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Emerging technology as a platform for market shaping and innovation☆

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ABSTRACT

Market shaping literature portrays markets as outcomes of deliberate and designed actions. While technological development might accelerate changes in the market, market-shapers do not often develop technology themselves. As they rely on complementary technologies, enabling new ways to integrate resources and co-create value, the field has not paid particular attention to the role of technology in market shaping and innovation. To advance the literature, we conceptually differentiate between technology "as a market offering" and "as a platform for market shaping and innovation". Through incorporating a structured Delphi study on the impact of 5G technology on the healthcare market, we identify nine important and probable market changes induced by 5G. We contribute to research on market change by highlighting a broad inclusion of market actors for a more holistic view of market changes introduced by emerging technology.

1. Background and purpose

Mainstream marketing has conventionally been built on the assumption that markets pre-exist, and firms enter a predetermined, existing context, in which they discover opportunities (cf. Coviello & Joseph, 2012). In this view, the market is beyond the control of the firm, and the firm reacts to the requirements of its business environment. Recently, marketing scholars have started questioning this neoclassical view of markets and have shifted from treating markets as pre-existing and given contexts toward viewing markets as entities performed and represented by various market actors. The change in the conceptualization of markets has underlined the importance of companies actively scripting markets with market propositions (Geiger, Kjellberg, & Spencer, 2012; Kjellberg & Helgesson, 2006; Storbacka & Nenonen, 2011).

This development has resulted in the emergence of a stream of literature, which is known as market shaping (Baker, Storbacka, & Brodie, 2019; Nenonen & Storbacka, 2018). It portrays markets as outcomes of deliberate and designed actions, which invites companies and other actors to engage in shaping markets (Kindström, Ottosson, & Carlborg, 2018) and generating market innovations (Kjellberg, Azimont, & Reid, 2015). Vargo, Wieland, and Akaka (2015, p. 64) define market innovations as institutionalized new solutions. They do not just randomly emerge but result from purposeful efforts by a focal actor that perform and transform markets (Nenonen, Storbacka, & Frethey-Bentham, 2019, p. 251). The result of a market-shaping process is considered a market innovation if there are significant changes in the market structure (new market devices and agents) or new market practices (Kjellberg et al., 2015). Correspondingly, according to the Service-Dominant (S-D) logic view, markets emerge through an interplay between technological innovations and institutional arrangements (Vargo et al., 2015). Markets are deliberately shaped by actors with agency (Mele et al., 2018), and these changes may relate to more specific levels, as identified by Nenonen et al. (2019), namely products and price, channels, customers and use, supply-side network, representations, and norms.

Markets are thus institutionalized solutions (cf. Vargo & Lusch, 2016) in which certain types of (market) actors typically partake in exchange. In addition, Baker et al. (2019) note that market change may also be partly driven by 'peripheral' or 'nontraditional' market actors. As follows, it is important to zoom out from traditional market actors and activity (institutionalized solution) to nontraditional actors and activity that may shape or create market practices.

Technological development is an example activity that can accelerate market change (Vargo et al., 2017). As noted by Nenonen, Storbacka, and Windahl (2019), market-shapers do not often develop

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technology themselves. Instead, they typically rely on complementary technologies that enable new ways to integrate resources and co-create value. Fehrer, Woratschek, and Brodie (2018) describe the setting, in which focal firms do not control the entire service system, using the concept of platform business model. Consequently, the technological infrastructure influences how actors collaborate in the market (Akaka & Vargo, 2014). Yet, the role of technology as a platform for market shaping and innovation has remained understudied. In other words, while the extant research raises awareness of the linkage between technological and market innovations on a high level of abstraction, there is a need for so-called midrange theory development (Brodie, Löbler, & Fehrer, 2019; Vargo & Lusch, 2017) that brings the abstract level closer to pragmatic approaches in explaining the relationship between constructs. Midrange theories target a subset of phenomena relevant to a specific context or subject, and contribute with descriptions, explanations, or predictions. Midrange theories thus bridge the gap between general theory and empirical research, keeping the process manageable during theory construction (Weick, 1989) and eventually refining and expanding the scope of general theories (Brodie, Saren, & Pels, 2011).

The purpose of this paper is to explore how an emerging technology may act as a platform for market shaping and innovation. This is accomplished by conducting a Delphi study on the impact of the next generation of wireless technology, 5G, on the healthcare market specifically, applying Nenonen et al. (2019) framework on market change. The study reveals various expert perceptions of what may change in the healthcare market in the near future, after the introduction of 5G technology. As a result, we are able to show both the usefulness of the model in an empirical setting, present a critique that helps to further develop the framework, and contribute with midrange theories on market shaping.

The context of the study, namely the emergence of 5G and its anticipated impact on the healthcare market, provides an interesting empirical context for studying market changes. First, 5G is developed by actors, who are not traditionally considered as major players in the institutionalized healthcare market. This follows from the interest of the technology developers to seek opportunities and use cases in various markets. Second, 5G technology is developed in collaboration by different actors globally, and it is not provided by a single market actor. Third, the technology enables new solutions to the healthcare market. For example, 5G is designed for very low-latency applications, a high level of accuracy in performing activities remotely, higher data rates, and lower energy consumption. For instance, 5G enables ultra-reliable, low-latency communications (URLLC), which use the mobile network for mission-critical applications that require continuous and robust data exchange (e.g., remote surgery using robots). 5G will boost the development of the Internet of Things (IoT), as the network will be used to connect a large number of devices (e.g., drones providing real-time data for emergency responders). Fourth, 5G is in the near future, which makes it easier for the industry experts to anticipate the potential impact of the technology on the market. Finally, safety requirements associated with heavy regulations make the healthcare market rather traditional and slow to change. Healthcare has tremendous societal impact, taking the bulk of public and private spending (which loads any market change with an economic interest) and is thus interesting to study further from the perspective of market shaping.

Along with having practical relevance, our research makes three specific theoretical contributions in the process of bringing the S-D logic narrative closer to empirical investigation (Brodie et al., 2019; Vargo & Lusch, 2017) and thus enriching midrange theories on market shaping and innovation. First, our research extends the base for understanding market shaping and innovation from an entrepreneurial perspective to a human-technology-induced change process. Nenonen et al. (2019) suggest that markets evolve through activities carried out by various actors and is partly based on unpredictable emergence. We show that some emergence is not necessarily driven by traditional actors of an institutionalized market but is still somewhat predictable if technology development of peripheral actors is carefully analyzed. This encourages the combination of effectual and causal logic in market shaping (Read, Dew, Sarasvathy, Song, & Wiltbank, 2009; Sarasvathy & Dew, 2005). Second, the key contribution of our research relates to the advancement of a framework to study market change. We illuminate how Nenonen et al. (2019) framework can be used as a part of a Delphi study that focuses on the anticipated market changes, and it presents a critique that encourages the broad inclusion of actors for a more holistic view of market changes. Third, we contribute to the technology and market innovation literature (Vargo et al., 2015) by increasing the understanding of the wider changes that new technologies bring to the market as well as how technology as a platform enables the introduction of market innovations.

This paper is structured as follows: First, we present research on market shaping and discuss the concept in light of emerging technologies and how technology may act as a platform for market shaping processes. Second, we present the empirical setting and method for collecting expert views on the impact of emerging technology (5G). Third, we present the results from the study. Fourth, we discuss the implications for market shaping research and the limitations of the study and suggest future research avenues.

2. Market shaping and innovation

Market shaping literature (cf. Kjellberg et al., 2015; Storbacka & Nenonen, 2011) takes an interest in how market actors can influence markets in ways that are to their own advantage, instead of simply taking the constraints of the market as a given and struggling with existing competitors for the best possible position within these limits. Markets are social constructions, "co-created by market actors as they engage in market practices" (Storbacka & Nenonen, 2011, p. 255) rather than pre-determined structures in which actors compete for fixed positions (Araujo, Kjellberg, & Spencer, 2008). Market actors change the way markets are configured through their intentional and unintentional actions. This recent attention towards market shaping and innovation has focused on the issue of the active production of markets, suggesting that markets are ongoing processes of "becoming" rather than stable entities (Kjellberg et al., 2015). Subsequently, markets are continuously shaped and reshaped. Kindström et al. (2018) propose that this malleability can be interpreted by examining technological, exchange-related, and institutional activities in markets. Furthermore, the authors identify the role of technology as a functional base for the shaping of single and combined activities as well as the creation of useful market offers, thus bringing technology to the forefront of market-shaping research. However, research that focuses specifically on market shaping and innovation linked to emerging technology is scarce.

2.1. Market innovation and incremental shaping

Kjellberg et al. (2015) bring forth market innovation as a process facilitated by actors in an attempt at shaping markets, and more specifically shaping the existing market structure and new market devices, altering market behavior, and reconstructing market agents. According to Kindström et al. (2018), market innovation is one approach to conceptualizing market shaping alongside driving markets (Jaworski, Kohli, & Sahay, 2000), market scripting (Storbacka & Nenonen, 2011), and market plasticity (Nenonen et al., 2014).

Market shaping does not necessarily entail the creation of entirely new markets (Jaworski et al., 2000), but is rather about incremental shaping (Kjellberg et al., 2015) with the goal of actively changing the behavior of the existing market. This implies a broader definition of market innovation than the opening up of new markets. Market innovation means altering the way in which business is traditionally done (cf. Kjellberg et al., 2015), through means and activities varying from sales to changing the rules of the market (Kjellberg & Helgesson, 2006;

Mele, Pels, & Storbacka, 2015).

2.2. Market shaping through market change

Nenonen et al. (2019) set out to study market change. They define a market as "[…] not only a set of customers, […] value chain or […] industry, but a much larger system (cf., Mele et al., 2015; Vargo et al., 2017); a socio-political-technological-material context, governed by institutional arrangements, making the market malleable (Nenonen et al., 2014) and to some extent designable" (Nenonen et al., 2019, p. 258). Their framework consists of formative indicators, grouped into elements: i) products and price, ii) customers and use, iii) channels, iv) supply-side network, v) representations, and vi) norms. There are a total of 22 facets to the elements that guide the use of the framework (see Table 1). Markets can be changed through adjustments to these elements; however, the authors point out that market change does not necessitate a change in all elements, and a modification to any of the elements does not necessarily result in changes to all its facets and their indicators. Of note, their framework focuses on market change from the subjective perspective of the focal actor (the organization or individual interested in mapping a market), which means that there are no objective market boundaries.

For this chapter, we briefly reviewed the literature on market shaping and innovation with a particular focus on Nenonen et al. (2019) framework of market change. Altogether, the extant literature focuses on *what* changes in the market as well as *how* market actors can shape various market elements. Yet, the literature in general is characterized by the absence of technology as an enabler of, or platform for, market shaping and innovation. In the following, we tackle this issue by paying specific attention to market shaping in the context of emerging technologies.

3. Market shaping through technology and technology-induced market change

Market innovation is driven by the combinatorial evolution of value propositions and the emergence and institutionalization of new solutions. We argue that if scholars intend to study markets in a "socio-political-technological-material context" (Nenonen et al., 2019, p. 258), there is a need to incorporate the role of technology in market changes. This argument follows S-D logic's (Akaka & Vargo, 2014) view that technology is a critical resource for value co-creation, service innovation, and systems (re)formation. In S-D logic, technology is conceptualized as an operant resource—one that is capable of acting on other resources to create value. Importantly, technology can be portrayed not only as a market offering (or value proposition) but as a medium of value co-creation and innovation (Vargo et al., 2015).

Market-shaping and innovation literature implicitly assumes that market-shaping technology is developed by actors who deliberately want to change the market. Consequently, the development of technology has to a large extent been treated as a vehicle or medium for market shapers (e.g., Biggemann, Kowalkowski, Maley, & Brege, 2013; Kindström et al., 2018). For instance, this would mean that in healthcare, the focus would merely be on the development and commercialization of new health technology (which can be regarded as central technology to the industry). However, the history of technology, from the invention of the steam engine to the Internet, has revealed that, occasionally, disrupting technologies are developed by nontraditional market actors, which can be regarded as peripheral technology.

Subsequently, we conceptually distinguish between central and peripheral technology. We define *central technology* as technology that is developed and offered by traditional market actors. *Peripheral technology*, however, is developed and offered by nontraditional market actors and introduces changes in the market offerings that would not take place in the absence of this technology. We refer to this as *technology-induced market change*. To understand the contrast between the two perspectives on the role of technology in market shaping and innovation, we conceptually differentiate between emerging technologies that act as *new offerings in a market* and emerging technologies that are *platforms for market shaping and innovation*. Next, we will elaborate further on the latter.

Table 1
The formative indicators of market change (Nenonen et al., 2019, p. 255).

Element of change	Indicators
Products & price	The products and/or services offered in our industry have radically changed (i.e., ours and/or our competitors'). The way products/services are combined into offerings has changed (i.e., the way offerings are bundled or configured). The pricing structure of products or services in our industry has changed (e.g., from pricing on an hourly basis to flat-rate pricing, from selling ownership to renting or leasing, etc.). The price levels of the products and/or services in our industry have changed considerably (e.g., from higher to lower–or vice versa, more variation in prices).
Customers & use	Customers have started to use existing products and/or services in different ways or for different purposes (than our industry originally intended). The kinds of customers who buy our industry's products and/or services have changed (i.e., the traditional customers have exited the market and/or new kinds of customers have entered the market). Within our industry, what customers are looking for in products and/or services has changed. Within our industry, the options customers have regarding full-service versus self-service have changed (e.g., gone from more full-service to more self-service–or vice versa). Physical or technological infrastructures that enable customers to use our industry's products and/or services have changed (i.e., things our industry does not directly produce but that enable usage–such as roads for cars, internet for online shops, etc.).
Channels	There are new or different channels that our industry uses to find and/or service customers. Customers are using new or different channels to find and/or contact potential service providers in our industry.
Supply-side network	The number of competitors operating in our industry has changed (i.e., there are fewer or more than 5 years ago). The ways in which competitors in our industry interact and cooperate have changed. There has been significant changes in the number of suppliers and/or partners that we and/or our competitors work with (there are fewer or more than 5 years ago). We and/or our competitors have started to work with new kinds of suppliers and/or partners. There have been changes in how we and/or our competitors outsource work to suppliers and/or partners (i.e., outsourcing occurs to a greater or lesser extent than 5 years ago).
Representations	The terminology commonly used in our industry has changed. The language and/or descriptions that media use to report on our industry has changed. The categories used by official statistics and/or research agencies to report on our industry and/or its products/services have changed (e.g., new categories have been created, old categories have been renamed, etc.). The key events and/or awards (e.g., trade fairs, exhibitions, competitions, prizes, etc.) related to our industry have changed their focus. The industry associations (sometimes known as trade associations) we are connected to have changed their focus (e.g., the types of businesses they represent, the themes they promote, etc.).
Norms	There have been changes in our industry's standards (e.g., technical standards, specifications, voluntary codes of conduct, etc.). There have been changes to the government regulations (regional, national, or international) relevant to our industry. In our industry, the types of products, services or activities perceived as generally acceptable have changed (e.g., environmental values have become more important).

3.1. Emerging technology as a platform for market shaping and innovation

The extant technological environment affects how organizations perceive their competencies and the availability of market resources (Fehrer, Benoit, et al., 2018), as well as the roles of actors, resources, and practices in markets (Breidbach & Maglio, 2016). Recent work on market shaping (Baker et al., 2019) acknowledges the role of "emerging alternatives"—work of nontraditional, peripheral actors—that shape the belief systems, and thus the behavior, of market actors. This introduces the idea that unconventional market actors can provide new platforms for resource integration and value co-creation. For instance, Amazon's Marketplace or the Open Handheld Alliance's Android are not simply new offerings that are available to customers but are also platforms for novel market practices. In fact, platforms can also be interpreted as technology ecosystems that enable a large number of actors to engage in new service exchange practices (Fehrer, Woratschek, et al., 2018). Thus, emerging technology can be regarded as an intermediary to orchestrate and facilitate the exchange of resources, rather than as an object of exchange in itself (Breidbach & Brodie, 2017). A platform may thus be referred to as "a set of shared core technologies and technology standards [that] supports value co-creation through specialization and complementary offerings" (Thomas, Autio, & Gann, 2014, p. 201), mediating interactions among users and providers of products and services. The notion of technology as platforms for market change is in line with previous research by Baker et al. (2019), Breidbach and Brodie (2017), Storbacka, Brodie, Böhmann, Maglio, and Nenonen (2016) as well as Breidbach, Brodie, and Hollebeek (2014). These streams of literature typically stipulate that the platforms are intentionally brought to the market by lead actors (Frow, McColl-Kennedy, & Payne, 2016). An exception is Pütz, Murphy, Mullins, and O'Malley's (2019) discussion of the effect of an emerging peripheral technology, namely the impact of connected automated vehicles on the motor insurance market.

Altogether, technologically-oriented research is scarce in market shaping and innovation literature. The extant studies grasp a limited view of market change. While market changes can be initiated by evolving technologies as market offerings, the direct and indirect impact of technology on representations, norms, and other characteristics of a market are rarely discussed. While studies might have considered this phenomenon, it is often kept implicit. There is less empirical insight on how peripheral technology influences market shaping and innovation. To fill these gaps on technology-induced market change, we particularly reflect how Nenonen et al. (2019) framework can be used to study the anticipated market changes in a context in which there is no single market shaper; rather, the market is shaped by several market actors reacting to the emergence of a new technology.

4. Research method

For empirical research, we utilize a structured Delphi study (Dalkey & Helmer, 1963), which is a futures research method that enables the generation of community consensus from expert opinion. Over the years, the Delphi method has been successfully employed in studying market dynamics, from the future of automotive industries in India and China (Winkler, Kuklinski, & Moser, 2015) to the role of online social networks in Spanish cultural firms (Gonzalez, Llopis, & Gasco, 2015). Emerging technologies, such as 5G, cause uncertainty, which makes the Delphi method superior to the methods that are based on quantitative factual information (Winkler et al., 2015). The method is particularly suitable for studying a context, in which the future depends less on the past and more on the agency of the actors, such as the context of rapid environmental changes (Hayes, 2007). Typically, the benefits of the Delphi method are that it can tease out subjective judgments on a collective basis, allowing for a diverse background of experts and enabling anonymous and more efficient group communication than face-to-face meetings (Mitroff & Turoff, 1975).

The Delphi method enables a pool of experts to contribute ideas, provide feedback, and assess the emerging judgment of the group (Dalkey & Helmer, 1963; Okoli & Pawlowski, 2004). By keeping the identities of experts confidential, the method avoids direct confrontation of opposing views. The speculative aspects of the Delphi method enable a community to both question current paradigms and norms and discuss future issues. In addition, multiple rounds of data collection and feedback enable the experts to revise their initial assumptions and opinions and to contribute to group consensus in an interactive way (Dalkey & Helmer, 1963). The insight developed throughout the study gives the individuals an opportunity to modify their judgments against the collective views of the panel (Mitroff & Turoff, 1975). Therefore, it is important to keep the same informants throughout the study. The process starts with expert selection.

4.1. Expert selection

While industry stakeholders provide interesting insight on market dynamics (Winkler et al., 2015), various market actors often have differing views on technological changes and how value is created in the future market (Sommarberg & Mäkinen, 2018). Therefore, it was important to enable plurality when selecting experts in both the healthcare market and 5G technology. Based on our earlier work, we were able to identify the most active developers of 5G in Finland and the key contact persons in these organizations. In terms of the healthcare market, we first reviewed a list of the largest health service providers in Finland. We decided to invite people in managerial positions as well as those in specialist roles that could be linked with either technology or market change (ideally both). To ensure the plurality of views, we did not limit our study to only the largest established healthcare companies operating in Finland; we also invited experts from public healthcare organizations as well as healthcare market consultants to join the panel. Being actively involved in the Finnish startup scene, we were able to collect a list of the most promising health technology startups and identified potential experts.

The experts from both subpanels (5G network and healthcare market) were formally invited to participate in the study by e-mail in June 2018. For some experts, we had agreed on their participation prior to the formal email invitation. Because we asked for their involvement in several interactive rounds over a lengthy period of time, we assumed that numerous invitees would decline or choose not to answer. On average, researchers need to invite 4.4 times more experts than who will actually participate in the first round of a Delphi study (Nowack, Endrikat, & Guenther, 2011). Yet, because Delphi does not seek to establish explanatory power from statistical variance, the number of respondents is usually small, with approximately 10–18 experts in a group (Okoli & Pawlowski, 2004). In heterogeneous groups the pool of experts may grow to 15–30, while in closely-selected expert groups, 5–10 experts may be enough (Loo, 2002). As a result, we aimed at receiving commitment from 5 to 10 experts in both subpanels. Accordingly, we invited 21 5G network experts and 25 healthcare market experts.

Our final panel comprised 20 experts (response rate 43.5%): 10 5G network experts and 10 healthcare market experts (Table 2). This panel size elicited sufficiently broad responses, while keeping the complexity of categorizing and consolidating responses manageable. The respondents represented a variety of organizations, with only two experts working for the same organization. All panelists held managerial or senior specialist roles in their organizations (e.g., CEO, CTO, head of research, country manager). The panels included both male and female experts, while we acknowledge the overrepresentation of men in the 5G network expert panel. Throughout the entire process all experts remained active, which is an achievement given that the average dropout rate after the first round is 18% (Nowack et al., 2011).

Table 2
Respondent information.

Expert group	Position of the expert	Number of different organizations	Type of organization	Male	Female
Healthcare market	CEO (4) Head of IT/ technology (3) Head of development (2) Change agent (1)	10	Private company (5) Non-profit organization/ foundation (3) Public organization (2)	6	4
5G network	Head of research/ CTO (4) Innovation manager (2) Branch manager (2) Country manager (1) System designer (1)	9	Private company (9)	9	1
Total		19		15	5

4.2. Data collection and analysis

We collected and analyzed the data in four rounds (see Fig. 1) from September 2018–April 2019, in a timely manner to avoid crucial changes in experts' circumstances, knowledge, and situational context (Day & Bobeva, 2005). Of note, we are not aware of any major news or events related to 5G or the healthcare market during these eight months that would have influenced the empirical findings.

In Round 1, the experts were presented with the following task with the intent of having them brainstorm about changes in the market, and they were encouraged to take an expansive view of potential changes: "Please, mention 5–10 things that 5G changes in the healthcare market." We used an open-ended question as a source of input for the idea-generation function (Nowack et al., 2011). We did not give any time scale, enabling the experts to discuss both immediate changes as well as long-term developmental trajectories following the introduction of 5G. Round 1 answers were summarized and coded based on their resemblance to Nenonen et al. (2019) framework on market change. We used NVivo to code each suggestion as *products & price*, *channels*, *customers & use*, *supply-side network*, *representations*, or *norms*. While coding the answers, we also used the code *other* to indicate market changes that described the changes in the technology itself or outcomes of the projected market changes, such as "safer and less expensive mobile network architecture," and "more cost-effective healthcare." While analyzing the results, we identified fairly few answers referring to representations and norms. Therefore, we decided to run Round 2 to specifically focus on teasing out insights on the potential shifts in these market-change categories.

In Round 2, the experts were given another brainstorming task: "[As a result of 5G] norms, language and rules need to be rethought. What could this mean in practice in the healthcare market?" The question was framed around a related comment by one of our expert panelists to avoid being too theoretical. We added new ideas to the original list of suggested changes. To make the list comprehensible to the panelists, we eliminated full- and near-duplications and consolidated similar themes (e.g., remote operations and remote monitoring) under wider topic areas. To increase the trustworthiness of the coding scheme and the whole research process, one of the authors met in-person with Professor Suvi Nenonen, the lead author of Nenonen et al. (2019). As a result of that discussion, we discarded the changes that were coded as belonging to *other*, as these referred to changes in the technology and the outcome of projected market changes and did not directly refer to the envisioned market changes. We also modified some of the codes. To ensure that nothing was missing and that all insights were covered in the list, we ran Round 3.

In Round 3, we asked the panelists to view and comment on the consolidated list of market changes: "In case you have something to add/ amend or comment, please make changes to the attached Word document or send comments by replying to this email. If you do not have any comments, simply reply to this email by sending us 'OK'." This kind of iteration and controlled feedback mechanism is characteristic of a Delphi study (Nowack et al., 2011). The iteration enables the panelists to consider each other's comments and inspires them to envision further changes. There were only some minor comments that first helped us to

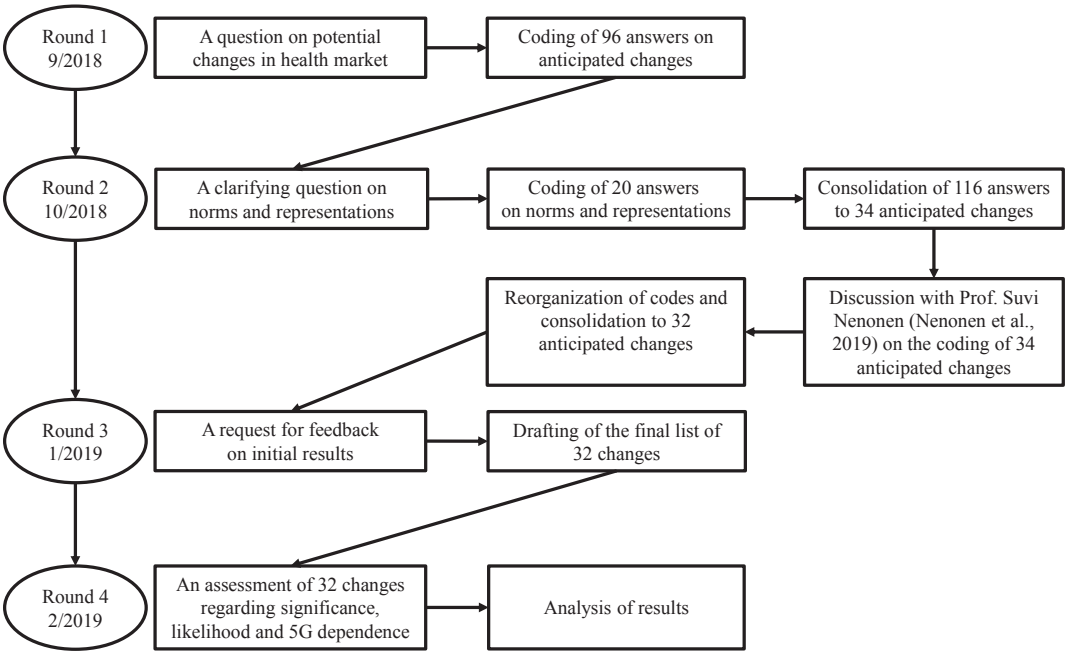

Fig. 1. The Delphi process.

draft the final list of anticipated changes and, second, indicated that there was a consensus of envisioned market changes.

In Round 4, we asked the experts to assess the importance, likelihood, and 5G dependence of the market change. Importance refers to the estimated impact of each suggested change on the healthcare market. Likelihood, in turn, refers to the estimated probability of each suggested change. The question on 5G dependence aimed to identify whether or not it was believed the changes could happen even without the emergence of 5G. Of note, while many Delphi studies also ask for the desirability of suggested futures, we decided not to include that question in our final survey to keep the number of questions at a minimum. Assessing 32 suggested changes in terms of importance, likelihood, and 5G dependence resulted in experts facing 96 questions. The most important and likely 5G-dependent changes were those that scored more than the mean for importance, likelihood, and 5G dependence, which was calculated for all suggested market changes. In other words, we were able to eliminate not only less-important changes but also those changes that were potentially important but less likely to occur or less dependent on 5G than other market changes on average.

5. Findings

5.1. Expert views within healthcare

The first three rounds of the Delphi study resulted in 32 suggested market changes. On a scale of 1–5, the means were 3.84 for importance, 3.71 for likelihood, and 3.24 for 5G dependence. As a result, the suggested changes were generally perceived as important, likely, and 5G-dependent.

Further analysis of the results revealed that there were nine market changes that scored above average on all three questions (importance, likelihood, and 5G dependence). As a result, we argue that these market changes are among the most important when identifying the impact of 5G technology on the healthcare market. These changes were as follows (see Table 3):

- Clients are increasingly served remotely through digital services.

  "*The remote hospital/healthcare (AR/VR/diagnostics) […] may really become possible due to better data traffic.*" (Innovation manager, technology vendor A)
  "*Experts and knowledge are conveyed to the patient without physical transfer, [like a] local service in your pocket.*" (Head of research/CTO, public healthcare provider)
  "*[5G enables] remote diagnostics [and] remote healthcare (video and artificial intelligence [AI] may be utilized, too*)." (Head of research/CTO, mobile operator B)

- Health-monitoring devices become the new normal.

  "*We will get more devices for everyday health monitoring. They will become ordinary.*" (Head of research/CTO, mobile operator A)
  "*Devices become such an integral part of the activity chain that work conventions are significantly adjusted accordingly.*" (Head of development, health technology vendor)
  "*The 5G era brings technology that increasingly enables collection of data related to health status, observations and analysis of different signals, voice, and picture. This surely requires new rules and changes familiar norms. In practice, within healthcare, voice recognition and analysis: Alexa/Siri: 'The person now talking is having a heart attack'.*" (Branch manager, mobile operator B)

Table 3
Industry experts' views on the most important and likely 5G-dependent changes in the healthcare market.

Market change	Category of market change	Importance	Likelihood	5G dependence
Clients are increasingly served remotely through digital services	Channels	4.35	4.55	3.40
Health-monitoring devices become the new normal	Norms	4.16	4.10	3.40
More remote services are offered: remote operations (e.g., robotic surgeries), remote monitoring, and remote consultations and diagnostics	Products & price	4.16	4.00	4.05
More sensor-based services are offered with alerts and predictive analytics	Products & price	4.15	4.35	3.80
More mobile sensors, sensor data, and IoT are offered to enable health monitoring, remote diagnostics, and AI	Supply-side network	4.05	4.30	3.89
Experts are more flexible and available for remote consultations	Supply-side network	4.05	4.10	3.55
Improvements are made in the flow of real-time information	Supply-side network	4.00	4.05	4.10
New innovation opportunities for medical device companies	Supply-side network	3.90	4.25	3.70
Better access to and maintenance of equipment through IoT is available	Supply-side network	3.85	3.90	3.45

- More remote services are offered: remote operations (e.g., robotic surgeries), remote monitoring, and remote consultations and diagnostics.

  "*Remote monitoring of the patient/customer, other active data and location: new innovations or monitoring and control data are achieved due to 5G [as there is] no latency. 5G [and] IoT enable the collection of data in an increasingly broad use area ([of for instance] smart clothes).*" (Head of research/CTO, public healthcare provider)
  "*Patients can be more effectively linked to various remote monitoring or surveillance [services] through [5G] mobile networks, using new IoT technology (NB-IoT and LTE-M). This enables increased cost efficiency in treatment of illness and predictive care.*" (Head of research/CTO, mobile operator C)
  "*[5G] could enable new remote consulting possibilities, for instance, during situations of demanding surgery.*" (CEO, healthcare tech startup)

- More sensor-based services are offered with alerts and predictive analytics.

  "*Sensors are already used for tracking exercise habits (step counters, jogging distances, whether your pulse is optimal etc.). In the future, [sensors are used] more broadly for predictive alarms [and] suggesting*

visiting your doctor if something alarming [is detected] (bad sleeping habits, for example)." (System designer, network operator)
"*[5G brings] smart living using different sensors with predictive analytics.*" (Head of IT/technology, private healthcare provider A)
"*5G means that there can be robots and sensors that follow elderly people in their every-day life on top of security bracelets, providing help or alarming [the care giver or hospital] if help is needed.*" (CEO, private healthcare provider B)

- More mobile sensors, sensor data, and IoT are offered to enable health monitoring, remote diagnostics, and AI.

"*People can have several personal sensors, which data is used for decision making; calls for further examination, for example.*" (System designer, network operator)
"*[5G] enables better use of technology: drones, smart living [with] different kinds of sensors and with predictive analytics, robot services for senior living or habitants within home care services.*" Head of IT/technology, private healthcare provider A)
"*5G networks will in the future provide wider opportunities to link healthcare processes into Internet of Things through various sensors and devices. Consequently, they bring big data and artificial intelligence as tools to optimize these processes.*" (Head of research/CTO, mobile operator C)

- Experts are more flexible and available for remote consultations.

"*Expert help/remote operations can be conducted flexibly at hospitals/healthcare centers.*" (Innovation manager, network vendor)
"*A top surgeon may, for instance, consult local healthcare personnel via video connection, or even conduct a critical surgery without being in the direct proximity of the patient. [This is enabled by] data speed, slicing and MEC [mobile edge computing].*" (Head of research/CTO, mobile operator B)
"*A world class specialist doctor may monitor a surgery or another demanding procedure in real-time from a different location.*" (System designer, network operator)

- Improvements are made in the flow of real-time information.

"*Real-time monitoring in the ambulance is conveyed to the emergency room [through 5G].*" (Head of research/CTO, technology vendor B)
"*Multiprofessional teams can share knowledge and thoughts more easily.*" (CEO, private healthcare provider C)
"*5G and the development of information systems offer patient data to the healthcare staff at the location, where it is needed.*" (Innovation manager, technology vendor A)

- New innovation opportunities for medical device companies.

"*The possibilities of medical device manufacturers to do new kinds of product design and development is enabled in a new way, as [mobile] networks offer remarkably lower latencies compared to earlier and a larger transfer capacity in wireless data transfer throughout hospital spaces and the near environment of the patients.*" (Head of development, health technology vendor)
"*New innovations [regarding] monitoring and control data will be enabled through 5G. […] [and] VR, AR and MR as well as other modeling tools within healthcare, and new application areas for mobile cloud services.*" (Head of research/CTO, public healthcare provider)

- Better access to and maintenance of equipment through IoT is available.

"*[5G will enable] mobile measurement and testing equipment.*" (CEO, private healthcare provider D)
"*Within home care, some tests can be conducted at home, for instance, diabetics care.*" (CEO, private healthcare provider B)
"*It becomes easier to manage hospital equipment. The accessibility, usability, and maintenance of hospital equipment improve when the equipment can be complemented with 5G-connections, and thus measured through them.*" (Head of development, health technology vendor)

The results reveal that experts anticipate important and likely changes driven by 5G technology in four different categories of market change. In fact, the top nine changes in the Finnish healthcare market refer to three of the six categories, namely *supply-side network*, *channels*, and *products & price* (Table 3). Interestingly, none of the market changes related to *representations*, *norms*, or *customers & use* were ranked above average in any of the three questions about importance, likelihood, and 5G dependence. The changes in *supply-side network* had the highest number (five) of mentions in the list of anticipated market changes.

5.2. The differing views of the subpanels

The views of experts both on the healthcare industry and 5G networks differed slightly from each other. The suggested changes were in general perceived as more important (3.93 vs. 3.76) and more 5G dependent (3.35 vs. 3.14) by healthcare industry experts than by 5G network experts. However, the changes were considered slightly less likely (3.62 vs. 3.80) on average by healthcare experts compared to 5G network experts.

Healthcare industry experts ranked the following market changes among the most important: "More sensor-based services are offered with alerts and predictive analytics"; "More remote services are offered: remote operations (e.g., robotic surgeries), remote monitoring, and remote consultations and diagnostics"; "Clients are increasingly served remotely through digital services"; "Improvements are made in the flow of real-time information"; "More mobile sensors, sensor data, and IoT are offered to enable health monitoring, remote diagnostics, and AI"; "More versatile use of video surveillance for patient and general safety"; "Experts are more flexible and available for remote consultations"; "New innovation opportunities for medical device companies"; "Health-monitoring devices become the new normal"; "The use of AI and robotics becomes accepted in healthcare" (Table 4). These market changes represented seven of the same market changes as in the overall results. In contrast, "The use of AI and robotics becomes accepted in healthcare" and "More versatile use of video surveillance for patient and general safety" were included in the healthcare experts' list but not in the general list. This indicates some differences in viewpoints between healthcare and 5G network experts.

"*The use of artificial intelligence and robotics becomes accepted.*" (Head of research/CTO, mobile operator B)
"*Through the use of robotics, procedures could be done by a person who does not fulfil the requirements of healthcare standards. This includes risks.*" (System designer, network operator)
"*The use of video monitoring becomes more versatile and common, enabling the surveillance of both patient and general safety in different spaces.*" (Head of development, health technology vendor)
"*Low latency also enables the fast transfer of alarm information to professionals and the reaction accordingly, including video connection to the surveillance target.*" (Head of research/CTO, public healthcare provider)

5G network experts ranked the following market changes among the

Table 4
Healthcare industry experts' views on the most important and likely 5G-dependent changes in the healthcare market.

Market change	Category of market change	Importance	Likelihood	5G dependence
Clients are increasingly served remotely through digital services	Channels	4.50	4.40	3.60
Experts are more flexible and available for remote consultations	Supply-side network	4.30	4.00	3.70
Health-monitoring devices become the new normal	Norms	4.22	3.80	3.70
The use of AI and robotics becomes accepted in healthcare	Norms	4.22	3.80	3.70
New innovation opportunities for medical device companies	Supply-side network	4.20	4.30	3.90
More sensor-based services are offered with alerts and predictive analytics	Products & price	4.20	4.10	4.20
Improvements are made in the flow of real-time information	Supply-side network	4.20	4.00	4.40
More mobile sensors, sensor data, and IoT are offered to enable health monitoring, remote diagnostics, and AI	Supply-side network	4.20	3.90	4.10
More remote services are offered: remote operations (e.g., robotic surgeries), remote monitoring, and remote consultations and diagnostics	Products & price	4.20	3.80	4.10
More versatile use of video surveillance for patient and general safety	Supply-side network	4.10	4.30	4.00

most important: "More remote services are offered: remote operations (e.g., robotic surgeries), remote monitoring, and remote consultations and diagnostics"; "More sensor-based services are offered with alerts and predictive analytics"; "New questions arise concerning privacy and the use of personal sensor data"; "Increased use of robots and smart systems"; and "More mobile sensors, sensor data, and IoT are offered to enable health monitoring, remote diagnostics, and AI" (Table 5). "New questions arise concerning privacy and the use of personal sensor data" and "Increased use of robots and smart systems" were included in the 5G network experts' list but not in the general list.

> "*People may have several personal sensors, and decisions are made on their data, [for instance] whether to call for additional examinations. Can this be done without the consent of people, or can we force them? In many phone applications the use of sensors is accepted for many other purposes.*" (System designer, network operator)
> "*Privacy concerns: the collection of bio and other personal data, their combination and storage possibilities create a need to define roles, rights, and responsibilities better than currently.*" (Innovation manager, technology vendor A)

Table 5
5G network experts' views on the most important and likely 5G-dependent changes in the healthcare market.

Market change	Category of market change	Importance	Likelihood	5G dependence
More remote services are offered: remote operations (e.g., robotic surgeries), remote monitoring, and remote consultations and diagnostics	Products & price	4.11	4.22	4.00
More sensor-based services are offered with alerts and predictive analytics	Products & price	4.10	4.60	3.40
New questions arise concerning privacy and the use of personal sensor data	Norms	4.00	4.50	3.40
Increased use of robots and smart systems	Customers & use	4.00	4.00	3.56
More mobile sensors, sensor data, and IoT are offered to enable health monitoring, remote diagnostics, and AI	Supply-side network	3.90	4.70	3.67

> "*Robot services for senior living or residents utilizing homecare. Systems that close devices, for instance, when you leave your home. If no one is at home, the stove turns off, etc.*" (Head of IT/technology, private healthcare provider A)

Interestingly, there were only three market changes that both subpanels deemed simultaneously important, likely, and 5G-dependent. These were "More remote services are offered: remote operations (e.g., robotic surgeries), remote monitoring, and remote consultations and diagnostics"; "More sensor-based services are offered with alerts and predictive analytics," and "More mobile sensors, sensor data, and IoT are offered to enable health monitoring, remote diagnostics, and AI".

6. Discussion and implications

6.1. Implications for research

We make an important contribution to the midrange theories of market shaping and innovation, aiming to facilitate the understanding of the abstract S-D logic narrative through empirical investigations (Brodie et al., 2019; Vargo & Lusch, 2017). To be concise, our study underlines how different views of technology influence our empirical findings as regards the role of technology in market shaping and innovation. We advance the collective theoretical understanding of duality of technology by revealing how technologies may be perceived as *peripheral* or *central*, and as *offerings* or *platforms*. Acknowledging this helps scholars to run empirical studies on the impact of technology on market shaping. This also helps managers and entrepreneurs to identify how technological development can shape the markets that they are interested in. By addressing issues related to 'non-intentional-design' aspects of markets, we challenge the current thinking in market shaping and market innovation literature. We elaborate our insight and its implications further below.

Market shapers are not necessarily considered technology developers but tend to rely on complementary technologies that enable new avenues for resource integration (Nenonen et al., 2019). This has partly discouraged scholars of market shaping and innovation from studying

technology-induced changes in the market. We contribute to the research by conceptually demarcating between technology as a *new offering in the market* and as a *platform for market shaping and innovation.* The former is a focal, market-specific concept that focuses on new value propositions introduced to the actors of that particular market. The latter encompasses a more generic view of technology that enables the introduction of new services and processes in a market. As a result, technology as platforms are not necessarily intentionally brought to the market by a lead actor (cf. Frow et al., 2016) but by nontraditional market actors. Therefore, we consider it important to conceptually distinguish between *central* and *peripheral* technology. Until today, market-shaping literature has to a large extent focused on central technology as a market shaper's vehicle for introducing changes. There are few empirical examples or conceptual works that would consider that market shapers can similarly build on peripheral technologies that act as platforms for market shaping.

Whether a technology is seen as a new offering or as a platform for market shaping and innovation depends partly on the viewpoint. For instance, AI technology might be perceived, in general, as a platform for market shaping in the healthcare market, while there can also be new AI-based offerings in the market. Some companies and organizations may bring a new solution to the market, such as Microsoft's Windows operating system or Open Handset Alliance's Android, which can be viewed as offerings in the PC and mobile device markets, respectively, as well as platforms that mediate interactions among users and providers of products and services in these same markets. While the new offering is by definition always at the core of the market (central technology), platforms for market shaping and innovation may be, and often are, developed by nontraditional actors (peripheral technology).

Consequently, we contribute more widely to the recently emerged theme of S-D logic, namely the linkage between technological innovations and markets (Vargo et al., 2015). Particularly, we add to the discussion on how the technological infrastructure influences value co-creation in the market (Akaka & Vargo, 2014). By conceptualizing technology as a platform, we provide insight to this discussion on the link between technology and value propositions as well as technology and market practices. In line with Wieland, Hartmann, and Vargo (2017), we show that a technology can play an important role in triggering changes in market practices by fostering new products and channels, without being actively exchanged by market actors. As a result, we argue that market practices can be built around a combination of both *technology as a new offering in a market* (e.g., sensor-, robot-, and AI-based health solutions) and *technology as a platform for market shaping and innovation* (here: 5G technology). We specifically provide empirical insight on platform business models, introduced by Fehrer, Woratschek, et al. (2018) to challenge the idea that focal firms manage, influence, and control entire service systems. Our example of 5G as a platform is categorically different from the examples of 'platform ecosystems as technology ecosystems' provided by Fehrer, Woratschek, et al. (2018) and does not feature the physical or virtual touch points as per Breidbach et al. (2014) or Breidbach and Brodie (2016), but complements their discussion on how technology ecosystems may organize actors and influence their business logic.

In our empirical findings, we discuss the interplay of technology as a platform (5G) with new market offerings. As a result, we show that experts are able to envision new offerings that emerge as new platforms enable their commercial usage. For instance, various remote services require a reliable wireless connection. For many life critical services, mobile networks have traditionally showcased too high a latency and too low an accuracy in performing activities remotely. For other markets, 5G's other qualities (e.g., higher data rates and lower energy consumption) may be more important and open some bottlenecks that have postponed the introduction of new offerings. Different technologies carry their own characteristics. For instance, 3D printing enables the creation of low-cost, malleable objects from materials available on-site. As a result, the impact of 3D printing technology can be assessed through these characteristics, and the impact can be very different in the healthcare market, in which highly-customized products are valued more than in the space industry, where 3D printers enable onsite printing. Thus, our research findings should be understood with the given limitation to one technology and one market. However, the discussion has wider implications for the role of technology in market shaping and innovation.

While the shift from market-shaping companies to technology-induced market change may be perceived as a critique against the active role of managers, we do not claim that markets are not influenced by market-shaping companies. Rather, we question the hegemonic role of focal actors by showing how peripheral technologies may also initiate market changes. Market-shaping entrepreneurs and companies can build on these technologies to develop, for instance, business models that eventually impact markets.

We contribute to the literature by illuminating how Nenonen et al. (2019) framework can be used as a part of a Delphi study that focuses on the anticipated market changes and by presenting a critique that partially stems from the framework's original purpose and research context. Our results indicate that 5G is anticipated to affect supply-side networks in the healthcare market more than other elements of market change. In fact, a majority of the important, likely, and 5G-dependent market changes concern the *supply-side network* category. This result contradicts the empirical results of Nenonen et al. (2019), which did not find any important relationship between supply-side network and market change. The opposing results may be explained by our focus on the market level rather than on focal firms, as well as our decision to include organizational changes in this category. There is room for debate on whether organizational change should be included as a market-level change, or if organizational change should form its own category.

The deployment of Nenonen et al. (2019) framework illuminates the focal actor–centric design of the original model and research setting. The framework was initially built on interviews with market-shaping firms, strengthened with organization-centric market shaping literature, and tested with questionnaires directed at organizations who aimed to reflect the market changes from the viewpoint of their own companies. This setting partly hindered the opportunity to portray market changes more objectively and did not invite comments on organizational changes or, more particularly, beyond the focal firm.

We revealed that oscillating the foci between focal market-shaping firms and other market actors challenges whether a market change belongs to a *customer* or to a *supply-side network* category. For instance, a public hospital can be simultaneously a focal organization, a customer, and a supplier, depending on who answers the question. Thus, some new services enabled by an emerging technology can be employed by companies that are customers to one company but suppliers to another. Similarly, robots can be increasingly used and owned by patients, healthcare providers, or insurance companies, making it challenging to determine which category the changes in robotics resources fall into. Although we present these concerns about the applicability of the original framework, they did not have a major influence on our study; we can still confidently interpret that industry experts expect that 5G will increase the use of sensors in the healthcare market. In other words, while this may be more of an issue of labeling, rather than distorting the results, it is important to acknowledge that the detailed descriptions of market change are not easily categorized when the focal actor perspective is not clearly defined *ex ante*.

Finally, we diverge from Nenonen et al. (2019) by teasing out more detailed descriptions of market change. Our research encouraged experts to envision how the healthcare market is changing after the launch of 5G. Instead of asking whether there will be a change (yes/no), the experts were allowed to describe the changes in their own words. While Nenonen, Storbacka, and Frethey-Bentham's study (2019) is limited to revealing whether changes have taken place, the original framework does not allow a detailed understanding of how market practices change. The modified framing in this study provides a more holistic view

of market change by eliciting more descriptive answers and thus delivers more practical insights rather than merely suggesting that there will be changes in how customers use the product/service.

6.2. Implications for managerial practice

The anticipated changes suggested by technology developers require, in some cases, imaginary-use cases to justify the need (and often, to guarantee funding) for the development of technology and to make value/market propositions to get other market actors committed to technology (Storbacka & Nenonen, 2011). By highlighting the differences in viewpoints between 5G network and healthcare market experts—as facilitated by the Delphi method—we underline the importance for technology developers to understand how other market actors perceive the market and the potential of the emerging technology.

We emphasize collaboration beyond direct customers and suppliers to realize new opportunities in the market. However, the growing opportunities in healthcare are largely dependent on the institutional environment of the local market. Healthcare is heavily regulated, which may limit the availability of remote services. Similarly, regulation may hinder internationalization efforts of healthcare technology startups. It is important that regulators recognize the findings and ensure that patient safety as well as competitiveness and the national economy are not at stake when 5G induces changes in the local healthcare market.

Our findings elucidate the threat of competition to conventional healthcare companies. Newcomers may introduce remote services that are more cost effective or higher quality. It is important for healthcare professionals to analyze how the envisioned changes in the market influence the position of their organizations as well as the new business opportunities that will emerge, particularly in the international arena, both for traditional healthcare companies and technology developers (e.g., digital services, sensors, and IoT).

Our study indicates that new opportunities and threats may materialize through the development of technology that is central or peripheral to the market. While managers are often well aware of what happens within the traditional market, they may be myopic to the technological development in other industries and therefore lack the vision of how these peripheral technologies may initiate market changes. This study encourages managers in the healthcare market and beyond to have a closer look at the development of peripheral technologies that may act as platforms for market shaping and innovation. In order to be a frontrunner and a market shaper, it is necessary to discover and exploit these opportunities.

6.3. Limitations and further research avenues

Conducting similar studies in other market contexts allows for comparing and contrasting the impact of the emerging technology as a platform for market shaping and innovation between various markets. Our study indicates that the changes in the supply-side network are in general perceived as more important, likely, and 5G-dependent than changes in other market elements. Whether this is the case in the context of other markets requires further research. In fact, the impact of 5G on various markets may largely vary. We acknowledge that the healthcare market may be a special case that highlights patient safety and is therefore more heavily impacted by technology that enables reliable flow of data for various remote services and monitoring. However, we did not ask the experts why 5G enables the introduction of remote services, patient monitoring, and sensor-based solutions. Other scholars could develop our method to include questions that reveal the characteristics of the technology necessary for the new market offerings, providing insight both to market actors as well as the developers of the peripheral technology.

The findings are partly dependent on our expert selection, who we chose carefully with an emphasis on plurality to represent companies that develop 5G technology as well as different healthcare organizations. While we might consider that as a good practice in Delphi studies, the methodology does not provide clear instructions on how to define and measure plurality among and between industries. Consequently, marketing scholars are invited to develop the methodology. Various experts could be identified by using network pictures (Mouzas, Henneberg, & Naudé, 2008) or network mobilization tools by Bockhaven and Matthyssens (2017).

We acknowledge that 5G may be considered a special case following a vertical collaboration of market actors. Our study is thus limited by our focus on a peripheral technology that acts as a platform for market shaping and innovation. However, we also encourage studies that portray technology as a market offering, to complete the discussion on how conceptually-different technologies induce market changes. It is equally important for scholars to focus on technology developed by a leading market actor when striving at a more holistic view on the impact of technology on market shaping and innovation.

Finally, while this study highlights the growing importance of remote health services (Go Jefferies, Bishop, & Hibbert, 2019), more research is needed on the technological and institutional forces enabling and hindering the development of remote services in healthcare. In other words, more research is needed for understanding what kind of institutional work, other than the introduction of new market offerings, is needed for taking full advantage of an emerging technology as a platform for market shaping and innovation.

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