design of IoT devices can lead, under certain conditions, to a highly problematic monopolistic data bottleneck with manifold negative effects on innovation and innovation competition on IoT-related secondary markets and the entire data economy. Although the Commission has understood this problem, it has failed in its Data Act proposal to offer effective solutions. It also shows that technological decisions by firms (here, by the IoT device manufacturers) about the design of the products can have serious negative effects on innovation and innovation competition. A dynamic concept of competition that includes innovation and an ensuing more innovation-oriented competition policy should be capable of taking such problems better into account (as it is already discussed with respect to interoperability problems and standardisation).

[16] For example, the scope of shared data is expected to be too narrow for offering many aftermarket services, interoperability problems are not solved, it is very difficult to build aggregated data sets from these individual user data for enabling innovation, and complex disputes can emerge about the protection of this data by data protection law or trade secret law. Therefore, many commentators have called for a far-reaching simplification of the data sharing mechanism (Metzger and Schweitzer, 2023; Martens, 2023).

References

Aghion, P. et al. (2005), "Competition and Innovation: An Inverted-U Relationship", *Quarterly Journal of Economics*, Vol. 129, pp. 701-728.

Arndt, H. (1952), *Schöpferischer Wettbewerb und klassenlose Gesellschaft*, Berlin.

Arthur, W.B. (2021), "Foundations of complexity economics", *Nature Reviews Physics*, Vol. 3, pp. 136-145.

Barney, J.B. (1991), "Firm Resources and Sustained Competitive Advantage", *Journal of Management*, Vol. 17, pp. 99-120.

Budzinski, O. (2008), "Monoculture versus diversity in competition economics", *Cambridge Journal of Economics*, Vol. 32, pp. 295-324.

Christiansen, A., and W. Kerber (2005), "Competition Policy with Optimally Differentiated Rules instead of 'Per Se Rules vs. Rule of Reason'", *Journal of Competition Law & Economics*, Vol. 2(2), pp. 215-244.

Cohen, W.M. (2010), "Fifty years of empirical studies of innovative activity and performance", in: Hall, B.H., and N. Rosenberg (eds.), *Handbooks in Economics, Volume 01*, Elsevier: Amsterdam, pp.129-213.

Curzon Prize, T., and M. Walker (2016), "Incentives to Innovate vs. Short-term Price Effects in Antitrust Analysis", *Journal of Competition Law & Economics*, Vol. 7, pp. 475-482.

Duhaime, I.M., Hitt, M.A., and M.A. Lyles (eds.) (2021), *Strategic Management: State of the Field and its Future*, Oxford Academic Press.

Eckardt, M., and W. Kerber (2023), "Property Rights Theory, Bundles of Rights on IoT Data, and the Data Act", *Andrássy Working Paper Series in Economics and Business Administration* No. 51, 2023, available at: https://dx.doi.org/10.2139/ssrn.4376833.

Ellig, J. and D. Lin (2001), "A Taxonomy of Dynamic Competition Theories", in: Ellig, J. (ed.), *Dynamic competition and public policy: Technology, Innovation, and Antitrust Issues*, Cambridge: Cambridge Univeristy Press, pp. 16-44.

European Commission (2017), Communication "Building a European Data Economy", COM(2017) 9 final (10 January 2017).

European Commission (2020), Communication "A European strategy of data", COM(2020) 66 final (19 February 2020).

European Commission (2022), Proposal for a Regulation of the European Parliament and of the Council on harmonised rules on fair access to and use of data (Data Act), COM(2022) 68 final (23 February 2022).

Evans, D., and K. Hylton (2008), "The Lawful Acquisition and Exercise of Monopoly Power and its Implications for the Objectives of Antitrust", *Competition Policy International*, Vol. 4, pp. 203-241.

Farrell, J. (2006), "Complexity, Diversity, and Antitrust", *Antitrust Bulletin*, 51, pp. 165-173.

Federico, G., F. Scott Morton and C. Shapiro (2020), "Antitrust and Innovation: Welcoming and Protecting Disruption", *Innovation Policy and the Economy*, Vol. 20/1, pp. 125-190.

Frenken, K. (2006), "Technological innovation and complexity theory", *Economics of Innovation and New Technology*, Vol. 15, pp. 137-155.

Furr, N.R. (2021), "Technology entrepreneurshipo, technology strategy and uncertainty", in: Duhaime et al (eds.), *Strategic Management: State of the Field and its Future*, Oxford Academic Press, pp. 205-220.

Gilbert, R.J. (2006), "Looking for Mr. Schumpeter: Where are we in the competition-innovation debate?", in: Jaffe, A., J. Lerner, and S. Stern (eds.), *Innovation Policy and the Economy*, Vol. 6, pp. 159-215.

Gilbert, R.J. (2019), "Competition, Mergers, and R&D Diversity", Review of Industrial Organization, Vol. 54, pp. 465-484.

Gilbert, R.J. and S.C. Sunshine (1995), Incorporating Dynamic Efficiency Concerns in Merger Analysis: The Use of Innovation Markets, *Antitrust Law Journal* 63, pp. 569 – 601.

Hayek, F.A. v. (1948), "The Meaning of Competition", in: Hayek, F.A. v., *Individualism and Economic Order*, Chicago: Chicago University Press, pp. 92-106.

Hayek, F.A. v. (1978), "Competition as a Discovery Procedure", in: Hayek, F.A. v., *New Studies in Philosophy, Politics, Economics and the History of Ideas*, Chicago: Chicago University Press, pp. 179-190.

Helfat, C. (2021), "The economic view of strategic management", in: Duhaime et al (eds.), *Strategic Management: State of the Field and its Future*, Oxford Academic Press, pp. 61 – 79.

Heuss, E. (1965), *Allgemeine Markttheorie*, Tübingen.

Hoppmann, E. (1977), *Marktmacht und Wettbewerb*, Tübingen.

Kaplow, L. (1992), "Rules versus Standards: An Economic Analysis", *Duke Law Journal*, Vol. 42, pp. 557-629.

Katz, M.L., and H.A. Shelanski (2007), "Mergers and Innovation", *Antitrust Law Journal*, Vol. 74, pp. 1-85.

Kerber, W. (2011), "Competition, Innovation and Maintaining Diversity Through Competition Law", in: Drexl, J. et al. (eds.), *Economic Approaches to Competition Law: Foundations and Limitations*, Cheltenham: Edward Elgar, pp. 173-201.

Kerber, W. (2018), "Competition, Innovation, and Competition Law: Dissecting the Interplay", in: Gerard, D. (ed.), *Dynamic Markets and Dynamic Enforcement – The impact of the digital revolution and globalisation on the enforcement of competition law in Europe*, Bruylant 2018, pp. 33-62.

Kerber, W. (2023), "Governance of IoT Data: Why the EU Data Act will not fulfill its objectives", *GRUR International. Journal of European and* International IP Law, Vol. 72(2), pp. 120-135.

Kerber, W., and N. Saam (2001), "Competition as a Test of Hypotheses: Simulation of Knowledge-generating Market Processes", *Journal of Artificial Societies and Social Simulation (JASSS)*, Vol. 4, No.3, https://www.jasss.org/4/3/2.html

Kerber, W., and B.J. Kern (2014), Assessing Innovation Effects in US Merger Policy: Theory, Practice, Recent Discussions, and Perspectives, https://ssrn.com/abstract=2983098.

Kerber, W., and S. Vezzoso (2019), "Dow/DuPont: Another Step Towards a Proper Assessment Concept of Innovation Effects of Mergers", https://dx.doi.org/10.2139/ssrn.3856885

Kern, B.R. (2014), "Innovation Markets, Future Markets, or Potential Competition: How should Competition Authorities account for Innovation competition in merger reviews?", *World Competition*, Vol. 37, pp. 137-206.

Kern, B.R., Dewenter, R, and W. Kerber (2016), "Empirical Analysis of the Assessment of Innovation Effects in U.S. Merger Cases", *Journal of Industry, Competition and Trade*, Vol. 16, pp. 373-402.

Kirzner, I.M. (1973), *Competition and Entrepreurship*, Chicago: University of Chicago Press.

Linge, G. (2008), *Competition Policy, Innovation, and Diversity*, Tectum: Marburg.

Martens, B. (2023), *Pro- and Anticompetitive Provisions in the Proposed European Union Data Act*, Working Paper 01/2023, Bruegel, https://www.bruegel.org/sites/default/files/2023-01/WP%2001.pdf

Metcalfe, S.J. (1998), *Evolutionary economics and creative destruction*, London and New York: Routledge.

Metzger, A. and Schweitzer, H. (2023), "Shaping Markets: A Critical Evaluation of the Draft Data Act", *Zeitschrift für Europäisches Privatrecht*, pp. 42-82.

Murmann, J. P. and F. Vogt (2023), "A Capabilities Framework for Dynamic Competition: Assessing the relative chances of incumbents, start-ups, and diversifying entrants", *Management and Organization Review*, Vol. 19, pp. 141 – 156.

Nelson R., Dosi, G., et al (2018), *Modern Evolutionary Economics*, Cambridge University Press.

Nelson, R. R., S. G. Winter (1982), *An Evolutionary Theory of Economic Change*, Cambridge/ London: Belknap Press of Harvard University Press.

OECD (2006), *Competition, Patents, and Innovation*, Background note, https://www.oecd.org/daf/competition/39888509.pdf

OECD (2015), *Data-Driven Innovation: Big Data for Growth and Well-Being*, OECD, http://dx.doi.org/10.1787/9789264229358-en.

OECD (2018), *Considering Non-price Effects in Merger Control*, Background note, DAF/COMP(2018)2

OECD (2019), *Enhancing Access to and Sharing of Data: Reconciling Riks and Benefits for Date Re-use across Societies*, https://doi.org/10.1787/276aaca8-en.

OECD (2020), *Consumer Data Rights and Competition.* Background note, DAF/COMP(2020)1.

Petit, N. (2018), "Innovation competition, unilateral effects, and merger policy", *Antitrust Law Journal*, Vol. 82(3), pp. 873-920.

Petit, N. and D. Teece (2020), *Taking Ecosystems Competition Seriously in the Digital Economy: A (Preliminary) Dynamic Competition/Capabilities Perspective*, OECD, DAF/COMP/WD(2020)90

Petit, N. and D. Teece (2021), "Innovating Big Tech firms and competition policy: Favoring dynamic over static competition", *Industrial and Corporate Change*, Vol. 30, pp. 1168-1198.

Petit, N. and T. Schrepel (2023), "Complexity-minded antitrust", *Journal of Evolutionary Economics*, https://doi.org/10.1007/s00191-023-00808-8

Puccioni de Oliveira Lyra, M. and C. Cabral Pires-Alves (2022): *Three Faces of Innovation Competition in Horizontal Mergers: Choosing the Framework for Competition Policy Assessment: Choosing the Framework for Horizontal Merger Assessment*, https://www.ie.ufrj.br/images/IE/TDS/2022/TD_IE_008_2022_LYRA_PIRES-ALVES.pdf.

Rubinfeld, D., and J. Hoven (2001), "Innovation and antitrust enfordement", in: Ellig, J. (ed.), Dynamic competition and public policy: technology, innovation and antitrust issues, Cambridge University Press, pp. 65-94.

Schumpeter, J. A. (1934/1911), *The Theory of Economic Development. An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*, Cambridge: Harvard University Press

Schumpeter, J.A. (1942), *Capitalism, Socialism and Democracy*, New York: Harper.

Shapiro, C. (2012), "Competition and innovation. Did Arrow hit the bull's eye?", in: Lerner, J. and S. Stern (eds.), *The Rate and Direction of Inventive Activity Revisited*, pp. 361-404.

Sidak, J.G. and D.J. Teece (2009), "Dynamic Competition in Antitrust Law", *Journal of Competition Law & Economics*, 5(4), pp. 581–631.

Teece, D.J. (2007), "Explicating Dynamic Capabilities: The Nature and Microfoundations of (sustainable) enterprise performance", *Strategic Management Journal* 28, pp. 1319–1350.

Teece, D.J. (2018), "Profiting from innovation in the digital economy: Standards, complementary asserts, and Business Models in the wireless world", *Research Policy*, Vol. 47, pp. 1367-1387.

Teece, D.J., G. Pisano, and A. Shuen (1997), "Dynamic Capabilities and Strategic Management", *Strategic Management Journal*, Vol. 18, pp. 509–533.

Teece. D.J. (2020), "Innovation, governance, and capabilities: implications for competition policy. A Tribute to Nobel Laureate Oliver Williamson by his colleague and mentee David J. Teece", *Industrial and Corporate Change*, Vol. 29, pp. 1075-1099.

Wójcik, P. (2015), "Exploring Links Between Dynamic Capabilities and Resource-Based View: A Literature Overview", *International Journal of Management and Economics*, pp. 83-107.