



# Corporate foresight: A systematic literature review and future research trajectories

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## ABSTRACT

Corporate foresight (CF) has received increasing attention from scholars and practitioners alike. Due to the increasing environmental complexity and unpredictability that the corporate world is encountering, companies from various sectors have realized the need to engage in CF to mitigate uncertainty. However, current research on the topic remains fragmented and lacks conceptual connection. This study, therefore, aims to examine the extant CF research and provides a systematic insight into its key components. Through a narrative synthesis of a sample comprising 73 articles published over the last two decades in leading business and management journals, we developed an integrative framework that maps the key elements underpinning CF literature (including antecedents, tools/activities, moderators, technology, and outcomes) and explicates their interplay. We also highlighted the bidirectional effect of technology, as a distinct construct, across CF elements, and discussed the need to identify technology-related boundary conditions that may influence the manifestation of CF outcomes. Moreover, we utilized the developed framework as a platform to identify critical gaps in the CF research and suggest related future research trajectories.

## 1. Introduction

As companies aim to remain competitive in an increasingly complex, uncertain and disrupted environment, the ability to understand and predict the future becomes vital (Maertins, 2016; Peirong & Al-Tabbaa, 2021). For this reason, companies, regardless of the size and scope of their operations, show a growing interest in enacting corporate foresight (CF) (e.g., Fergnani, 2020; Gordon, Ramic, Rohrbeck, & Spaniol, 2020; Mühlroth & Grottke, 2018). In principle, CF involves the application of future and foresight practices (e.g., technological forecast, strategic anticipation) “by an organization to advance itself; that is, to fulfill its purpose and achieve success on whatever terms it defines such success” (Gordon et al. 2020, p. 1). As such, organizations that engage in CF are likely to envision external disruptions (e.g., caused by new technological developments) and assess their potential impact, aiming to be prepared for several possible future scenarios of their business environment (Bezold, 2010; Scheiner, Baccarella, Bessant, & Voigt, 2015). This implies that CF does not only support companies in anticipating the future

but also enables flexibility and responsiveness required to counter potential disruptions (Rohrbeck & Kum, 2018).

The interest in CF is likewise reflected through increasing academic engagement in the field. Indeed, CF has become an important field of inquiry (Gordon et al., 2020). The number of publications on CF has significantly increased in recent years and already outnumbers that of previous decades (Singh, Dhir, Das, & Sharma, 2020). However, by exploring this body of knowledge, we identified two key issues. First, the CF literature is still fragmented and lacks a comprehensive framework that integrates the *empirical-driven* insights developed in this critical field. While, few studies have emerged over the past few years that review the CF literature, these studies are limited in different ways. Importantly, they have been developed based primarily on conceptual reasoning (e.g., Fergnani, 2020); offer a historical timeline on the development of the CF content as evolved in one journal (e.g., Gordon et al., 2020) or in general (e.g., Rohrbeck, Battistella, & Huizingh, 2015); or adopt a narrow perspective that focuses on CF-related tools - such as using data mining in scanning the environment (e.g., Mühlroth &

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Grottke, 2018). This highlights the need for a more comprehensive approach to integrating empirical scholarly effort pertaining to CF given that CF antecedents, core activities, and influencing factors are derived from various research streams (e.g., strategic management, decision making, organizational learning, and futures studies) (Fergnani, 2020, Rohrbeck & Schwarz, 2013), and cover a variety of diverse domains (e.g. marketing and innovation management) (Gordon et al., 2020; Sarpong & Meissner, 2018). Lacking an integrative view of the CF fragmented literature can seriously hamper the development and advancement in theory and practice, as researchers and practitioners alike would not have a unifying point of reference (Snyder, 2019).

Second, it is notable that the role of technology in the context of CF is not well understood and connected with the different elements of CF (Gordon et al., 2020, Kaivo-oja & Lauraeus, 2018). More specifically, so far, technology has been largely addressed in relation to CF either as an external factor to be assessed in order to gain and maintain strategic benefits (for example by using technology roadmapping) (e.g., Yoon, Kim, Vonortas, & Han, 2019), as a tool itself (e.g., the application of machine learning for generating better market forecasts) (Crews, 2019, e.g., Yoon et al., 2019), or as an output of CF (Mühlroth & Grottke, 2018, Sarpong & Meissner, 2018). This, in turn, highlights the complex nature of technology-CF relationship, indicating the need to scrutinize the multiplicity of technology in the CF context, and elaborate its differential impact on the various elements of CP practices and processes.

We aim to address the above gaps by setting three research questions: 1) *what is the state of empirical research on the concept of CF*, 2) *how technology (as a distinct construct) is regarded in this body of research?*, and 3) *what are the potential trajectories for the CF research?* To answer these questions, we adopted a Systematic Literature Review (SLR) procedure by collecting, analyzing, and consolidating findings from 73 empirical articles published between 2000 and 2020 in leading business management journals.

Overall, our study offers several key contributions to the extant literature. First, we scrutinized and integrated the empirical research on CF to develop an evidence-based framework. Using a process-oriented approach, we investigated CF as a process that encompasses key elements, including motivations, tools and activities, moderators, and outcomes. This framework can act as an integrative and unifying platform to realize and expand CF research. Second, contrary to the current simplistic approach that fundamentally regards technology as an ‘input for’ or ‘output from’ CF, we addressed technology as a distinct construct that affects all CF elements. This approach is particularly novel as it reveals the extended role of technology and how it intersects with the CF process. Finally, we drew on the emerged insights from our analysis of the empirical literature on the CF concept, as well as the developed framework, to identify key gaps in this field and document areas for future research. In doing so, we suggest novel research avenues by the cross-fertilization of research along with greater contextualization, theoretical integration, and geographic coverage to revitalize this important area of research.

The rest of the article is structured as follows: First, we discuss existing review perspectives to CF, followed by an explanation of the research design (SLR), giving a detailed overview of each conducted step. After that, an overview of the status of empirical research on CF is given. The next section introduces the framework and explains the SLR outcomes through a narrative synthesis. Finally, we present implications for theory and practice, offer directions for future research trajectories, and outline research limitations.

## 2. Corporate foresight

In general, researchers refer to foresight activities in profit-oriented organizations as “corporate foresight” (Gordon et al., 2020; Vecchiato & Roveda, 2010a). Due to the speed and uncertainty of environmental changes, firms become less confident in the effectiveness of planning that is based on previous experience and assumptions (Bennett &

Lemoine, 2014). Instead, executives started to recognize that business decisions should not only be driven by past data, but also be based on systematic evaluation of possible forthcoming trends by constantly scanning for and interpreting discontinuities in the external environment (Day & Schoemaker, 2005). Accordingly, CF can be regarded as a firm’s capacity to interpret changes in the business environment, outline and evaluate plausible future based on these changes, and then utilize this information to build and sustain competitive advantages (Fergnani, Hines, Lanteri, & Esposito, 2020).

Historically, CF evolved in the 1950 s from two main schools. Gaston Berger developed the French ‘prospective school’ (focus on collaborative systems thinking), while at the same time the US RAND corporation laid the foundation for the “strategic foresight” school (focus on future anticipation methods) (Rohrbeck et al., 2015). Until the early 1990 s, CF activities followed a predominantly quantitative approach, focussing on the prediction of developments applying numerical information (Walton, O’Kane, & Ruwhiu, 2019). Today, however, the anticipation of the future follows a significantly different approach, whereby companies apply a variety of tools across different hierarchical levels to understand future challenges (Gordon et al., 2020). The openness of these newer approaches is further characterized through the willingness to exploit CF benefits by applying them in different contexts such as product development, innovation management or organizational change (Heger & Rohrbeck, 2012; Van der Duin et al., 2014).

### 2.1. Perspectives to review corporate foresight

Recognizing its importance and development, several researchers sought to review the CF body of knowledge from different angles. Adopting an evolutionary perspective, scholars have attempted to understand how the CF as a concept has evolved over time (Rohrbeck et al., 2015). In this respect, Gordon et al. (2020) has highlighted that the CF field has developed from, merging technology with market forecasting, to expanding forecast approaches to reach the phase of ‘organizational integration’ to create agile and adaptive organizations. Such integration can be achieved when CF platform connects “many inter- and intra-organizational actors, advancing foresight insights and defining options for organizational responses” (Gordon et al., 2020, p. 9). However, the ‘organizational integration’ phase, and despite emphasizing the final anchoring of CF in praxis and theory, creates a fertile area for the investigation of single CF application fields and future directions but likewise leaves a variety of loose ends (Schoemaker, Day, & Snyder, 2013).

Extending the previous conclusion, and criticizing the lack of a theoretical foundation in CF scholarship (Iden, Methlie, & Christensen, 2017), researchers started to use the dynamic capabilities (DCs) lens to review and understand the sophistication of CF as an organizational component (Schwarz, Rohrbeck, & Wach, 2020, Semke & Tiberius, 2020, Yoon, Kim, Vonortas, & Han, 2018). That is, studies adopting the DCs perspective perceive CF as an organizational capability that cuts across all firm levels (Pulsiri & Vatananan-Thesenvitz, 2018, Rohrbeck, 2010). Therefore, CF is considered as a series of micro activities aimed at negotiating an organizational path towards the future, and involves constant interaction across all firm’s members, rather than being limited to the upper echelons discussions (Fergnani, 2020). Notably, studies adopting the DCs perspective, have predominantly applied Teece’s microfoundations framework (Schwarz et al., 2020, Semke & Tiberius, 2020). For instance, Fergnani (2020) discussed CF in the DCs framework, proposing a model that specifies the components of CF sensing (e.g., information collection), seizing (e.g., techniques variety and integration), and reconfiguring (e.g., foresight-strategy linkage). However, the model does not capture the motivations for CF, which is a fundamental factor that explains a firm’s orientation toward the integration of CF system (Boe-Lillegraven and Monterde, 2015). Also, the technology side, which is a central dimension across all CF activities (Gershman, Bredikhin, & Vishnevskiy, 2016), is only addressed as part of the seizing

activity.

## 2.2. The role of technology in CF research

In general, technology represents a critical factor in CF research, whereby researchers have highlighted its role as vital for enabling firms' CF potentials (Crews, 2019; Heiko, Bañuls, Turoff, Skulimowski, & Gordon, 2015). Accordingly, several studies have scrutinized the relationship between CF and technology, which can be largely clustered into two streams: 1) technology roadmapping; and 2) the application and development of ICT-based systems for foresight processes.

Technology roadmapping is the process of matching a firm's goals (both short and long-term) with specific technology solutions to help the firm to achieve those goals (Gershman et al., 2016). It is a tool that, includes a variety of information exchange processes among stakeholders (Vishnevskiy, Karasev, & Meissner, 2015), for supporting technology management and planning so that a firm can connect its resources and strategy with environmental disruptions (Yoon et al. 2019). Therefore, CF and technology roadmapping has widely been regarded as interlinked (Hussain, Tapinos, & Knight, 2017; Milshina & Vishnevskiy, 2018). As such, empirical studies show that CF is an important antecedent for technology roadmapping. That is, the configuration of technology arrangement and deciding which alternative technological pathways to adopt, in order to build the innovation capacity of a firm, can be largely dependent on the firm's CF practice (Nazarenko, Vishnevskiy, Meissner, & Daim, 2021). For example, Yoon et al. (2019) found that CF is vital for the development of effective technology roadmapping process that would enable firms to develop and commercialize new/emerging technology, and design how the adopted technology can be leveraged against potential disruptions in the market.

On the other hand, there is an *emerging* research stream that investigates how ICT-based systems (e.g., communication interface applications and dedicated decision-making software) and new information-related technologies (e.g., machine learning, artificial intelligence, and text-mining tools) can enhance the CF process (Boysen, 2020; Díaz-Domínguez, 2020; Heiko et al., 2015). In essence, these technological systems acting as enablers support firms' capacity to perform complex quantitative and qualitative data analysis, and advance their modelling processes (Keller & Heiko, 2014; Heiko et al., 2015). In turn, this enables contextual identification of environmental uncertainties in the present and from the future allowing systematic identification of opportunities and threats (da Silva Nascimento, Reichert, Janissek-Muniz, & Zawislak, 2020). In other words, these systems provide a "platform for information exchange and creation, collaboration, analyses and assessments...[that] should enable a general but also solution-oriented foresight process to examine short and long-term developments and scenarios" (Heiko et al., 2015, p. 2). For instance, Mühlroth and Grottko (2018) reviewed research on data analytics (e.g., text-mining systems) and visualization techniques as applied in CF for detecting weak signals (i.e., fine-grained issues in the corporate environment that can transform into future opportunities and/or threats). By using these techniques, firms can enhance the automation of data processing, which can reduce the human actor bias during the detection and interpretation of the weak signal leading to improved CF (in futuristic decision making). Similarly, Boysen (2020) emphasizes that technologies based on machine learning and artificial intelligence can advance firm's analytical capabilities to minimize cognitive bias during the CF process.

However, reflecting upon the above two technology-related streams, it can be realized that these research streams can be criticized as they do not scrutinize the multiplicity of technology during the CF context. In other words, it is limited in elaborating the differential effect of technology on the multiple components of CF practices and processes. The interplay between technology and CF demands deeper investigation as the extant research suggests that the proposed unilateral relationship between technology and CF is inaccurate.

## 2.3. Towards a conceptual framework for corporate foresight

Recognizing the development and limitations in the CF field (as discussed above), this study aims to critically integrate the *empirical* CF literature and addresses the identified gaps by tying the loose ends particularly evolved in the last two decades into a comprehensive framework. This framework reflects the whole width of CF elements and provides a platform for future research trajectories and theoretical extensions, as well as enables practitioners to understand the essence of this process.

We discuss next our underpinning conceptual foundation. As a starting point, there is a need to clarify CF meaning to establish our conceptual boundaries. Following Rohrbeck et al. (2015), CF fundamentally involves "identifying, observing and interpreting factors that induce change, determining possible organization-specific implications, and triggering appropriate organizational responses... [it] involves multiple stakeholders and creates value through providing access to critical resources ahead of the competition, preparing the organization for change, and permitting the organization to steer proactively towards a desired future" (p. 2). Notably, this conceptualization enabled the inclusion of processual, systemic, and technique-based views, without *exclusively* defining CF as either a capability or set of techniques and tools. More specifically, we adopted this broad definition to inform our analysis and synthesis, where we investigated the CF as a continuous process, that involves CF initial conditions (i.e., motivations), internal mechanisms (i.e., activities and tools), boundary conditions (i.e., moderators and influencing factors), and output (i.e., CF multiple outcomes). Importantly, adopting this process-oriented framework as our theoretical foundation is an important advantage of this systemic review. That is, we avoided the issue of decoupling between CF key practices (Iden et al., 2017): *detecting* discontinuities in the environment (e.g., environmental scanning), and *deciding* appropriate organizational responses (e.g., scenario planning); where such separation has limited the potential of fully understanding the CF (Fergnani, 2020). Therefore, by adopting the process-oriented framework, we were able to capture the full breadth of CF and its extended complexities, unlike most existing reviews that focus fundamentally on certain aspects, such as tools and technologies (de Alcantara & Martens, 2019; Mühlroth & Grottko, 2018), capabilities and learning (Fergnani, 2020, Pulsiri & Vatananan-Thesenvitz, 2018); and historical evolution (Gordon et al., 2020; Rohrbeck et al., 2015).

## 3. Research design

In this study, we adopted the Systematic Literature Review (SLR) methodology. SLR, in contrast to semi-systematic or integrative reviews, which illustrate data on a research topic selectively, inevitably bearing researchers' subjective view (Snyder, 2019), has the advantage of identifying "all empirical evidence that fits the pre-specified inclusion criteria to answer a particular research question" (Snyder, 2019, p. 334). This fits with the overarching aim of this study: to develop an integrative evidence-based framework that can be used to understand the concept of CF and its underpinning complexities, and set trajectories for future research directions in this field. In effect, the SLR can yield novel insights by scrutinizing, evaluating, and accumulating the knowledge developed in a certain field in an unbiased, transparent and reproducible manner (Al-Tabbaa, Ankrah, & Zahoor, 2019; Apostolopoulos Ratten, Petropoulos, Liargovas, & Anastasopoulou, 2021). By minimizing the risk of subjectivity and/or overlooking relevant literature, the SLR study can produce a reliable platform for advancing our understanding of a specific concept and enable related theoretical extensions (Snyder, 2019).

Overall, our SLR was guided by Tranfield, Denyer, and Smart (2003) four steps model. Fig. 1 summarizes the research design and methodological approach.

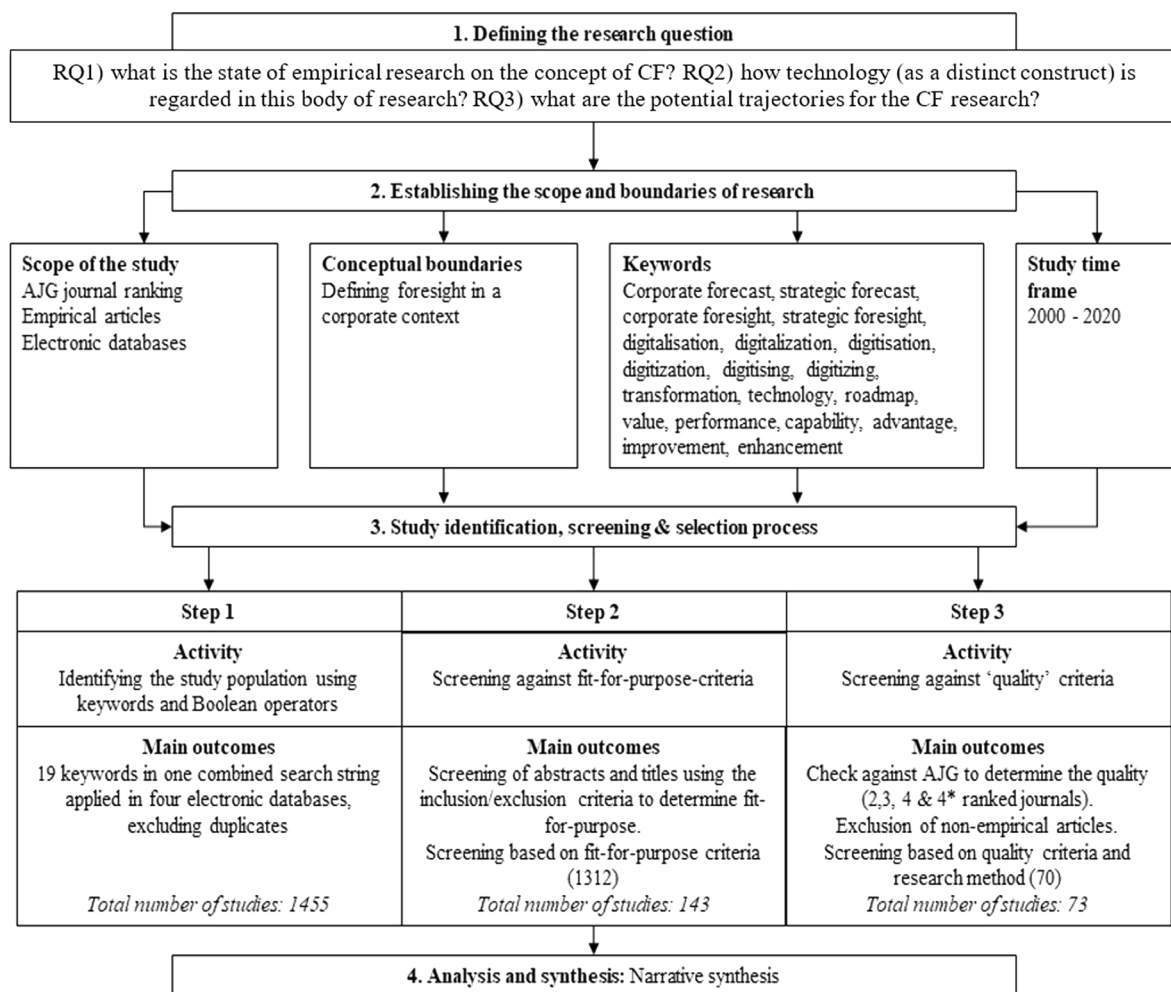


Fig. 1. Methodological approach to the systematic review.

### 3.1. Key questions guiding the systematic review

In order to determine and guide the direction of the systematic review, the article focuses on the following three key research questions:

*RQ1) what is the state of empirical research on the concept of CF?* This question focuses on the spectrum of publications, applied methodologies and the theories underlying CF. Also, it explores the key aspects of CF as identified in the conceptual framework including motivation to engage in CF, the tools and methods applied, facilitators and inhibitors moderating variables of CF, and CF outcomes.

*RQ2) how technology (as a distinct construct) is regarded in this body of research?* The focus of this question is to investigate how technology as a distinct construct affects or is affected by the CF different aspects (i.e., to map the bidirectional effect of technology in the CF process).

*RQ3) what are the potential trajectories for the CF research?*

### 3.2. Review boundaries and scope

The review scope includes articles published in the period from 2000 to 2020. The year 2000 was set as a cutting point because the rapid increase of technological disruptions and environmental uncertainty faced by companies from the early 2000 s has triggered and significantly amplified the interest in foresight within the business domain (i.e., by connecting technology and market foresight with strategic planning) (Gordon et al., 2020). Prior literature on foresight focussed rather on the development of future states and forecasts in more stable environments (Rohrbeck et al., 2015). Furthermore, CF is still an evolving field,

emancipating from purely quantitative-based forecasting since the 1990 s. For this reason, pre-2000 literature can be regarded as less relevant (Djuricic & Bootz, 2019), where CF as defined in this paper, is broader and distinguished from 'forecasting' which was the initial concept of foresight activities and has a dominant quantitative foundation.

Following this, relevant search terms and combinations were established. Guided by our definition of CF, three main terms were ascertained: 'Corporate Foresight', 'Technology' and 'Value'. These were complemented by a variety of similar keywords to ensure that all related articles are covered. As an example, the term 'Strategic Foresight' is frequently used synonymously with 'Corporate Foresight'. Moreover, the imprecise term 'Corporate Forecast' is casually applied to illustrate foresight activities due to a lack of differentiation, particularly in earlier articles. All the identified terms were combined with the Boolean operators 'odds ratio (OR)' and 'AND'. As an example, a search term combination was: 'Corporate Foresight' AND 'Technology' AND 'Value'. A full overview of used search terms is given in Table 1.

Next, relevant literature databases were identified. To ensure access, only electronic databases were selected which include a broad range of currently published research in social sciences and business research (Snyder, 2019). Only peer-reviewed journal articles in the English language were included in our review (thus omitting other sources such as books, book chapters, conference papers, and other non-peer-reviewed publications). This decision was necessary to 1) minimize quality-related concerns, as these articles have been subject to the rigorous review process; 2) keep our sample within a manageable size without the risk of omitting important/relevant work as researchers would typically



**Table 1**  
Keywords and search strings.

1. Foresight	2. Technology	3. Value	4. Search strings example
“corporate forecast” OR “strategic forecast” OR “corporate foresight” OR “strategic foresight”	“digitalisation” OR “digitalization” OR “digitisation” OR “digitization” OR “digitising” OR “digitizing” OR “transformation” OR “technology” OR “roadmap”	“value” OR “performance” OR “capability” OR “advantage” OR “improvement” OR “enhancement”	“corporate forecast” OR “strategic forecast” OR “corporate foresight” OR “strategic foresight AND “digitalisation” OR “digitalization” OR “digitisation” OR “digitization” OR “digitising” OR “digitizing” OR “transformation” OR “technology” OR “roadmap” AND “value” OR “performance” OR “capability” OR “advantage” OR “improvement” OR “enhancement”

publish their scholarly work in academic journals first; and 3) ensure that we had access to all possible sources within our sample.

Four electronic databases were selected: Elsevier (Science Direct), International Bibliography of the Social Sciences (IBSS), JSTOR (Journal Storage), and SAGE Journals. These databases are accessible and cover a wide range of research studies on CF (Iden et al., 2017). Besides that, the vast majority of relevant business and management journals are publishing research on the CF topic in these databases (as informed by the ‘tracking of citation’ process and checking using Google Scholars that we did while scrutinizing the relevant articles).

### 3.3. Study identification, screening, and selection process

To reach our final sample, we adopted three specific steps, as summarized in Fig. 1. In step 1, we used the 19 keywords and their combinations (see Table 1) to generate several *search strings* which we used to search the four electronic databases. The search was conducted under the application of the databases’ advanced search engine. After searching with all combinations in each database, an initial sample of 1455 articles was obtained (after deleting duplications). For clarity reasons, and to maintain an overview of the sample, the online referencing tool RefWorks was used. There, each article was listed by publication date, author, topic, and journal.

In step 2, we screened each article’s abstract and title to determine its relevance based on the fit-for-purpose criteria (which we also set as the inclusion/exclusion criteria in this step). More specifically, we employed the four overarching CF aspects (determined earlier in our conceptual framework) which together created a comprehensive view on CF: initial conditions (e.g., motivations), internal mechanisms (e.g., CF tools), boundary conditions (e.g., moderators/facilitator/inhibitors), and output (e.g., CF outcomes). Based on these themes, we set several questions: 1) Does the research address foresight in a business/company context?; 2) Does the research address foresight of/for technology/technological developments?; 3) Does the research address foresight motivations?; 4) Does the research address foresight tools/methods/techniques?; 5) Does the research include factors that facilitate/inhibit foresight?; and 6) Does the research address outcomes/value contribution of foresight? We applied these questions to exclude all irrelevant articles. So, an article was included in the sample if it answered ‘yes’ to question 1 and at least one of the questions 2 – 6. This step has resulted in 143 relevant articles.

Finally, we applied step 3 to ensure the quality and rigor of our sample. The verification against fit-for-purpose criteria (step 2) was conducted before the quality assessment. This was necessary to initially identify all relevant articles regardless of their quality, which enabled a broadening of our understanding of the topic. To ensure a maximum degree of quality, the 143 articles were verified by checking their listing on AJG (Academic Journal Guide – 2018) of the Chartered Association of Business Schools (Saebi, Foss, & Linder, 2019), which defines quality criteria for journals publishing business-related articles. Only papers published in journals ranked as 2\*, 3\*, and 4\* were included in this study. This screening criterion was necessary to ensure the quality and rigor of our sample, as the 2\* ranked journals publish articles that are “recognized internationally in terms of originality, significance and rigour” (Academic Journal Guide – 2018). This is why the AJG list is

widely recommended in previous review articles (Soundararajan, Jamali, & Spence, 2018). This quality verification reduced our sample to 109 articles. Finally, we excluded all non-empirical research (i.e. conceptual and review studies) from our final sample. This was necessary to offer a state-of-the-art review on the CF empirical research, and develop a comprehensive and integrative framework of the CF that is exclusively supported by empirical evidence. However, as non-empirical studies can offer important contributions; we referred to these studies in our discussion of the definitional and theoretical foundations of the field. Following this screening step, the final sample consisted of 73 articles.

### 3.4. Analysis and synthesis

The final sample was analyzed and synthesized through narrative synthesis. A narrative synthesis was applied because of its suitability for covering a heterogeneous research field such as CF through a comprehensive lens. It allowed presenting the combined research outcomes of the final sample articles in a storytelling-manner through the qualitative analysis of text elements (Bailey, Madden, Alfes, & Fletcher, 2017) and was conducted through tabulation techniques commonly applied in qualitative research as proposed by Miles and colleagues (Miles, Huberman, & Saldana, 2014). The articles were deductively analyzed by reading them word by word. This allowed the identification of formal information (author, publishing year, and journal) research methodology (qualitative, quantitative, or mixed-method approach), theoretical background, and findings on the defined topics (technology, motivation, tools, moderators, inhibitors, outcomes). Results were summarised and collected in an excel spreadsheet.

Next, our analysis of the published content was guided by the process-oriented framework, which identifies several overarching themes for the coding. These themes were used as the initial coding templates. These themes included CF-related motives (i.e., initial conditions), activities and tools (i.e., internal mechanisms), moderators (i.e., boundary conditions), technology, and outcomes, see Appendix A. The appendix clarifies the definitional boundaries of these overarching themes, where we used these definitions as the guiding criteria in the coding process. For example, any empirical findings that relate to factors influencing the relationship between the use of CF tools and outcomes (i.e., facilitate or complicate the process of CF) were coded under the moderator theme. In addition, during the analysis, we adopted the deductive-inductive logic which was necessary to determine aggregation levels of the topics and each of the article’s content within these themes. In specific, we started the coding process with the framework themes, then under each of these themes, we inductively identify several underpinning sub-themes and categories. For example, when analyzing the papers against the motivations theme, we identified all empirical research that explains why firms engage in CF (i.e., as per *motivations* definition in Appendix A). Then, by scrutinizing this content, we noticed two outstanding sub-themes (*adaption* and *anticipation*). The former captures firms’ intention to use CF as a mechanism to identify and react to external changes, whereas the latter describes firms’ drivers to use CF as an approach to develop the future in the company’s favour. Under each of these themes, we were able to further identify other categories that offer fine-grained details that explain the essence of *adaption* and *anticipation* (see Table 2 in the finding section). In addition, this logic

**Table 2**  
Analysing CF motivations.

	Motivation Drivers	Key Insights	Selected studies
<b>A Adaption</b>	I. Assessing signals and trends	<ul style="list-style-type: none"> <li>- “Traditional” view on CF as an early warning system for organizations</li> <li>- Focus on assessment of varying environmental impacts (rather static)</li> <li>- Strategic development to gain advantages</li> </ul>	Vecchiato & Roveda, 2010a, Vecchiato & Roveda, 2010b; Vecchiato, 2012a, Vecchiato, 2012b
	II. Enhance reactivity and create responses	<ul style="list-style-type: none"> <li>- Increase of an organization’s ability to react to changes (rather dynamic)</li> <li>- Focus on ability to change in accordance to (external) factors influencing the organization</li> <li>- Strategic development in order to gain advantages by quickly reacting to external impacts</li> </ul>	Savioz & Blum, 2002; Daheim & Uerz, 2008; Battistella & De Toni, 2011; Engau et al., 2011
	I. Support strategic planning and decision-making	<ul style="list-style-type: none"> <li>- Identification of internal/ external key elements for strategy making</li> <li>- Focus on (general) strategy building</li> <li>- CF conducted in order to support and foster the strategy development process itself</li> </ul>	Savioz & Blum, 2002; Peter & Jarratt, 2015; Buehring & Liedtka, 2018; Schweitzer et al., 2019
	II. Identify, monitor and enhance innovation	<ul style="list-style-type: none"> <li>- Analysis of internal and external factors that enhance innovation</li> <li>- Applied in different contexts (e. g. product, service, or collaboration models)</li> <li>- The main motivation is to systematize and track constant innovation generation with regard to different aspects</li> </ul>	Costanzo, 2004; Ruff, 2006; Rohrbeck & Gemünden, 2011; Ruff, 2015; Rohrbeck, Thom, et al., 2015; Gershman et al., 2016; Calof, Meissner, et al., 2018; Ho & O’Sullivan, 2018
<b>B Anticipation</b>	III. Anticipate future market and business fields	<ul style="list-style-type: none"> <li>- Analysis of internal and external capabilities to be applied in order to gain an advantage in particular markets/business fields</li> <li>- A particular focus in the identification and exploration of new areas of activity</li> <li>- Strong linkage to marketing and sales as well as business development areas</li> </ul>	Heger & Rohrbeck, 2012; Von der Gracht & Stillings, 2013; Açıkgoz et al., 2016; Bisson & Diner, 2017; Schweitzer et al., 2019

was essential to identify emerging themes that could not fit with the initial themes (i.e., the coding templates). Importantly, we discovered several technology-related factors that affect all the themes in the process-oriented framework. Therefore, we added *Technology* as a new ‘distinct’ theme in the CF framework.

A detailed overview of articles included in the analysis is provided in Appendix B.

#### 4. The status of empirical research on corporate foresight

This section gives an overview of the current status of empirical research on CF. It illustrates the width of research by highlighting main journals, authors and dates of publication as well as methodological orientations and theoretical antecedents. This section aims to provide the answer to RQ1 (What is the current state of empirical research on corporate foresight?).

##### 4.1. Descriptive trends

Academic journals publishing empirical research on CF stretch from predominantly business- and management-related ones to technology and engineering journals. More than half of the final sample articles (51%) were published in *Technological Forecasting and Social Change* ( $n = 37$ ). *Technology Analysis & Strategic Management* and *Futures* account each for 14% ( $n = 10$ ). These three journals in total constitute 79% ( $n = 57$ ) of all articles in the final sample. The remaining publications spread equally across different journals with the *Journal of Engineering and Technology Management* and *Technovation* being the only exemptions with 4% ( $n = 3$ ) and 3% ( $n = 2$ ) respectively, see Appendix C for more details. Overall, the composition of publishing journals illustrates the multidisciplinary background of the published material on CF. Most journals are technology-oriented, yet cover topics from social sciences.

Only a minority of literature was published before 2010. Most (15%) was published in 2015 ( $n = 11$ ), followed by 2020 with 14% ( $n = 10$ ) and 2018 with 13% ( $n = 9$ ). These three years account for 41% of literature ( $n = 30$ ), whereas the period from 2010 until 2020 (11 years) constitutes 92% ( $n = 67$ ) of all final sample literature. This illustrates the topic’s growing importance among scholars and is congruent with findings in other research on CF (Iden et al., 2017; Rohrbach et al., 2015; Singh et al., 2020). The distribution of articles and their publishing dates is shown in Fig. 2.

##### 4.2. Context and methodologies applied

The final sample includes data from a broad range of countries and industries. Single country studies accounted in total for 36 with Europe being over-represented ( $n = 30$ ). This consisted of UK ( $n = 8$ ), Germany ( $n = 7$ ), Austria ( $n = 3$ ), Russia ( $n = 3$ ) and Finland ( $n = 2$ ). The remaining European countries include Turkey, Switzerland, Spain, the Netherlands, Lithuania, Italy, and France, accounting for one study

each. Non-European countries were the US ( $n = 3$ ), South Korea ( $n = 2$ ), and China ( $n = 1$ ). Cross-country studies accounted for 30 cases. The largest group among these was international cross-country research, with no or not mentioned specification of the continent ( $n = 15$ ), followed by cross-country research in Europe ( $n = 14$ ). One case was a cross-country study in Asia exclusively. Overall, a European dominance can be seen ( $n = 44$ ), indicating the importance of the topic among scholars in this region, whereas research interest elsewhere appears to be limited.

About the examined industry, the number of single-industry examinations was slightly higher ( $n = 38$ ), than cross-industry cases ( $n = 34$ ). In one case, no data about the industry was given. Among single-industry examinations, the most frequent were ICT ( $n = 7$ ), manufacturing ( $n = 5$ ), automotive ( $n = 4$ ), software ( $n = 3$ ), utilities ( $n = 3$ ) and medical technology ( $n = 2$ ). Furthermore, agriculture, aviation, beauty and cosmetics, biotechnology, chemicals, financial services, food and beverage, infrastructure, logistics, media, retail and construction were represented with one case each. The amount of technology-related industries ( $n = 28$ ) illustrates the importance of CF in technology assessment. Furthermore, for cross-industry examinations can be stated that these include ICT and manufacturing cases, at least as one industry among others. This indicates a bias towards industry since European economies are predominantly service-oriented. Lastly, most articles focus on large, multinational enterprises (MNEs), which shows that CF is of high importance for internationally operating companies.

Relating to research methods, both qualitative and quantitative studies were conducted. Qualitative research was the most frequent ( $n = 48$ ), followed by mixed approaches ( $n = 15$ ) and quantitative research ( $n = 10$ ). The majority of qualitative research was based on case studies (single, multiple, longitudinal or exploratory,  $n = 45$ ), whereas field study, action research and Delphi study were each conducted once. Qualitative research was supported by interviews ( $n = 22$ ) of which ten ( $n = 10$ ) were semi-structured. Furthermore, internal and external documents ( $n = 5$ ) were used and workshops were conducted ( $n = 4$ ). The mixed cases consisted of qualitative approaches complemented by quantitative research. Most commonly applied were case studies in combination with surveys ( $n = 5$ ). The remaining included qualitative analysis of interviews and quantitative analysis of surveys, where most frequently descriptive statistics were applied ( $n = 7$ ). The quantitative research was predominantly conducted through surveys ( $n = 8$ ). Statistical methods were mostly descriptive ( $n = 5$ ) in combination with different regressions.

Overall, the dominating approach to CF is qualitative, which is congruent with the development of foresight and its separation from the rather quantitative term forecasting. Quantitative approaches, with few exceptions, appear to be limited to simple descriptive statistics.

##### 4.3. Theoretical foundations

An initial observation that emerged from our analysis is that many

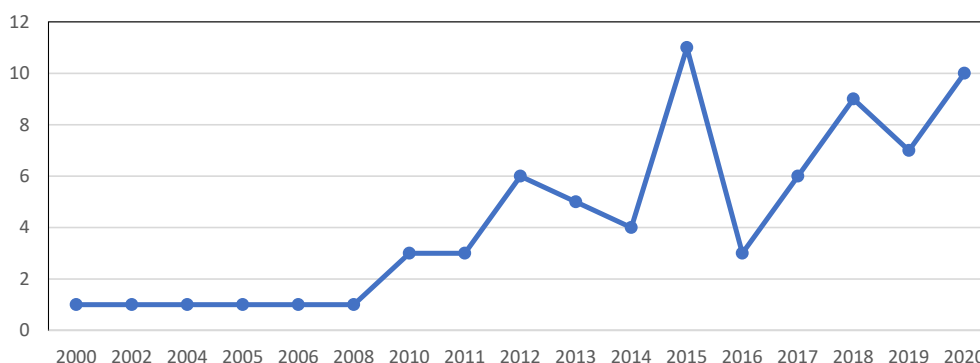


Fig. 2. Articles published per year.

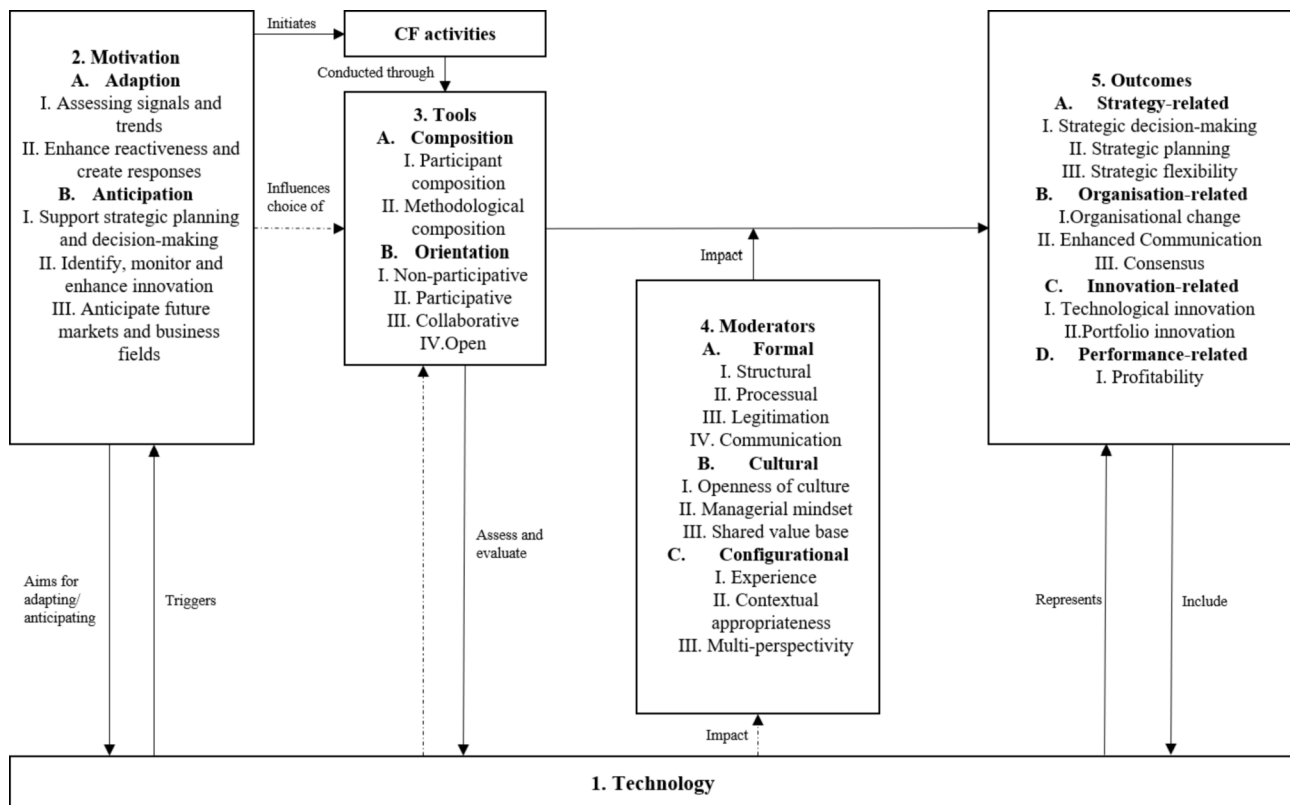


Fig. 3. Corporate foresight: An integrative process framework.

research articles lack a clear theoretical foundation. However, in the remaining articles, the authors adopted various theoretical foundations to conduct their empirical inquiry. Notably, the most frequently applied theoretical background are dynamic capabilities, network theory, and organizational learning.

The dynamic capabilities (DCs) theory explains how organizations can remain competitive in a changing environment by developing the capacity to reconfigure their resource-based to remain aligned with that environment (Teece, Pisano, & Shuen, 1997). This justifies the suitability of DCs, as a theoretical foundation, to study the CF concept (where CF is viewed as an iterative process of recognizing and interpreting environmental changes. Accordingly, studies embracing the DCs perspective focus on how CF can create value by investigating CF as an antecedence (or microfoundations) of DCs (e.g., Haarhaus & Liening, 2020; Vecchiato, 2015), or by conceptualizing CF as a unique form of organizational capability (e.g., Rhisiart, Miller, & Brooks, 2015). At the same time, other studies utilize the DCs perspective to explain the connection between CF and firms' innovation (Rohrbeck & Gemünden, 2011). For instance, Yoon et al. (2018) drew on the DCs notion to explain how the relationship between CF and organisational learning (where the latter is essential for boosting innovation) is likely to be stronger when an organisation's DCs are high. Here the ability to combine knowledge and consolidate diverse competencies (which reflect the firm's DCs) play a contextual role in driving its engagement in learning behaviour, and thus innovativeness.

Network theory views a company and its environment as a system consisting of a variety of relationships between its participants (Al-Tabbaa, Lopez, Konara, & Leach, 2021). This equally applies to organizations as well as single individuals. In a CF context, this refers to the opening of CF activities initially conducted by a rather small number of managers and strategists to lower-level employees and externals to increase success. This area of CF literature represents a newer research stream. The importance of inter-organizational and inter-personal relationships in CF is closely related to open foresight and further

collaborative approaches (Heger & Boman, 2015; Wiener, Gattringer, & Strehl, 2020). A large amount of recent research has further been conducted in the field of networked and open foresight in combination with innovation management. Generally, scholars agree on the close relationship of foresight to companies' innovation capacity (Rohrbeck, 2012; Rohrbeck & Gemünden, 2011). However, recent literature is emphasizing the fact that the evolution of innovation management and foresight follows a similar development (Van der Duin, Heger, & Schlesinger, 2014; Wiener et al., 2020; Yoon et al., 2019) and therefore provides both fields with new research trajectories.

Organizational learning aims to explain how organizations generate, keep and transfer knowledge between their members. It is associated with the learning curve of an organization that illustrates how knowledge about a particular topic increases over the time an organization deals with this particular topic. In a CF context, this refers predominantly to knowledge gained through CF activities and knowledge about CF and its tools as well as their application (Burt & Nair, 2020; Favato & Vecchiato, 2017; Gattringer & Wiener, 2020; Yoon et al., 2018). For example, Burt & Nair (2020) used the single and double-loop learning mechanisms to explain the temporal learning stages that firms go through to generate strategic foresight from their scenario planning exercises. Similarly, Gattringer & Wiener (2020) used the components of inter-organizational learning, such as trust, intermediaries, reciprocity, and commitment (that are rooted in the organizational learning theory), to study how the start-up phase for a collaborative foresight project can be designed and realized.

## 5. Findings on the current status of empirical research on foresight in companies

The narrative synthesis allowed the identification of CF main themes across the final sample, and the development of the comprehensive CF framework, as in Fig. 3. It shows the identified main elements: technology, motivations, tools and activities, moderators (facilitators and



**Table 3**  
Analysing CF tool.

Tools		Key Insights	Selected studies
<b>A Tool Composition</b>	I. Participant composition	- Focuses on the set up of different participants (groups) within the performed tool (e.g., experts, employees, managers, etc.)	Förster & von der Gracht, 2014; Gary & von der Gracht, 2015
	II. Methodological composition	- Focuses on the set up of different tools applied within one foresight activity (e.g., combinations of workshops and roadmaps)	Heger & Rohrbeck, 2012; Favato & Vecchiato, 2017
<b>B Tool Orientation</b>	I. Non-Participative	- Exclusively applied in high management contexts by a small group of specialists or decision-makers	Dufva & Ahlqvist, 2015; Djuricic & Bootz, 2019
	II. Participative	- Inclusion of a limited number of stakeholders in a chosen group, predominantly executives from different levels and areas/departments	Heger & Rohrbeck, 2012; Heger & Boman, 2015
	III. Collaborative	- Purposeful inclusion of a larger group of members from different levels/departments/backgrounds of stakeholders (employees, partners, customers, etc.)	Major & Cordey-Hayes, 2000; Milshina & Vishnevskiy, 2018
	IV. Open	- Organization-wide participation is desired and enabled across all employees and remaining stakeholders	Van der Duin et al., 2014; Wiener et al., 2020

inhibitors), and outcomes. Furthermore, it illustrates sub-topics and interrelationships. *Dotted* relationship lines depict research areas that are less prominent and could profit from the intensified investigation in the future.

### 5.1. Research on motivations

Companies' motivation to engage in foresight is widely discussed in the extant literature and can be divided into two categories: *adaption* and *anticipation*, see Table 2. Adaption refers here to an organization's perception of CF as a mechanism to identify and quickly react to external changes. In this respect, the literature shows a wide range of 'traditional' research dealing with the 'outside-in' perspective of CF as a method to cope and counter threats of external origin. Scholars extend research in this field primarily due to the increase in environmental dynamism and complexity (Vecchiato, 2012b; Vecchiato & Roveda, 2010a). CF research on adaption, therefore, is concerned with the need of companies to develop and maintain (strategic) flexibility in a highly uncertain business world, where flexibility involves 1) capturing weak signals and trends emerging from the periphery (Battistella & De Toni, 2011; Daheim & Uerz, 2008; Savioz & Blum, 2002), and 2) enacting timely response to these signals/trends (Engau, Hoffmann, & Busch, 2011), see Table 2.

Anticipation, on the other hand, aims to (more than solely estimate what driving forces might impact the company) build upon what is captured from the periphery, and more actively develop the future in the company's favour. Research on anticipation reflects a wide extent the strategic planning view, according to which CF is conducted to ease strategic planning and development. This relatively broad area of research focuses on the necessity of CF for strategic success and its role in the strategy development process (Buehring & Liedtka, 2018; Peter & Jarratt, 2015). In this context, another main motivator for CF engagement is the need for higher certainty in decision-making (Savioz & Blum, 2002; Schweitzer, Hofmann, & Meinheit, 2019).

More recent research explores the concept of CF in more concrete contexts. These are primarily the application of CF for the systematic integration of innovation in various varieties (e.g., products and technology and the application of CF in determining future market developments and business models) (Costanzo, 2004; Ruff, 2006). Concerning innovation, notable contributions were made from 2011 onwards by Rohrbeck and Gemünden (2011), marking the starting point of CF for innovation exploration. Since 2011, research shows an increased interest in the relationship between CF and innovation and shows how it can be used to monitor innovation (Rohrbeck et al., 2015) and increase the overall innovation capacity of companies (Calof, Meissner, & Razheva, 2018; Gershman et al., 2016; Ho & O'Sullivan, 2018; Ruff, 2015).

Literature on CF applied to the exploration of new business fields and market understanding is less prominent than the previously mentioned innovation focus of CF. However, it is subject to recent academic discussion, aiming to identify how foresight on markets can lead to future

advantage. Research in this area focuses on the early detection of market signals (Bisson & Diner, 2017) to estimate their future development and how CF can be applied to the exploration of new business fields (Heger & Rohrbeck, 2012). Furthermore, it deals with future-oriented development of products in (Açıkgöz, Günsel, Kuzey, & Zaim, 2016) and the development of precise understanding of customer demands and product configuration (Schweitzer et al., 2019; Von der Gracht & Stillings, 2013).

Notwithstanding the different foci research has on motivations, it is congruent with the fact that most reasons for CF are environmentally driven and seek to generate a better understanding of the future. In fact, the majority of motivators to engage in CF did not change in essence since the birth of the discipline. They were rather extended under the impact of current peripheral developments and are still tied to the need for future strategic advantage.

Motivation represents the key driver for companies' engagement in CF. As Fig. 2 shows, they are linked to tools and technology in different ways. Firstly, the achievement of outcomes is realized through CF activities, i.e. the use of applied tools. Indeed, literature shows that CF motivations are not only the reason for conducting CF tools but also influence their choice and contextual application. Secondly, the relationship between motivation and technology is mutual. The main motivation for CF is to assess technology, whereas technology drives CF motivation due to the disruptions it causes.

### 5.2. Research on tools and activities

Fundamentally, CF activities comprise two iterative actions: detecting discontinuities in the environment (for example, by performing environmental scanning to identify weak signals), and determining how such changes are likely to unfold creating opportunities or posing threats (for example, by conducting scenario planning exercises). These activities are applied via a wide range of tools.

Tools applied in CF stretch over a broad range of methods and techniques with different categorization methodologies (Gershman et al., 2016; Tapinos, 2013). These include 'traditional' strategic management techniques such as SWOT, PESTEL and Value Chain (Calof, Arcos, & Sewdass, 2018; Kunc & O'Brien, 2017; Sarpong & Hartman, 2018; Vecchiato & Roveda, 2010a). However, the majority of research on tools is centred around scenarios and roadmaps (Heger & Rohrbeck, 2012) with scenarios being described as the overall tool for envisioning strategies, consensus-making and sensitizing for the future (Lehr, Lorenz, Willert, & Rohrbeck, 2017; Metz & Hartley, 2020; Ringland, 2010; Tapinos, 2013). Roadmaps, however, are rather applied in a concrete context, when particular goals need to be achieved. They find more usage in technology-related domains where they are part of overall technology strategies (Gershman et al., 2016; Milshina & Vishnevskiy, 2019; Yoon et al., 2019).

Empirical research is widely concerned with tool *composition*, the combination of different tools instead of a single tool application, see Table 3. It is emphasized that these combinations lead to enhanced

**Table 4**  
Analysing CF-related moderators.

Moderators		Key Insights	Selected studies
<b>A Formal</b>	I. Structural	<ul style="list-style-type: none"> <li>- Design and composition of structure (flat, deep, or matrix)</li> <li>- Depth of hierarchy, reporting levels, span of control, instance of decision making</li> </ul>	Daheim & Uerz, 2008; Rohrbeck & Gemünden 2011; Farrington et al., 2012; Peter & Jarratt, 2015; Rohrbeck & Kum, 2018
	II. Processual	<ul style="list-style-type: none"> <li>- Design, composition and pace of internal and formalized decision-making processes</li> <li>- Bureaucracy, lean processes</li> </ul>	Rohrbeck & Gemünden, 2011; Farrington et al., 2012; Rohrbeck & Kum, 2018; Haarhaus & Liening, 2020; Vecchiato, 2020
	III. Legitimation	<ul style="list-style-type: none"> <li>- Support for CF by high-ranked authorities (senior executives etc.) in the organization</li> <li>- Dependency on managerial engagement and prioritisation of CF</li> </ul>	Daheim & Uerz, 2008; Engau et al., 2011; Rohrbeck & Schwarz, 2013; Tapinos, 2013; Peter & Jarratt, 2015; Klos & Spieth, 2020
	IV. Communication	<ul style="list-style-type: none"> <li>- Supportive factor for fostering transparency during CF processes and for results</li> <li>- Enables inclusion of stakeholders</li> </ul>	Daheim & Uerz, 2008; Farrington et al., 2012; Peter & Jarratt, 2015; Carbonell et al., 2017
<b>B Cultural</b>	I. Openness of culture	<ul style="list-style-type: none"> <li>- The degree of cultural openness reflects the openness towards CF activities in the organization</li> </ul>	Savioz & Blum, 2002; Daheim & Uerz, 2008; Peter & Jarratt, 2015; Sarpong & Maclean, 2016; Yoon et al., 2019; Haarhaus & Liening, 2020; Wiener et al., 2020;
	II. Managerial mindset	<ul style="list-style-type: none"> <li>- The degree of managerial willingness to conduct CF activities and changes</li> <li>- The managerial mindset sets the frame for employee willingness to engage in CF</li> </ul>	Daheim & Uerz, 2008; Engau et al., 2011; Rohrbeck & Schwarz, 2013; Tapinos, 2013; Peter & Jarratt, 2015; Milshina & Vishnevskiy, 2018; Klos & Spieth, 2020
	III. Shared value base	<ul style="list-style-type: none"> <li>- Defines common acceptance for CF in the organisation</li> <li>- Enables the integration of different viewpoints into an overarching perspective</li> </ul>	Savioz & Blum, 2002; Rohrbeck & Gemünden, 2011; Sarpong et al., 2013; Dufva & Ahlqvist, 2015; Battistella, 2014; Boe-Lillegraven & Monderde, 2015; Schweitzer et al., 2019; Gattringer & Wiener, 2020; Gordon, 2020
<b>C Configurational</b>	I. Experience	<ul style="list-style-type: none"> <li>- The amount of time spent by an organization on CF activities with a certain number frequency</li> <li>- Usually higher in MNEs with a longer history in CF and more systematized approaches</li> </ul>	Heger & Rohrbeck, 2012; Gordon, 2020; Haarhaus & Liening, 2020;
	II. Contextual appropriateness	<ul style="list-style-type: none"> <li>- Knowledge of the organization on how and when to apply certain CF activities to achieve a certain outcome</li> </ul>	Heger & Rohrbeck, 2012; Gordon, 2020; Haarhaus & Liening, 2020
	III. Multi-perspectivity	<ul style="list-style-type: none"> <li>- Aims to generate a holistic view of the future by including many viewpoints</li> <li>- Supports the comprehensiveness of CF activities</li> </ul>	Ruff, 2006; Heger & Rohrbeck, 2012; Rohrbeck & Schwarz, 2013; Förster & von der Gracht, 2014; Heger & Boman, 2015; Weber et al., 2015; Açıkgoz et al., 2016; Gershman et al., 2016; Sarpong & Maclean, 2016; Chau & Quire, 2018

**Table 5**  
Analysing CF-related outcome.

Outcomes		Key empirical Insights	Selected studies
<b>A Strategy-related</b>	I. Strategic decision-making	<ul style="list-style-type: none"> <li>- “Traditional application field”</li> <li>- Used to support managerial decisions</li> <li>- Based on an external assessment of environmental factors</li> </ul>	Ringland, 2010; Rohrbeck, 2012; Von der Gracht & Stillings, 2013; Peter & Jarratt, 2015; Gershman et al., 2016; Schwarz et al., 2019; Yoon et al., 2019
	II. Strategic planning	<ul style="list-style-type: none"> <li>- Support for strategy development (“traditional” application field)</li> <li>- Applied to increase the comprehensiveness of the strategy</li> <li>- Visualization of future scenarios and pathways</li> </ul>	Ringland, 2010; Rohrbeck, 2012; Von der Gracht & Stillings, 2013; Peter & Jarratt, 2015; Gershman et al., 2016; Schwarz et al., 2019; Yoon et al., 2019
	III. Strategic flexibility	<ul style="list-style-type: none"> <li>- Increased organizational capability to react and adapt quickly to externally induced changes</li> </ul>	Vecchiato, 2012b; Peter & Jarratt, 2015; Gershman et al., 2016; Haarhaus & Liening, 2020
<b>B Organisation-related</b>	I. Organizational change	<ul style="list-style-type: none"> <li>- “Side-effect character” of CF</li> <li>- Increases awareness of organization members (managers, employees) for future disruptions and the need for change</li> </ul>	Costanzo, 2004; Ringland, 2010; Rohrbeck, 2012; Van der Duin et al., 2014; Boe-Lillegraven & Monderde, 2015; Paliokaite & Pačesa, 2015; Ruff, 2015; Schweitzer et al., 2019; Burt & Nair, 2020; Wiener et al., 2020
	II. Communication	<ul style="list-style-type: none"> <li>- Openness of CF tools enables improved communication in an organisation</li> </ul>	Rohrbeck, 2012; Schweitzer et al., 2019
	III. Consensus	<ul style="list-style-type: none"> <li>- Opening up to lower-level organizational members</li> <li>- The purposeful application of tools for a certain aim within the organization (create orientation)</li> </ul>	Rohrbeck & Schwarz, 2013; Förster & von der Gracht, 2014; Boe-Lillegraven & Monderde, 2015; Ho & O’Sullivan, 2017; Bootz et al., 2019
<b>C Innovation-related</b>	I. Technological Innovation	<ul style="list-style-type: none"> <li>- Early identification of disruptions and technological innovations (focus on external scanning)</li> <li>- Strategic incorporation of technological innovation into the organization (internal capabilities)</li> </ul>	Rohrbeck & Gemünden, 2011; Von der Gracht & Stillings, 2013; Battistella, 2014; Paliokaite & Pačesa, 2015; Rohrbeck, Thom, et al., 2015; Scheiner et al., 2015; Gershman et al., 2016; Ho & O’Sullivan, 2018; Schwarz et al., 2019; Wiener et al., 2020
	II. Portfolio Innovation	<ul style="list-style-type: none"> <li>- Development of new products and services as well as business models</li> <li>- Definition of new product purposes and match with future customer demands</li> <li>- Increased market understanding</li> </ul>	Battistella & De Toni, 2011; Vecchiato, 2012a; Ruff, 2015; Açıkgoz et al., 2016; Schweitzer et al., 2019;
<b>D. Performance-related</b>	I. Profitability	<ul style="list-style-type: none"> <li>- Approximative approach to quantify CF results monetarily</li> <li>- Hard to estimate due to the strategic character of CF activities</li> <li>- Rather expressed through sustained competitive advantage</li> </ul>	Rohrbeck, 2012; Vecchiato, 2012b; Rohrbeck & Schwarz, 2013;; Boe-Lillegraven & Monderde, 2015

outcomes and should consist of a mix of qualitative and quantitative approaches (Favato & Vecchiato, 2017; Heger & Rohrbeck, 2012). When combining different tools, scenarios and Delphi studies are commonly applied as a starting point, and later complemented by ‘build-upon’ tools such as roadmaps (Favato & Vecchiato, 2017; Gordon, 2020; Kunc & O’Brien, 2017; Schwarz, Ram, & Rohrbeck, 2019). The most commonly followed approach to CF tools is the workshop format. Therefore, scholars also focus on the composition of tool participants and how they come to practice in companies. Research in this field aims to gain understanding of the most purposeful combination of internal and external participants. Scholars agree on enhanced outcomes through multiperspectivity and participatory approaches. (Förster & von der Gracht, 2014; Gary & von der Gracht, 2015).

Research interest in composition goes along with an increasing interest in tool orientation. Orientation in this case expresses the degree of tools’ openness towards the organization and externals, see Table 3. Research increasingly deals with participatory and collaborative as well as open CF methods (Heger & Boman, 2015; Heger & Rohrbeck, 2012; Major & Cordey-Hayes, 2000; Milshina & Vishnevskiy, 2018; Van der Duin et al., 2014; Wiener et al., 2020). The main focus here is to increase tool quality by opening them up to lower-level organization members or in joint foresight projects with other companies, which is further reflected through the expressed need for multi-perspective in CF (Djuricic & Bootz, 2019; Dufva & Ahlqvist, 2015; Haarhaus & Liening, 2020). Another generally prevailing field of investigation is the different application of CF tools in large corporations and MNEs and small and medium-sized enterprises (SMEs), attesting a more systematic approach to larger companies due to better availability of resources. On the other hand, research finds that SMEs apply rather basic tools more situational and can profit from the trend to collaborative approaches (Chau & Quire, 2018; Heger & Boman, 2015; Major & Cordey-Hayes, 2000; Milshina & Vishnevskiy, 2018; Pouru, Dufva, & Niinisalo, 2019; Savioz & Blum, 2002).

CF tools are the causal result of motivations and reflect the initial cause of engagement. As expressed above, the choice of applied tools is influenced by the reasons to engage in CF. Because tools represent an extension of motivation, they as well share an interdependency with technology. Firstly, they are used to assess emerging technologies and are important for the development of technology strategies. Secondly, technology impacts CF tools and enhances their effectiveness and scope of application (Rohrbeck et al., 2015). However, relatively little research was conducted on the technological upgrading of tools (Rohrbeck & Kum, 2018). Moderators have either facilitating or inhibiting effects on the relationship between CF activities and their outcomes. Therefore, the outcomes of CF activities are subject to the influence of formal, cultural, and contextual factors as discussed next.

### 5.3. Research on moderators

Moderators of CF can be seen as two sides of the same coin since they can influence the outcomes of CF activities in both ways, positive and negative, acting either as facilitators or inhibitors (Sarpong, Maclean, & Davies, 2013). Fig. 3 demonstrates the effect of moderators on the relationship between CF activities and their outcomes, and Table 4 maps this effect. In principle, we clustered the moderators into three groups: *formal, cultural, and contextual moderators*.

Formal category (that comprises structural, processual, legitimation and communication) captures all formalized organizational elements, expressed and codified in inner-organizational documents, policies and organization charts. Structural moderators, therefore, refer to the organizational design of an organization, hierarchical levels and the distance of CF to relevant decision-making instances. Research emphasizes the impact formal structures have on CF outcomes (Daheim & Uerz, 2008; Peter & Jarratt, 2015), attesting a facilitating role of flat structures and hierarchies (Costanzo, 2004). The formal integration of CF is dependent on organizational size. Research stresses the importance of

having institutionalized CF structures (organizational units) to enable unbiased activities (Battistella, 2014; Farrington, Henson, & Crews, 2012; Rohrbeck & Kum, 2018; Ruff, 2015; Wiener et al., 2020), which is frequently the case in large companies and MNEs. SMEs however, do not possess the resources to establish such units, leading to unstructured CF with high dependency on individuals (Milshina & Vishnevskiy, 2018; Pouru et al., 2019). On the other hand, research also illustrates disadvantages emerging from strict institutionalization. This can cause “organizational blindness”, leading to significant failures in CF, therefore, a certain degree of flexibility is likewise necessary (Costanzo, 2004).

Processual moderators facilitate CF by its inner-organizational embeddedness, particularly the distance and linkage to the strategic decision-making process and value streams within a company. Literature frequently stresses the importance CF incorporation into strategy development (Farrington et al., 2012; Rohrbeck & Gemünden, 2011; Rohrbeck & Kum, 2018). Insufficient structure and a lack of integration into decision-making and strategy development processes (as commonly the case in SMEs) have a negative effect on CF outcomes (Milshina & Vishnevskiy, 2018). They can cause dissatisfaction among organization members and doubt in CF legitimation (Daheim & Uerz, 2008). In large corporations, outcomes of non-formalized CF are likely to dilute over time due to organizational inertia (Haarhaus & Liening, 2020; Vecchiato, 2020).

The moderating factor of CF legitimation is dependent on managerial inclusion in CF activities, as emphasized by a broad set of research. By engaging in CF and prioritizing it, managers create credibility among organization members (Peter & Jarratt, 2015; Rohrbeck, 2012; Rohrbeck & Schwarz, 2013; Savioz & Blum, 2002; Tapinos, 2013). However, if CF is not a management priority, it lacks the required entitlement, causing ineffectiveness (Battistella, 2014; Daheim & Uerz, 2008).

Communication represents the last formal moderator. It is seen as of high importance by researchers (Ruff, 2006), who attributes it to two roles. Firstly, communication fosters the factor legitimation by making CF outcomes transparent in the organization (Carbonell, Sánchez-Esguevillas, & Carro, 2017; Daheim & Uerz, 2008; Farrington et al., 2012; Peter & Jarratt, 2015). Secondly, communication is required to support inclusion of stakeholders and decision-makers (Rohrbeck & Gemünden, 2011; Savioz & Blum, 2002; Schweitzer et al., 2019).

The second group of moderators is composed of cultural factors, namely openness of culture, managerial mindset and shared value base. The openness of culture is frequently addressed by research as a facilitator of CF as initially stated by Daheim and Uerz and Savioz and Blum (Daheim & Uerz, 2008; Savioz & Blum, 2002). This is congruent with the development to more participation in foresight, where scholars emphasize the importance of an open-minded organizational atmosphere for CF success (Haarhaus & Liening, 2020; Peter & Jarratt, 2015; Sarpong & Maclean, 2016; Wiener et al., 2020; Yoon et al., 2019). On the other hand, restrictive culture can have a negative influence on CF (Major & Cordey-Hayes, 2000; Ruff, 2015).

Furthermore, managerial attitude is of primary importance for CF (Li & Sullivan, 2020). A large amount of research focuses on CF’s managerial impact on performance (Milshina & Vishnevskiy, 2018). Scholars agree that a positive managerial view on CF facilitates outcomes (Daheim & Uerz, 2008; Engau et al., 2011; Klos & Spieth, 2020; Peter & Jarratt, 2015; Rohrbeck & Schwarz, 2013; Tapinos, 2013). Therefore, future-oriented and change-willing management are essential (Haarhaus & Liening, 2020). Further research particularly focuses on the role of middle management, which is of particular importance since it is actively carrying out strategies following CF outcomes (Darkow, 2015; Heger & Rohrbeck, 2012; Sarpong & Hartman, 2018; Sarpong & Maclean, 2014). On the other hand, managers with a biased view of CF and ‘traditional’ management styles inhibit CF outcomes (Haarhaus & Liening, 2020; Major & Cordey-Hayes, 2000).

Lastly, a shared value base moderates the relationship between CF activities and outcomes. Research stresses that an organization needs



**Table 6**  
Insights on CF-related technology effect.

Technology		Key Insights	Selected studies
<b>A Technology-motivation relationship</b>	I. Trigger	<ul style="list-style-type: none"> <li>- External disruptions are frequently caused by technological developments</li> <li>- Moving towards technologization of societies causes an increased number of disruptions with a higher frequency</li> </ul>	<a href="#">Savioz &amp; Blum, 2002</a> ; <a href="#">Scheiner et al., 2015</a> ; <a href="#">Weber et al., 2015</a> ; <a href="#">Rohrbeck &amp; Kum, 2018</a> ; <a href="#">Schweitzer et al., 2019</a>
	II. Aim	<ul style="list-style-type: none"> <li>- Organizations need to envision and assess technology-related disruptions (that becomes the dominant disrupting force)</li> <li>- Organizations need to correctly evaluate technologies and technological development in order to maintain strategic advantages</li> </ul>	<a href="#">Heger &amp; Rohrbeck, 2012</a> ; <a href="#">van der Duin &amp; Ligetvoet, 2019</a>
<b>B Technology-tool relationship</b>	I. Assessment and evaluation	<ul style="list-style-type: none"> <li>- CF tools particularly focus on the assessment of technologies (e.g., technology roadmapping)</li> <li>- Inclusion of technologies in strategy development process under application of certain tools</li> <li>- CF tools' effectiveness and efficiency is increased by the application of technology into the tool itself</li> </ul>	<a href="#">Gershman et al., 2016</a> ; <a href="#">Ho &amp; O'Sullivan, 2018</a> ; <a href="#">Milshina &amp; Vishnevskiy, 2019</a> ; <a href="#">Yoon et al., 2019</a> <a href="#">Van der Duin et al., 2014</a> ; <a href="#">Rohrbeck, Thom, et al., 2015</a> ; <a href="#">Yoon et al., 2019</a>
<b>C Technology-moderator relationship</b>	I. Technological impact	<ul style="list-style-type: none"> <li>- Technology impacts organizations as a whole, therefore formal, cultural and configurational moderators change with increased technological development</li> <li>- Automatization enables quicker decision-making processes which in turn facilitate the CF activity within firms organization</li> </ul>	<a href="#">Rohrbeck &amp; Gemünden, 2011</a> ; <a href="#">Rohrbeck, Thom, et al., 2015</a> ; <a href="#">Rohrbeck &amp; Kum, 2018</a> ;
<b>D. Technology-outcome relationship</b>	I. Meta-outcome (Represent)	<ul style="list-style-type: none"> <li>- In relation to outcomes, technology is one of the main meta-results of CF itself. Therefore, technology <i>represents</i> a key outcome of CF activities. As organizations aim to assess their environment, organizations inevitably assess technology in form of an external disruption</li> <li>- Technology is further included in the strategy development process and is a main trigger for organization-related outcomes (e.g., as a change inductor). Furthermore, it can be part of innovation itself or enhance product- and portfolio innovation</li> </ul>	<a href="#">Heger &amp; Rohrbeck, 2012</a> ; <a href="#">Boe-Lillegraven &amp; Monterde, 2015</a> ; <a href="#">Heger &amp; Boman, 2015</a> ; <a href="#">Rohrbeck &amp; Kum, 2018</a> ; <a href="#">van der Duin &amp; Ligetvoet, 2019</a> ; <a href="#">Haarhaus &amp; Liening, 2020</a>
	II. Part of CF outcomes (Include)	<ul style="list-style-type: none"> <li>- CF outcomes can include technology. Here, innovation-related outcomes can involve new technology in different forms (e.g., as a novel tool to be used within the organization) that can affect how a firm conducts its CF activity</li> </ul>	

‘congruence of values’ to enable a commonly accepted view on the approach to the future (Dufva & Ahlqvist, 2015; Gattringer & Wiener, 2020; Gordon, 2020; Sarpong et al., 2013). This can include a variety of views as long as the overarching organizational mindset is present (Battistella, 2014; Boe-Lillegraven & Monderde, 2015). In-congruence of values can therefore negatively impact the activity-outcome relationship (Sarpong et al., 2013).

The final group of moderators is described as “configurational” in the framework. It consists of the factors experience, contextual appropriateness and multi-perspective. Experience refers to the period of time CF is applied in companies. Research emphasizes that long-time engagement in CF generates more experience and specialization, by facilitating outcomes (Battistella, 2014; Rohrbeck & Kum, 2018; Ruff, 2015). This is predominantly the case for large corporations and MNEs, who were pioneers of systematic CF. However, beliefs fostered over a long period can have negative effects as well (Vecchiato, 2020), causing organizational inertia.

Contextual appropriateness describes the right application of CF tools for the right purpose. Overarchingly, this is the knowledge of a company about when and how to conduct which CF activity. Research stresses the importance of this factor for CF outcomes, seeing it as significantly enhancing for the gaining of desired outcomes (Gordon, 2020; Haarhaus & Liening, 2020; Heger & Rohrbeck, 2012). On the other hand, tools applied in the wrong context can be ineffective. Therefore, CF activities need to fit into their context to ensure positive outcomes.

Lastly, multi-perspective is frequently addressed across research and seen as an immensely facilitating CF factor. Multi-perspective among CF participants broadens the view of foresight activities, enabling the envisioning of a variety of important future factors and a holistic view (Açıkgöz et al., 2016; Chau & Quire, 2018; Förster & von der Gracht, 2014; Gershman et al., 2016; Heger & Boman, 2015; Heger & Rohrbeck, 2012; Rohrbeck & Schwarz, 2013; Ruff, 2006; Sarpong & Maclean, 2016; Weber, Sailer, & Katzy, 2015). Moreover, the inclusion of different stakeholders, particularly externals, is given particular attention (Haarhaus & Liening, 2020; Heger & Rohrbeck, 2012; Van der Duin et al., 2014; van der Duin & Ligtvoet, 2019; Von der Gracht & Stillings, 2013) to cope with increasing uncertainty, which once more highlights the collaborative direction CF is adopting. However, Wiener, Gattringer and Strehl (2020) emphasize that a smaller number of CF participants can increase focus on a particular desired outcome (Wiener et al., 2020). CF activities limited to certain perspectives bear the risk of missing out peripheral signals, thus inhibiting outcomes. Furthermore, strong dependence on single stakeholders causes an overweight of their viewpoint in CF activities, distorting desired outcomes (van der Duin & Ligtvoet, 2019).

Overall, moderators cover a wide range of factors on different organizational levels and dimensions. This emphasizes the variety of variables affecting outcomes that needed to be considered when conducting CF.

#### 5.4. Research on outcomes

CF outcomes are broadly spread. Their range as shown in the framework is divided into four groups, as shown in Fig. 2. These are *strategy-related*, *organization-related*, *innovation-related* and *performance-related*, see Table 5.

Overall, the analysis shows that strategy-relatedness outcomes (covering the broad set of strategic management enhancements, expressed in the framework as *strategic decision-making*, *strategic planning* and *strategic flexibility*) as a key output from the CF process. From a historical viewpoint, these represent ‘traditional’ outcomes enabling advanced strategy development. Indeed, research agrees widely on CF outcomes as facilitators of strategic decision-making (Battistella & De Toni, 2011; Calof, Arcos, et al., 2018; Gershman et al., 2016; Heger & Rohrbeck, 2012; Milshina & Vishnevskiy, 2018; Vecchiato, 2012b;

Weber et al., 2015). This is primarily attributed to CF’s outside-in perspective, particularly the early identification of peripheral signals (Battistella, 2014; Calof, Arcos, et al., 2018; Peter & Jarratt, 2015).

CF outcomes support strategic planning. Scholars emphasize the contribution of CF for strategic planning and its linkage to strategy development (Gershman et al., 2016; Peter & Jarratt, 2015; Ringland, 2010; Rohrbeck, 2012; Schwarz et al., 2019; Von der Gracht & Stillings, 2013; Yoon et al., 2019), highlighting the tangibility-effect of CF (Lehr et al., 2017; Weber et al., 2015), easing managers’ long-term planning efforts by providing visualized views of possible futures. This is expressed through the amount of research conducted on individual tools (Farrukh & Holgado, 2020; Gordon, 2020; Tapinos, 2013). Scholars find that particular scenarios and roadmaps facilitate planning (Boe-Lillegraven & Monderde, 2015; Lehr et al., 2017; Yoon et al., 2019).

Strategic flexibility is expressed through the ability of companies to counter environmental disruptions and is linked back to the anticipatory elements of CF. The literature stresses that CF significantly increases strategic flexibility (Gershman et al., 2016; Haarhaus & Liening, 2020; Peter & Jarratt, 2015; Vecchiato, 2012b). This is done by creating an understanding for externally imposed changes (Battistella, 2014; Gordon, 2020), thus enhancing organizational reactivity (Battistella & De Toni, 2011; Rohrbeck, 2012; Vecchiato & Roveda, 2010b).

The second group is the organization-related outcomes, including *organizational change*, *enhanced communication*, and *consensus*, representing soft factors induced by CF. In contrast to strategy-related outcomes, these have rather the character of ‘side-effects’, since they do not constitute ‘traditional’ business goals. However, research highlights the importance of CF for ‘soft’ organizational factors. CF is widely recognized as a strong enabler for organizational change (Boe-Lillegraven & Monderde, 2015; Costanzo, 2004; Rohrbeck, 2012; Schweitzer et al., 2019; Van der Duin et al., 2014). The actual contribution of CF to this outcome is the sensitization of organization members and particularly managers for disruptions. CF visualizes what is yet to come and enables the company to reflect on its current position, eventually breaking prevalent mindsets and facilitating organizational renewal (Burt & Nair, 2020; Paliokaite & Pačesa, 2015; Ringland, 2010; Ruff, 2015; Schweitzer et al., 2019; Wiener et al., 2020), which is linked to the above-mentioned strategic flexibility.

As CF activities make use of a large pool of interactive tools which are increasingly getting participative and open, enhanced communication is another effect of CF. Scholars commonly agree on the communication-fostering role CF bears through stimulating inner-organizational discussions (Rohrbeck, 2012; Schweitzer et al., 2019). However, research also started investigating the role of CF in fostering network communication and therefore its role in cross-organizational discussions (Djuricic & Bootz, 2019).

Lastly, research attests to CF the generation of organizational consensus. This is done in two ways: Through orientation of many CF tools and through the opening up to lower-level organizational members, generating multi-perspective. CF tools traditionally follow a consensus-building approach, anchored in its roots of the French philosophic school *la prospective* (Bootz, Monti, Durance, Pacini, & Chapuy, 2019; Förster & von der Gracht, 2014; Ho & O’Sullivan, 2017). Furthermore, research stresses CF’s ability to integrate stakeholders for strategy development (Boe-Lillegraven & Monderde, 2015; Rohrbeck & Schwarz, 2013). All over, organization-related outcomes present a significant CF research stream. Initially seen as side effects of ‘actual’ CF, they are increasingly growing in importance due to the recently emerging trend of collaborative strategizing.

Innovation-related outcomes are the youngest of all outcomes thematized by research. They cover *technological innovation* and *portfolio innovation*. Generally, researchers are attesting to the positive impact of CF on organizational ambidexterity (the ability to explore and exploit innovation) (Paliokaite & Pačesa, 2015; Sarpong et al., 2013), regardless of the particular field.

Technological innovation can be seen as the most traditional CF

outcome, since it is linked to technology assessment, which in turn is one of the main motivations for CF. Research on technology innovation can be divided into two streams: Technology assessment for early identification of disruptions and the systematic integration of innovations in the company. The first focus on peripheral scanning and weak signal identification as well as the ability to create radical innovation (Gershman et al., 2016; Paliokaite & Pačesa, 2015; Rohrbeck, Thom, et al., 2015; Rohrbeck & Gemünden, 2011; Scheiner et al., 2015; Von der Gracht & Stillings, 2013; Wiener et al., 2020), which is directly tied to strategic flexibility. The latter centres around the ability to strategically incorporate technological innovation in the organisation (Battistella, 2014; Ho & O'Sullivan, 2018; Rohrbeck, Thom, et al., 2015; Rohrbeck & Gemünden, 2011; Schwarz et al., 2019).

Portfolio innovation refers to all outcomes influencing current products and services, markets and business models. Empirical research shows that CF outcomes can develop new product purposes and match products with customer needs by envisioning future preferences (Açıkgöz et al., 2016; Battistella & De Toni, 2011; Ruff, 2015; Schweitzer et al., 2019; Vecchiato, 2012a). This goes along with enhanced market understanding and identification of new business fields (Boe-Lillegraven & Monderde, 2015; Farrington et al., 2012; Fritzsche, 2018; Paliokaite & Pačesa, 2015), facilitated through peripheral scanning activities. Further research examines the application of CF for business model creation and evaluation (Højland & Rohrbeck, 2018; Van der Duin et al., 2014).

Finally, performance-related outcomes constitute the 'traditional' economic result *profitability*. Paradoxically, due to the long-term orientation and qualitative nature of CF, these are difficult to estimate (Boe-Lillegraven & Monderde, 2015; Rohrbeck, 2012; Rohrbeck & Schwarz, 2013; Vecchiato, 2012b). Instead, articles tend to vaguely indicate enhanced CF-induced performance (Milshina & Vishnevskiy, 2018; Wiener et al., 2020) by illustrating that CF engagement positively affects company performance. However, scholars recently attempt to quantify CF outcomes and their contribution to profitability (Rohrbeck & Kum, 2018). Generally, profitability contributions of CF occur rather indirectly by providing non-financial outcomes. Potential future research could therefore focus on directly assessing CF performance outcomes.

### 5.5. Research on technology

Research stresses that technology becomes increasingly important since it represents a key element of most businesses (Shah, Palacios, & Ruiz, 2013). Initially, application fields of technology CF were found predominantly in R&D departments of companies in technology-intensive industries, (Ruff, 2006; Vecchiato, 2012b; Vecchiato & Roveda, 2010b). This changed significantly with the rise of ICT, and the technological pervasion of the entire business world. Companies once not depending on technology, increasingly require it today, making CF a necessity (Ahuja, Coff, & Lee, 2005; Saritas & Nugroho, 2012). The pervasive effect of technology is illustrated in the comprehensive framework (Fig. 3) and summarized in Table 6. Fig. 3 illustrates how technology interrelates with CF motivation, tools, moderators, and outcomes. Yet, it needs to be considered individually, due to its role ambivalence, which is reflected through the fragmentation of research in this field.

Importantly, our analysis revealed several key technology-related insights. Firstly, technology is the main source of environmental uncertainty and increasing complexity and dynamics, leading to disruptive changes (Rohrbeck & Kum, 2018; Savioz & Blum, 2002; Scheiner et al., 2015; Schweitzer et al., 2019; Weber et al., 2015). This is why companies, when aiming to proactively anticipate the future, turn their attention frequently to technology (Dufva & Ahlqvist, 2015; Rohrbeck, 2012; Ruff, 2006). Secondly, to identify and analyze emerging technologies, companies apply CF tools. The environment is scanned for new technologies, estimating their potential value for the company (Heger & Rohrbeck, 2012; van der Duin & Ligtvoet, 2019). Scan results (e.g. from

scenarios) are then processed and integrated into roadmaps (Farrington et al., 2012; Rohrbeck, 2012). The majority of researchers emphasize the importance of roadmaps for the exploitation and integration of technologies since they allow eased integration into overarching strategies (Gershman et al., 2016; Ho & O'Sullivan, 2018; Milshina & Vishnevskiy, 2019; Yoon et al., 2019). On the other side, tools can be enhanced by integrating technology. Particularly data-driven and quantitative tools can profit from technology support (Rohrbeck, Thom, et al., 2015; Van der Duin et al., 2014; Yoon et al., 2019). Thirdly, with regard to moderators, scholars illustrate the positive effects of technology in opening foresight practices in terms of transparency and collaboration. Through making CF activities available to a wide range of participants, communication is eased, a shared value base is facilitated and multi-perspective is fostered (Rohrbeck, Thom, et al., 2015). By this, technology indirectly influences the relationship between CF activities and outcomes.

Lastly, technology can *represent* different outcomes of CF activity. As organizations assess their environment, they inevitably assess technology as an external disruption leading to the generation of new knowledge and innovation that are rooted in the disrupting technology itself (Rohrbeck & Kum, 2018; van der Duin & Ligtvoet, 2019). More recent research, which focuses on a systematic approach to innovation management, stresses the importance of innovating constantly to gain and sustain competitive advantage (Boe-Lillegraven & Monderde, 2015; Haarhaus & Liening, 2020; Heger & Boman, 2015), where technology informed by CF activity can be part of the innovation itself, e.g., by enhancing product- and portfolio innovation (Heger & Rohrbeck, 2012; Rohrbeck & Gemünden, 2011; Rohrbeck & Kum, 2018). On the other hand, CF outcomes can *include* technology. Here, innovation-related outcomes can involve new technology in different forms (e.g., as a novel tool to be used within the organization) that can affect how a firm conducts its CF activity. For example, Calof et al. (2018) have illustrated how organizations can facilitate their engagement in open innovation networks using CF tools, and in turn, such involvement can yield technology and crowd-sourcing platforms that enhance the CF capacity of these firms.

Overall, the roles of technology in CF can be described as follows: Technology is a motivator for and a reason to conduct CF, it is subject to CF tools and likewise supports them, as well as a moderator and outcome of CF at the same time.

## 6. Discussion and implications

CF has attracted significant scholarly interest over the last two decades. However, the produced body of knowledge in this field is still fragmented, lacking a systematic view into the different aspects of CF, and their conceptual connection. Therefore, the purpose of this study is to critically review and synthesize the extant empirical literature on CF, and scrutinize the role of technology as a key factor that affect the different aspects of CF. We also drew on this critical evaluation and integration to identify key gaps in the existing research and provide important areas for future work. Next, we discuss the implications of our findings, and offer directions for future research directions.

### 6.1. Theoretical and practical implications

Our study provides a number of theoretical implications. First, we offer a unique and comprehensive view of CF by offering an evidence-based framework, therefore contributing to the development of a unified perception of CF. Using a process-oriented approach, we investigated the CF as a process that encompasses CF key elements—including motivations, tools and activities, moderators, and outcomes. This contribution is particularly relevant as Dadkhah, Bayat, Fazli, Tork, and Ebrahimi (2018, p. 1) asserted that "to enhance CF performance, it seems necessary to recognize affecting factors on CF [...] to improve corporate's [capacity] against discontinuous changes and to design a structured and professional framework in order to develop CF capabilities". We also

investigated the interplay between these elements. While linkages between single CF elements were until recently addressed predominantly from a bilateral detailed perspective of the relationships (i.e., most articles deal only with the effect of one element, for example, “the role of motivation for engaging in CF” or “how tool X applied in company Y”), we show the full breadth of CF elements interactions. Accordingly, we respond to [Gordon et al.’s \(2020\)](#) call that “[w]hile much knowledge has been produced on how to conduct foresight, less attention has been given to how foresight is integrated with a firm’s strategic planning processes, innovation, and operational activities” (p. 1). As such, this review reveals and combines multiple relationships between single CF elements for the first time into a unique state-of-the-art conceptual framework. Most fundamental amongst these are the relationship between ‘CF activities and tools’ and ‘CF outcomes’ under the impact of the whole width of moderators. In specific, while the CF activities are conducted with the aim of a certain CF outcome ([Sarpong & Meissner, 2018](#)), it emerged that these relationships are contingent on a wide spectrum of moderating effects that we clustered as formal, cultural, and configurational. So by analyzing the existing empirical research, we were able to identify the overarching key characteristics of CF ‘motivations, tools, and activities’ and ‘outcomes’ relationship - mostly by defining the subthemes within these elements and assessing their effectiveness. The aggregation of different subthemes allowed us to gain an in-depth understanding of the relationship between the different CF elements. This provides a unique opportunity to understand the full complexity of the topic and its ramifications.

*Second*, our study advances the CF literature by highlighting the critical bidirectional effect of technology, as a distinct construct, across CF elements. While some empirical studies have partially investigated this effect (e.g., [Højland & Rohrbeck, 2018](#), [Klos & Spieth, 2020](#), [Milshina & Vishnevskiy, 2018](#), [Rohrbeck & Schwarz, 2013](#), [Yoon et al., 2019](#)), we offer a unique perspective by integrating and explaining how technology interrelates (affect and affected by) with *all* CF elements, including motivations, tools, moderators and outcomes. Ultimately, this contribution (i.e., highlighting and revealing the multifaceted role of technology in CF) offers new insight to the extant research by changing the perception of technology from being regarded as either an ‘input to’ or ‘output from’ the CF process, to consider the other technology-related effect in CF. Accordingly, we address the need to identify contextual and boundary conditions (e.g., human interaction with technological advancement) that may influence the manifestation of CF process and outcomes overtime ([Schweitzer et al., 2019](#); [Yoon et al., 2018](#)). In this respect, for instance, [Gordon et al. \(2020\)](#) advised that firms, when managing their CF process and activities, should carefully consider how to balance between “artificial intelligence-generated and human-generated insights and their impact on decision-making” (p. 119966). This is because the technology role is getting more complex in CF (e.g., creating a foresight platform) and cuts across the various organizational levels and aspects in firms ([Boe-Lillegraven and Monterde, 2015](#), [Fergnani et al., 2020](#)). *Third*, and finally, our in-depth analysis of the CF literature allowed us to identify several avenues for future research that we discuss comprehensively in the next sub-section.

In addition to research, our study offers implications for practice. Importantly, the evident-based framework developed in this study can be used by practitioners as a platform to plan systematically for the CF process. As such, the different elements captured by the framework and the explained relationship between the different CF variables can put the managers in better planning and executing positions as they can realize and account for the factors that matter. For instance, in this study, we identified a wide range of moderators that are likely to influence the CF process which was clustered in three groups (formal, cultural, and configurational). By understanding and considering these moderators, managers responsible for strategic foresight can have better control over the conditions that might facilitate or complicate their CF process.

## 6.2. Future research trajectories

### 6.2.1. Theory-centred future research directions

We offer suggestions for theory development based on two of the most prominent theories in CF research: dynamic capabilities (DCs) and network theory.

The DCs perspective represents a significant extension of the resource-based view (RBV), explaining how companies can achieve and sustain competitive advantage. The DCs perspective breaks with, the rather static view of companies as pools of resources, and pay particular attention to a company’s (internal) abilities to facilitate these resources and organize them in a way to ensure future success by anticipating and exploiting external opportunities via rapid adjusting to environmental changes ([Teece et al., 1997](#)). Therefore, and from a theoretical viewpoint, the application of DCs perspective on CF is congruent with overcoming the static view of CF (as a set of tools to assess external changes), to view CF as an iterative process of recognizing-interpretation of weak signals in firm’s external environment ([Fergnani, 2020](#); [Schwarz et al., 2020](#)). This is also consistent with [Heger and Boman \(2015\)](#) who highlight that CF activities are congruent with [Teece et al.’s \(1997\)](#) DCs framework, where these activities can lead to competitive advantage by enabling the firm to sense, seize and transform its capabilities to exploit emerged opportunities ([Fergnani, 2020](#)). Accordingly, adopting the DCs perspective can allow a broader understanding of CF by enabling the development of a theoretical foundation to explain how CF can create value ([Haarhaus & Liening, 2020](#)). However, it is noticeable that, while several studies have acknowledged the DCs perspective as an adequate framework to conceptualize the CF construct, the use of this framework is rather simplistic by either regarding CF as a significant antecedent of firm’s DCs (e.g., [Haarhaus & Liening 2020](#); [Schwarz et al., 2020](#)) or suggesting CF as a DC itself (e.g., [Fergnani, 2020](#)). This implies the need to better understand and establish the relationship between CF and DCs ([Haarhaus & Liening 2020](#)). Therefore, for theoretical development, researchers can focus on studying how the different CF activities can facilitate firm’s cognitive capabilities to sense emerging opportunities and risks, and to be able to adapt their resource base in response to the perceived coming environmental changes ([Vecchiato, 2015](#)). Also, future inquiries can look into the differential effect of CF activities (such as environmental scanning or scenario planning) on the types of DCs (e.g., strategic flexibility, decision rationality and strategic agility) which can reveal more granular insights on the mechanisms through which DCs can mediate the relationship between CF and value creation. In addition, a theoretical extension can be achieved by investigating the CF-DCs connection using the notion of microfoundations. In this regard, researchers can draw on [Teece et al.’s \(1997\)](#) conceptualization of DCs pillars: 1) vision and leadership skills of managers, and 2) the cohesion and flexibility of the organization as a whole. By focusing on the former (i.e., top management attributes), future studies can investigate how CF-related training can help decision-makers and managers to make ‘cognitive leaps’ ([Schwarz et al., 2020](#)), by overcoming dominant mental models ([Vecchiato, 2020](#)), where these leaps are vital in determining the firm’s response and adaptation against external uncertainty. In addition, scholarly attention should be paid to refine and develop our understanding of how the different behavioural-related factors (for example the moderators as identified in our study, including cultural and structural) can influence firm’s routines for building and applying DCs. We expect that conducting empirical studies in this direction can yield useful conceptual advancement by theorizing how internal boundary conditions (i.e., firm-level moderators) can alter CF potential to deliver value through DCs ([Haarhaus & Liening, 2020](#)), for example, by “allowing a firm to change its resource base” ([Fergnani, 2020, p. 37](#)).

Considering the network theory, many CF studies have built upon network and collaboration theories. These theories support the development of CF from a static, externally oriented, performed by a number of externals to generate an advantage to a collaborative system of shared



knowledge on future developments with a comprehensive internal and external view. This latest development is characterized as the fourth generation of CF, named *networked foresight* (Van der Duin et al., 2014). In addition, network elements of CF are applied on different levels within a company, between companies and in different constellations of collaborations between private and public participants of *collaborative* or *open foresight* (Gattringer, Wiener, & Strehl, 2017; Gattringer & Wiener, 2020; Van der Duin et al., 2014). Recognizing this development, several research areas can be identified. First, the effectiveness of more open foresight activities needs further investigation (Gordon et al., 2020). It might appear advantageous to open up foresight activities to wider stakeholders within an organization, however, this bears the danger of distracting the initial aim of a strategic advantage since focus might be lost due to a too wide number of participating stakeholders (Zeng, Koller, & Jahn, 2019). Second, future research could explore the degree of openness that appears optimal in what type of organization (e.g., independence of size and industry). The contextual factor might be of primary importance here since it cannot be said beforehand what degree of openness suits a certain company (in a certain industry and size such as large vs entrepreneurial firms) at a particular moment in its existence. Third, research should try to explore the usefulness of parallel CF activities within an organization. Synergetic effects could be achieved by combining the results of two or more simultaneously executed CF campaigns in the same organization with differing levels of openness and participation (Wiene, Gattringer, & Strehl, 2018). These activities bear the potential to cross-fertilize and achieve a higher degree of suitable results for an organization. Future studies could also examine the impact of CF activities and scenario planning on workers' welfare and safety.

#### 6.2.2. Phenomenon-centered future research directions

A key contribution of this study is the development of an overarching framework (Fig. 3) that identifies the constructs/themes in the CF literature and explicates their interconnection. However, this framework is also useful to envision several fundamental research directions that demand careful scholarly attention. We discuss these directions across the different elements of the framework, focusing on motivations, tools/activities, moderators, outcomes, and technology.

**6.2.2.1. Motivations.** Motivation is commonly addressed throughout literature as the result of environmentally-induced disruptions which need to be countered. It is also widely accepted that motivation culminates in the application of CF tools. However, research so far only superficially covered the application of tools for a particular purpose. For example, roadmaps are widely used in technology foresight. This illustrates a common practice and the benefits of this approach are shown in literature, but rather as indirectly evolving from the practical context. There is currently little research on how motivation impacts the systematic choice of tools. What could therefore be addressed through the dynamic capabilities approach is the question of *when* to apply *which* tool to receive *which* outcome. This investigation could be enhanced by generally examining the impact of contextual factors on foresight tools.

**6.2.2.2. Tools/activities.** As CF is done through a variety of different tools and activities (e.g., scenario analysis and technology roadmapping), research in this area has so far focussed on the application of these tools/activities in a given context. However, little academic focus so far is made to explore the change of these tools/activities over time (i. e., there is a need to factor in the effect of 'time'). For instance, Burt, Mackay and Perchard (2015) warned that long-term searching for foresightful insights using techniques, such as scenario planning, can create harmful consequences as managers would focus primarily on "that which is far off (temporally, spatially or cognitively) whilst failing to interpret and manage that which is close" (p. 134). Therefore, researchers can design longitudinal studies to investigate similar effects

within the array of CF tools/activities. In addition, there is a need to investigate the "evolution" of CF tools, as these tools which include technological components might have changed their character (e.g., to analyze in which way tools developed from the past until today in order to interpret the future character of CF tools and activities). For instance, these investigations can look into the conduction of tools through different computer-aided software such as remote sessions (e.g. large CF workshops) and how they differ from traditional formats.

**6.2.2.3. Moderators.** Foresight moderators include a variety of factors impacting the relationship between CF activities and outcomes. Since the increase of research interest on the topic from 2010 onwards, substantial research was conducted to assess the role of moderating factors such as organization, culture and management (Darkow, 2015; Sarpong et al., 2013). However, these have an inner-organizational view, focussing on formal, cultural and contextual issues. The role of external moderating factors is only considered to a limited extent. Gattringer et al. (2017) explain that external factors can inhibit a company's ability to conduct CF, but without further specification. Therefore, future research could explore the impact of external factors (e.g. industry, competition, and regulations) on the relationship of CF activities and outcomes. Furthermore, research sees moderators as a changeable, but to a wide extent static element. At the time CF activities are conducted, they are given (Sarpong et al., 2013). Another potential research direction therefore could include a contextual assessment of moderators. This could aim to explain under which (internal, external) conditions which moderator is mostly affected. Furthermore, it could assess which individual moderator has the most significant impact on the relationship of current activities and their outcomes. A situational view on moderators could immensely enhance the success of CF activities, allowing companies to proactively counter weaknesses in the long term and design their current activities to minimise inhibiting effects. Lastly, research shows the width of CF outcomes, varying from broad strategic, to organisation-, innovation-, and performance-related ones. Still, three potential research directions are identified through the narrative synthesis.

**6.2.2.4. Outcomes.** The wide applicability of foresight is reflected through the amount of research conducted particularly on the traditional domains of decision-making, planning and strategic flexibility. Organization-related outcomes are as well frequently subject to CF research (Rohrbeck, Thom, et al., 2015). However, we identified three key gaps in this aspect. First, there is little research on the linkages between strategy-related and organization-related outcomes, i.e. the relationship between strategic flexibility and organizational renewal and transformation during and after a crisis. Future research could further explore to what extent organizational renewal is linked to organizational responsiveness. Second, there is a need to focus on an exploration of service innovation. Due to the predominance of industry-based research, little attention is given to the effect of CF innovation in service-based companies, which form the majority of most developed economies businesses. Research on CF-induced service innovation could complement the existing picture and help to identify similarities and differences between the industries. Future studies need to broaden the scope of inquiry and conduct multi-country and industry studies on CF and its connection with firms' survival and resilience. Future studies could also draw insights from the agency and behavioral theory and document the role of CF on firm-level outcomes including innovation and performance. Since the role of the managers as key decision-makers is important, thus future research on CF should pay more attention to the microfoundations and examine how managerial cognition and decision-making influence CF activities in the firm. Lastly, the third research direction addresses the insufficient attention for CF contribution to profitability. Research equally stresses the difficulties in assessing financial value generated through CF activities and the need for the

same (Rohrbeck & Schwarz, 2013). The outcomes of the narrative synthesis support this view and emphasize the importance of performance-related outcome measurability mainly to eliminate doubts about the necessity of CF.

**6.2.2.5. Technology.** Scholars widely recognize the importance of technology in the CF context, demonstrated through the linkages of technology and the remaining topics. However, two main questions appear insufficiently covered by the existing research. *First*, the vast majority of articles view technology in a broad sense, without further specification. The term *technology* is present, but particularities of *what* technologies, *where* and *how* they cause disruptions are rarely examined. This might be because most articles possess a CF perspective and do not focus on a particular technology, and modern CF roots trace back to philosophical approaches (Bootz et al., 2019). In practice, this might be different. Still, to enhance the comprehensiveness of the discipline, future research based on the dynamic capabilities approach could examine the relationship of particular technologies such as the Internet of Things (IoT), digital platforms, and how they trigger CF motivation. In addition, it is clear that research so far did not explicitly focus on the full breadth of emerging technology trends (Gordon et al., 2020), such as machine learning (ML), digital platforms and artificial intelligence (AI) tools. For example, there are few studies that offer insights on AI and ML as new technology that has the potential to increase automation (and thus efficiency and effectiveness) in scenario planning or roadmapping (Díaz-Domínguez, 2020; Mühlroth & Grottko, 2018). However, many issues remained unaddressed, for instance, the moderating effect of AI/ML on CF (inhibitor and facilitator alike) is not yet researched to its full extent (Gordon et al., 2020). While it can be expected that AI/ML can improve CF performance in an organisation, the adoption of this technology can be challenging as firms need to learn how to encounter potential technical errors (e.g., in algorithm coding) with human intelligence. In addition, studying how firms can integrate technology-generated insights with human judgement when interpreting future trends is a vital question (Schoemaker & Tetlock, 2017). This is of particular interest since CF activities are a man-made construct incorporating human decisions and thoughts. *Second*, the enhancement of tools through technology has so far received little awareness of research (Van der Duin et al., 2014; Yoon et al., 2019). This might be due to the mentioned generalizing view on technology and the negating of quantity-based approaches by foresight practitioners. However, this still leaves gaps to be addressed by future research. Technology integration in CF tools can open new spaces of human–machine interaction and support activities without turning foresight into a forecast. Future research could analyze the positive effect of technology integration on foresight tools as well as to what extent this integration is possible and useful. Another important research direction should focus on exploring the meaning/role of technology in the wider CF context. The term ‘technology’ is an outcome itself, however, it is likewise the main tool

for outcome generation (i.e., epistemologically, technology is regarded as a multifaceted construct). Therefore, future research should precisely determine the meaning of the term technology in the CF context and assess the different “types” or “subtypes” of technologies that are assessed and how these are perceived by an organization for aiding CF.

### 6.3. Limitations

Despite the advantages the methodological approach provided for this review, three main limitations need to be taken into consideration. Firstly, the final sample consists exclusively of peer-review journal articles ranked on AJG and excludes all remaining research outlets (e.g., books, conference proceedings, and journals not included in the AJG list). Secondly, the choice of Boolean operators might not be sufficiently comprehensive, i.e. terms could be used with different synonyms by others, which could cause different search results. Thirdly, the SLR is based on four electronic databases, additional databases could have increased the research outcomes and complemented the sample.

## 7. Conclusion

This review provides important insights on the fragmented state of the current literature on corporate foresight by performing a systematic literature review. Through a narrative synthesis of a sample comprising 73 articles published over the last two decades in leading business and management journals, we developed an integrative framework that maps the key elements underpinning CF literature (including antecedents, tools/activities, moderators, technology, and outcomes) and explicates their interplay. We also highlighted the bidirectional effect of technology, as a distinct construct, across CF elements, and discussed the need to identify technology-related boundary conditions that may influence the manifestation of CF outcomes. Finally, we utilized the developed framework as a platform to identify critical gaps in the CF research, and suggest related future research trajectories.

### CRediT authorship contribution statement

**Milan Marinković:** Writing – original draft, Conceptualization, Formal analysis, Methodology. **Omar F. Al-Tabbaa:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Zaheer Khan:** Conceptualization, Project administration, Supervision, Writing – review & editing. **Jie Wu:** Writing – review & editing, Supervision.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Definitional boundaries for the CF overarching themes

CF key components	Definitional boundaries	Selected key studies
Motivations (i.e., initial condition)	Factors that induce companies to enact and engage in CF process	Ruff, 2006; Vecchiato & Roveda, 2010; Rohrbeck, Thom, et al., 2015; Ruff, 2015; Gershman et al., 2016; Calof, Meissner, et al., 2018; Ho & O'Sullivan, 2018
Activities and tools (i.e., Internal mechanisms)	Iterative actions applied in CF, and what tools (i.e., methods and techniques) are deployed in these actions and how they are applied.	Major & Cordey-Hayes, 2000; Gary & von der Gracht, 2015; Heger & Boman, 2015; Favato & Vecchiato, 2017; Djuricic & Bootz, 2019
Moderators (i.e., boundary conditions)	Organizational factors that influence the relationship between the use of CF tools and outcomes (i.e., facilitate or complicate the process of CF).	Daheim & Uerz, 2008; Engau et al., 2011; Dufva & Ahlqvist, 2015; Rohrbeck & Kum, 2018; Klos & Spieth, 2020
Outcomes	Forms of CF impact on firm's strategic behaviour and operational performance.	Heger & Rohrbeck, 2012; Boe-Lillegraven & Monterde, 2015; Milshina & Vishnevskiy, 2018; Yoon et al., 2019
Technology	Various technology-related aspects that are applied or affected by any of CF components (including motivations, tools, moderators, and outcomes).	Rohrbeck, Thom, et al., 2015; Gershman et al., 2016; Scheiner et al., 2015; Ho & O'Sullivan, 2018; Rohrbeck & Kum, 2018; Schweitzer et al., 2019; Haarhaus & Liening, 2020

## Appendix B. Overview of the final sample

Article no.	Year	Author(s)	Title	Journal
1	2016	Açıkgöz, A., Günsel, A. Kuzey, C., Zaim, H.	Team Foresight in New Product Development Projects	<i>Group Decision and Negotiation</i>
2	2005	Ahuja, G., Coff, R. W., Lee, P. M.	Managerial Foresight and Attempted Rent Appropriation: Insider Trading on Knowledge of Imminent Breakthroughs	<i>Strategic Management Journal</i>
3	2014	Battistella, C.	The organisation of Corporate Foresight: A multiple case study in the telecommunication industry	<i>Technological Forecasting and Social Change</i>
4	2011	Battistella C., De Toni, A. F.	A methodology of technical foresight: A proposal and field study	<i>Technological Forecasting and Social Change</i>
5	2017	Bisson, C., Diner Ö. Y.	Strategic Early Warning System for the French milk market: A graph theoretical approach to foresee volatility	<i>Futures</i>
6	2015	Boe-Lillegraven, S., Monterde, S.	Exploring the cognitive value of technology foresight: The case of the Cisco Technology Radar	<i>Technological Forecasting and Social Change</i>
7	2020	Burt, G., Nair, A.K.	Rigidities of imagination in scenario planning: Strategic foresight through 'Unlearning'	<i>Technological Forecasting and Social Change</i>
8	2018	Calof, J., Arcos R., Sewdass, N.	Competitive intelligence practices of European firms	<i>Technology Analysis &amp; Strategic Management</i>
9	2017	Carbonell, J., Sanchez-Esguevillas, A., Carro, B.	From data analysis to storytelling in scenario building. A semiotic approach to purpose-dependent writing of stories	<i>Futures</i>
10	2017	Chau, V. S., Quire, C.	Back to the future of women in technology: insights from understanding the shortage of women in innovation sectors for managing corporate foresight	<i>Technology Analysis &amp; Strategic Management</i>
11	2004	Costanzo, L. A.	Strategic foresight in a high-speed environment	<i>Futures</i>
12	2008	Daheim, C., Uerz, G.	Corporate foresight in Europe: from trend-based logics to open foresight	<i>Technology Analysis &amp; Strategic Management</i>
13	2015	Darkow, I.	The involvement of middle management in strategy development - Development and implementation of a foresight approach	<i>Technological Forecasting and Social Change</i>
14	2019	Djuricic, K., Bootz, J.	Effectuation and foresight - An explanatory study of the implicit links between the two concepts	<i>Technological Forecasting and Social Change</i>
15	2015	Dufva, M., Ahlqvist, T.	Elements in the construction of future-orientation: A systems view of foresight	<i>Futures</i>
16	2011	Engau, C., Hoffmann, V. H., Busch, T.	Airlines' Flexibility in Facing Regulatory Uncertainty: To Anticipate or Adapt?	<i>California Management Review</i>
17	2012	Farrington, T., Henson, K., Crews, C.	Research Foresights: The Use of Strategic Methods for Ideation and Portfolio Management	<i>Research Technology Management</i>
18	2020	Farrukh, C., Holgado, M.	Integrating sustainable value thinking into technology forecasting: A configurable toolset for early stage technology assessment	<i>Technological Forecasting and Social Change</i>
19	2017	Favato, G., Vecchiato, R.	Embedding real options in scenario planning: A new methodological approach	<i>Technological Forecasting and Social Change</i>
20	2014	Förster, B., von der Gracht, H.	Assessing Delphi panel composition for strategic foresight - A comparison of panels based on company-internal and external participants	<i>Technological Forecasting and Social Change</i>
21	2017	Fritzsche, A.	Corporate foresight in open laboratories - a translational approach	<i>Technology Analysis &amp; Strategic Management</i>
22	2015	Gary, J. E., von der Gracht, H.	The future of professionals: Results from a global Delphi study	<i>Futures</i>
23	2020	Gattringer, R., Wiener, M.	Key factors in the start-up phase of collaborative foresight	<i>Technological Forecasting and Social Change</i>
24	2017	Gattringer, R., Wiener, M., Strehl, F.	The challenge of partner selection in collaborative foresight project	<i>Technological Forecasting and Social Change</i>
25	2016	Gershman, M., Bredikhin, S., Vishnevskiy, K.	The role of corporate foresight and technology roadmapping in companies' innovation development: The case of Russian state-owned enterprises	<i>Technological Forecasting and Social Change</i>
26	2019	Gordon, A. V.	Matrix in scenario planning: Implications of congruence with scenario project purpose	<i>Futures</i>
27	2020	Haarhaus, T., Liening, A.	Building dynamic capabilities to cope with environmental uncertainty: The role of strategic foresight	<i>Technological Forecasting and Social Change</i>
28	2015	Heger, T., Boman, M.	Networked foresight - The case of EIT and ICT Labs	<i>Technological Forecasting and Social Change</i>
29	2012	Heger, T., Rohrbeck, R.	Strategic foresight for collaborative exploration of new business fields	<i>Technological Forecasting and Social Change</i>
30	2018	Ho, J., O'Sullivan, E.	Standardisation framework to enable complex technological innovations: The case of photovoltaic technology	<i>Journal of Engineering and Technology Management</i>
31	2018	Højland, J., Rohrbeck, R.	The role of corporate foresight in exploring new markets - evidence from 3 cases in the BOP markets	<i>Technology Analysis &amp; Strategic Management</i>
32	2017	Kunc, M., O'Brien, F. A.	Exploring the development of a methodology for scenario use: Combining scenario and resource mapping approaches	<i>Technological Forecasting and Social Change</i>
33	2017	Lehr, T., Lorenz, U., Willert, M., Rohrbeck, R.	Scenario-based strategizing: Advancing the applicability in strategists' teams	<i>Technological Forecasting and Social Change</i>
34	2000	Major, E. J., Cordey-Hayes, M.	Engaging the business support network to give SMEs the benefit of Foresight	<i>Technovation</i>
35	2020	Metz, A., Hartley, P.	Scenario development as valuation: Opportunities for reflexion	<i>Technological Forecasting and Social Change</i>
36	2018	Milshina Y., Vishnevsky, K.	Potentials of collaborative foresight for SMEs	<i>Technology Analysis and Strategic Management</i>
37	2019	Milshina, Y., Vishnevsky, K.	Roadmapping in fast changing environments - the case of the Russian media industry	<i>Journal of Engineering and Technology</i>
38	2015	Paliokaitė, A., Pačėsa, N.	The relationship between organisational foresight and organisational ambidexterity	<i>Technological Forecasting and Social Change</i>
39	2015	Peter, M. K., Jarratt, D. G.	The practice of foresight in long-term planning	<i>Technological Forecasting and Social Change</i>

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Article no.	Year	Author(s)	Title	Journal
40	2019	Pouru, L., Dufva, M., Niinisalo, T.	Creating organisational futures knowledge in Finnish companies	<i>Technological Forecasting and Social Change</i>
41	2010	Ringland, G.	The role of scenarios in strategic foresight	<i>Technological Forecasting and Social Change</i>
42	2012	Rohrbeck, R.	Exploring value creation from corporate-foresight activities	<i>Futures</i>
43	2011	Rohrbeck, R., Gemünden, H. G.	Corporate foresight: Its three roles in enhancing the innovation capacity of a firm	<i>Technological Forecasting and Social Change</i>
44	2018	Rohrbeck, R., Kum, M. E.	Corporate foresight and its impact on firm performance: A longitudinal analysis	<i>Technological Forecasting and Social Change</i>
45	2013	Rohrbeck, R., Schwarz, J. O.	The value contribution of strategic foresight: Insights from an empirical study of large European companies	<i>Technological Forecasting and Social Change</i>
46	2015	Rohrbeck, R., Thom, N., Arnold, H.	IT tools for foresight: The integrated insight and response system of Deutsche Telekom Innovation Laboratories	<i>Technological Forecasting and Social Change</i>
47	2015	Ruff, F.	The advanced role corporate foresight in innovation and strategic management - Reflections on practical experiences from the automotive industry	<i>Technological Forecasting and Social Change</i>
48	2006	Ruff, F.	Corporate foresight: integrating the future business environment into innovation and strategy	<i>International Journal of Technology Management</i>
49	2012	Saritas, O., Nugroho, Y.,	Mapping issues and envisaging futures: An evolutionary approach	<i>Technological Forecasting and Social Change</i>
50	2018	Sarpong, D., Hartman, D.	Fading memories of the future: the dissipation of strategic foresight among middle managers	<i>Technology Analysis &amp; Strategic Management</i>
51	2014	Sarpong, D., Maclean, M.	Unpacking strategic foresight - A practice approach	<i>Scandinavian Journal of Management</i>
52	2016	Sarpong, D., Maclean, M.	Cultivating strategic foresight in practise: A relational perspective	<i>Journal of Business Research</i>
53	2013	Sarpong, D., Maclean, M., Davies, C.	A matter of foresight: How practices enable (or impede) organizational foresightfulness	<i>European Management Journal</i>
54	2002	Savioz, P., Blum, M	Strategic forecast tools for SMEs: how the opportunity landscape interacts with business strategy to anticipate technological trends	<i>Technovation</i>
55	2015	Scheiner, C. W., Baccarella, C. V., Bessant, J., Voigt, K.	Thinking patterns and gut feeling in technology identification and evaluation	<i>Technological Forecasting and Social Change</i>
56	2019	Schwarz, J. O., Ram, C., Rohrbeck, R.	Combining scenario planning and business wargaming to better anticipate future competitive dynamics	<i>Futures</i>
57	2019	Schweitzer, N., Hofmann, R., Meinheit, A.	Strategic customer foresight: From research to strategic decision-making using the example of highly automated vehicles	<i>Technological Forecasting and Social Change</i>
58	2013	Shah, A. N., Palacios, M., Ruiz, F.	Strategic rigidity and foresight for technology among electric utilities	<i>Energy Policy</i>
59	2013	Tapinos, E.	Scenario planning at business unit level	<i>Futures</i>
60	2014	van der Duin, P., Heger, T., Schlesinger, M. D.	Toward networked foresight? Exploring the use of futures research in innovation networks	<i>Futures</i>
61	2019	van der Duin, P., Ligtvoet, A.	Lines into the future. Exploring how Dutch infrastructure providers organize and manage their foresight processes	<i>Futures</i>
62	2012	Vecchiato, R.	Environmental uncertainty, foresight and strategic decision making: An integrated study	<i>Technological Forecasting and Social Change</i>
63	2012	Vecchiato, R.	Strategic foresight: matching environmental uncertainty	<i>Technology Analysis &amp; Strategic Management</i>
64	2020	Vecchiato, R.	Analogical reasoning, cognition, and the response to technological change: Lessons from mobile communication	<i>Research Policy</i>
65	2010	Vecchiato, R., Roveda, C.	Foresight in corporate organisations	<i>Technology Analysis &amp; Strategic Management</i>
66	2010	Vecchiato R., Roveda, C.	Strategic foresight in corporate organizations: Handling the effect and response uncertainty of technology and social drivers of change	<i>Technological Forecasting and Social Change</i>
67	2013	von der Gracht, H., Stillings, C.	An innovation-focused scenario process - A case from the materials producing industry	<i>Technological Forecasting and Social Change</i>
68	2015	Weber, C., Sailer, K., Katzy, B.	Real-time foresight - Preparedness for dynamic networks	<i>Technological Forecasting and Social Change</i>
69	2020	Wiener, M., Gattringer, R., Strehl, F.	Collaborative open foresight - A new approach for inspiring discontinuous and sustainability-oriented innovations	<i>Technological Forecasting and Social Change</i>
70	2018	Yoon, J., Kim, Y. J., Vonortas, N. S., Han, S. W.	Corporate foresight and innovation: the effects of integrative capabilities and organisational learning	<i>Technology Analysis &amp; Strategic Management</i>
71	2019	Yoon, J., Kim, Y. J., Vonortas, N. S., Han, S. W.	A moderated mediation model of technology roadmapping and innovation: The roles of corporate foresight and organizational support	<i>Journal of Engineering and Technology Management</i>
72	2020	Li, A., Sullivan, B. N.	Blind to the future: Exploring the contingent effect of managerial hubris on strategic foresight	<i>Strategic Organization</i>
73	2020	Klos, C., Spieth, P.	READY, STEADY, DIGITAL?! How foresight activities do (NOT) affect individual technological frames for managerial SENSEMAKING	<i>Technological Forecasting and Social Change</i>

## Appendix C. Overview of journals included in the sample

Journal	No. articles	%	IF	CiteScore
Technological Forecasting and Social Change	36	49,3	8.593	12.1
Futures	11	15,1	3.073	5.5
Technology Analysis & Strategic Management	10	13,7	2.874	4.1

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Journal	No. articles	%	IF	CiteScore
Technovation	2	2,7	6.606	10.4
Journal of Engineering and Technology Management	2	2,7	3.347	5.2
International Journal of Technology Management	1	1,4	1.667	2.0
Research Technology Management	1	1,4	–	3.3
California Management Review	1	1,4	8.836	8.6
Strategic Management Journal	1	1,4	8.641	12.5
Group Decision and Negotiation	1	1,4	2.648	4.1
Scandinavian Journal of Management	1	1,4	2.433	3.7
Journal of Business Research	1	1,4	7.550	9.2
European Management Journal	1	1,4	5.075	6.4
Energy Policy	1	1,4	6.142	10.2
Research Policy	1	1,4	8.110	11.4
Strategic Organization	1	1,4	5.409	7.0
Journal of Engineering and Technology	1	1,4	3.374	5.2

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