

Ivancic, Ronald; Ott, Stefan

Article

Machine Economicus – Business Forecast 4.0 - Methods to Predict Short-, Medium- and Long-term Futures

Marketing Review St.Gallen

Provided in Cooperation with:

Universität St. Gallen, Institut für Marketing und Customer Insight

Suggested Citation: Ivancic, Ronald; Ott, Stefan (2020) : Machine Economicus – Business Forecast 4.0 - Methods to Predict Short-, Medium- and Long-term Futures, Marketing Review St.Gallen, ISSN 1865-7516, Thexis Verlag, St.Gallen, Vol. 37, Iss. 3, pp. 20-31

This Version is available at:

<https://hdl.handle.net/10419/276086>

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Customer Foresight



Machine Economicus – Business Forecast 4.0

Methods to Predict Short-, Medium- and Long-term Futures

An ever-increasing amount of information, digitization and interconnectedness makes predictions of the future easier. Conversely, systems have never been as complex, uncertain, ambiguous and ambivalent as they are today, resulting in the interference of prognoses. Therefore, different approaches to projections of futures (forecasting, foresight, future creation) have to be combined to anticipate probable developments, assess weak signals and prepare a company effectively for the unforeseeable. The combination ensures the viability of a company in the short-, medium- and long-term perspective.

Dr. Mag mult. Bakk. mult. Ronald Ivancic, Dr. oec. (HSG) Dipl.-Math. oec. (Univ.) Stefan Ott

Economy (micro- and macro-perspective), ecology, sociology and technology are characterized by unprecedented complexity, uncertainty, ambiguity, ambivalence and volatility (VUCA; Bennet & Lemoine, 2014a, p. 27; Bennet & Lemoine, 2014b, p. 311 ff.), with exponentially accelerating transformations and disruptions (Hengstschläger & Strugl, 2015, p. 94) making the situation increasingly unmanageable. Unpredictable, complex and dynamic events lead to unforeseeable developments (Lanza, Moser, & Ruhrmann, 2012, p. 200 ff.) caused by, e.g. financial and economic crises, Brexit, the worldwide migratory flows or COVID-19. Which is why “(n)ot long ago, many serious people would dismiss studies of a long-term future.” (Miles, Saritas, & Sokolov, 2016, p. 1) and it has been known since Igor Ansoff 1975 that companies are well-advised to pay attention to ‘so called’ weak signals, or black swans and wild cards (van Rij, 2013, p. 68 ff.).

On the other hand, as a result of digitization and interconnectedness, an ever-increasing amount of information can be accessed, making it easier to analyze, observe and control objects (Hengstschläger & Strugl, 2015, p. 84). This was one reason why foresight approaches have become more respectable (Miles et al., 2016, p. 3). As for example, the globally produced data volume is estimated to grow to 44 trillion gigabytes in 2020 (Hengstschläger & Strugl, 2015, p. 88), and companies like Microsoft, Apple, Google, Facebook or Amazon are able to assemble detailed profiles of customers. These two facts lead to a paradox of dealing with different, only partly, predictable futures. As a consequence, many companies have started dealing with methods of futu-

rology, from forecasting to foresight, with the latter in particular gaining importance in recent years (Leitner & Pinter, 2016, p. 157).

“Although strategic planning methods exist and planning processes are technologically supported, it is difficult to make predictions about the future.” (Menck, Weidig, & Aurich, 2013, p. 133 following Wiendahl, Reichhardt & Hernández, 2001). Consequently, a combination of different methods and approaches has the greatest potential for reducing uncertainties and optimally preparing the company for possible futures. “Therefore, it is necessary to utilize foresight in corporations to encounter difficult future conditions, to forecast future trends, and to identify and interpret weak signals (...)” (Dadkhah, Bayat, Fazli, Tork, & Ebrahimi, 2018, p. 1), so as to realize visions of the future.

Present contribution tries to show promising possibilities of such a combination (On dealing with futures) on basis of primarily literature study and practical examples. Starting from approaches of short-term prognoses (Forecasting – the anticipation of futures), estimations of medium-term developments (Foresight – dealing with uncertainty) up to a normative identity creation of a company for anticipatory future creation (Identity of the company determines futures), essential methods and procedures for the successful handling of different futures are shown and illustrated by means of selected examples. In this context the aim is not to formulate patent remedies, but to show companies of different sizes approaches and possibilities to successfully deal with short-, medium- and long-term developments in order to ensure their viability against the background of different framework conditions.

Dr. Mag mult. Bakk. mult. Ronald Ivancic

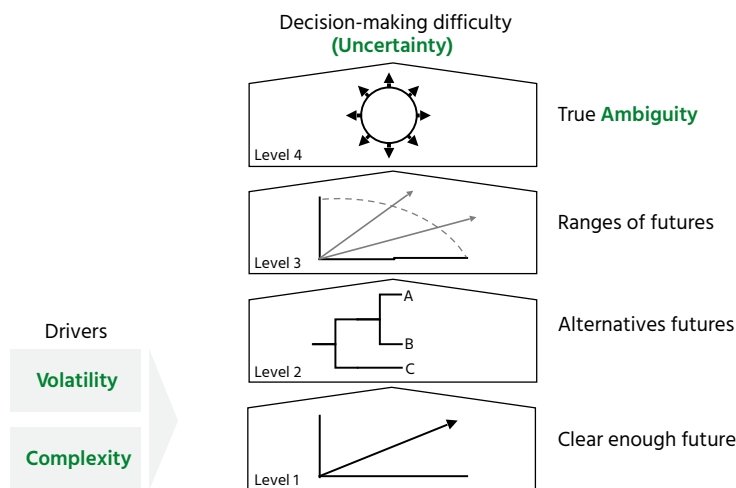
Studies at the Alpen-Adria University of Klagenfurt; lecturer and project manager at the FHS St. Gallen, lecturer at various further education institutions, management consultant, speaker, author, editor and advisory board member

ronald.ivancic@ost.ch
Tel.: +41 (0) 71 2261739
www.fhsg.ch/wtt

Dr. oec. (HSG) Dipl.-Math. oec. (Univ.) Stefan Ott, St.Gallen

Studies at the University of Augsburg and the University of St.Gallen; lecturer at the FHS St.Gallen, participation in projects and research in different fields as a statistical and mathematical consultant

stefan.ott@ost.ch
Tel.: +41 (0) 71 2261707
www.fhsg.ch

Fig. 1: Relationships Between the VUCA Factors

Source: Thorén/Vendel 2019, p. 301; slightly modified representation.

On Dealing with Futures

The further into the future decisions are aimed, the higher the level of uncertainty (Gordon, 2009). Volatility, uncertainty, complexity and ambiguity (VUCA) are interrelated with each other and have a direct connection to different futures and possible ways of analyzing them (cf. Fig. 1). Relatively short time horizons foster the acquisition of information and making predictions for the future. “For longer time frames, however, it is more or less futile to try to predict the future. The number of factors and possible interconnections between them simply grows too large (cf. ‘wicked problems’) and the long series of interactions make minimal changes in initial conditions cause very different outcomes (cf. ‘butterfly effect’).” (Thorén & Vendel, 2019, p. 300).

Analyses of already existing data (i.e. of the past) provide probable scenarios for a near future by relying

on methods such as data sciences, big data analyses, market research approaches, trend analyses and customer tracking (forecasting as an operative futurology). The more uncertain and complex future prognoses become, the less it can be referenced to developments in the past and other approaches

as, for example, Delphi studies, Scenario Techniques, Artificial Intelligence are needed to approach possible futures (foresight as strategic future assessments). For very long-term future prognoses the development of clear visions and a corporate identity, as well as an attentional corporate culture – a kind of normative futurology – in combination with backcasting methods, are necessary.

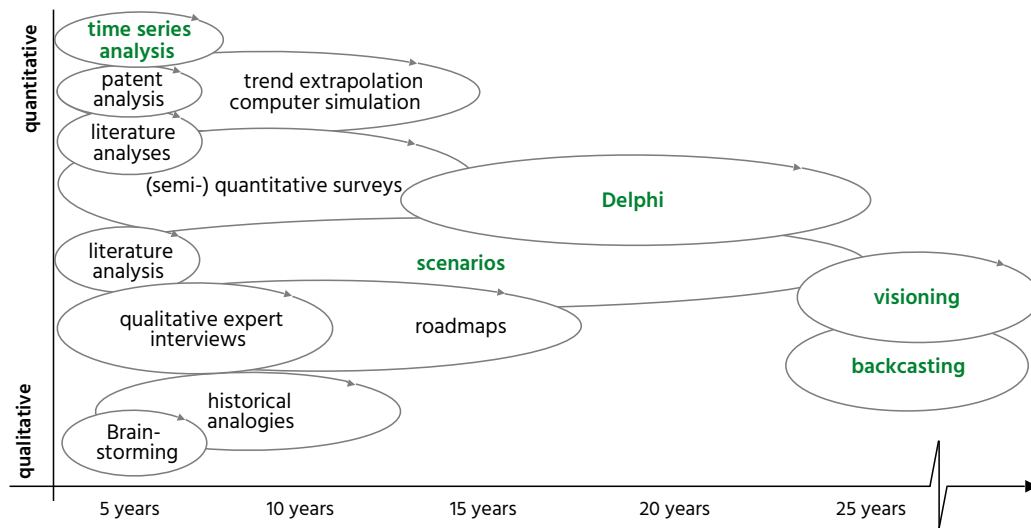
The “purpose (of future research) is not to know the future, but to help us make better decisions today via its methods that force us to anticipate opportunities and threats and consider how to address them – strategically it is better to anticipate, rather than just respond to change. The purpose of future methodology is to systematically explore, create, and test both possible and desirable futures to improve decisions.” (Giaoutzi & Sapio, 2013, p. 4).

Forecasting – The Anticipation of Futures

The origin of Corporate Foresight dates back to the 20th century and is characterized by two antipodes that develop

Management Summary

An ever-increasing amount of information, digitization and interconnectedness makes predictions of the future easier. Conversely, systems have never been as complex, uncertain, ambiguous and ambivalent as they are today, resulting in an interference with prognoses. Therefore, different approaches to projections of futures have to be combined. Analyses of already existing data provide probable scenarios for a near future (forecasting as an operative futurology). For the prognoses of more uncertain, complex, and distant futures, other approaches are more suitable (foresight as strategic future assessments). For very long-term future prognoses the development of clear visions, a corporate identity, and a holistic normative orientation (a kind of normative futurology), in combination with backcasting methods, are promising.

Fig. 2: Methods of Future Sciences

Source: Cuhls 2011, p. 196; slightly modified and extended representation.

ped independently: fantasy-driven utopias and science fiction on the one hand, science-based prediction techniques, often promoted by governmental or economic interests, on the other hand. Already at the end of the 19th century, companies like IBM or Coca-Cola started to use forecasting methods, which gained importance in the course of the two world wars and lead to the discipline of operations research, founded by the British military in 1937, as a multi-discipline field combining optimization and prediction techniques (Leitner & Pinter, 2016, p. 158). In this respect, forecasting methods are, by definition, related to historical data and can be seen as a link between the past and foresight techniques, or even as a part of foresight (Leitner & Pinter, 2016, p. 161). “Foresight (...) should not be confused with forecasting, though it should take into account the results of serious forecasting exercises, and such exercises may be part of a Foresight process. Forecasters often aspi-

“Its core idea is creating a logical path from a depicted future back to the present, to share, to analyze and manage strategic challenges.”

Thorén & Vendel

re for precision in an attempt to predict how the world might look at some point in the future, often using techniques like trend extrapolation, computer modelling, etc.” (Miles et al., 2016, p. 11). More specifically, forecasting as the anticipation of the future often refers to the discussion of time-series data (Karlsen & Karlsen, 2013, p. 37).

Basically, every data series that refers to specific points in time can be

described and analyzed as a **time series**: climate data like the North Atlantic Oscillation (NOA), United Kingdom beer sales, or exchange rates (Mills, 2019, p. 2 ff.). Time series analysis usually focuses on decomposing observed data into cyclic (short to midterm cycles like seasonality, midterm to long-term cycles like business cycles) and acyclic components (trends). Although often observing non-linear data classical time series analysis is based on linear modelling, nonlinearities are taken account of by technical transformations. ARMA (autoregressive moving average) and ARIMA (autoregressive integrated moving average) models are widely used for stationary and nonstationary models resp., as well as the more general ARMAX models, allowing for exogenous independent variables, or GARCH models, taking into account conditional variances (Mills, 2019, p. 31 ff. and Paoletta, 2018, p. 311). Apart from these univariate appoa-

ches, with multivariate models, ARDL (autoregressive distributed lag) e. g., “an ‘endogenous’ time series is influenced by one or more ‘exogenous’ series. The endogenous/exogenous distinction may be relaxed to allow a group of time series to all be considered endogenous. This leads to the vector autoregressive (VAR) model and the related concept of (Granger) causality.” (Mills, 2019, p. xi).

Apart from the descriptive and predictive aspect of a time series analysis, it is embedded in the context of inferential statistics, testing the model quality and model parameters, as well as yielding confidence intervals for point estimations. In this way, forecasting based on time series analysis also incorporates a component for quality and risk

assessment. Modern concepts like neural networks had until now only limited influence on time series analysis. “(...) (T)he superiority of ML (machine learning) is not apparent when it comes to forecasting. While ML algorithms have been successful (Weron, 2014) in some applications like energy forecasting (Dimoulkas, Mazidi, & Herre, 2019), where the series being extrapolated are often numerous, long, and accompanied by explanatory variables, the performance of ML algorithms in more typical time series forecasting, where the data availability is often limited and regressors are not available, tends to be below expectations (Makridakis, Spiliotis, & Assimakopoulos, 2018b).” (Smyl, 2019, p. 75). However, Smyl (2019), introduces a hybrid method of

exponential smoothing and recurrent neural networks for time series forecasting, which is only one modern approach for deep time series forecasting (Lewis, 2016). The availability of Big Data led to various new statistical and data mining techniques with applications in economics, finance, population dynamics, forensic science, energy, biomedical science, etc. (Hassani & Silva, 2015, p. 10) “Wang (...) uses Support Vector Machines as an auxiliary method, along with Neural Networks, and ‘MapReduce’ technology, for forecasting Big Data originating from China’s electricity consumption” (Hassani & Silva, 2015, p. 14). Further Big Data techniques are bibliometrics, semantic analysis and network analysis (Miles et al., 2016, p. 80 ff.).

The well-known IT giants Amazon, Microsoft, Google and IBM all offer cloud-based ML services with different functionalities, both in the form of standardized, automated or semi-automated versions and platforms for custom modeling (cf. Tab. 1). Further players in the data science as a custom service market include SAP (Leonardo) Amdocs Inc. (Smartbot), N-iX, Infogix, Inc., Analyze Corporation and InData Labs.

Forecasting models may be sophisticated, still they usually remain very sensitive in the case of changes in trends, patterns and relationships. “However, when changes are detected, or if we can know when they are about to occur, human judgment is the only viable alternative for predicting both their extent and their implications on forecasting” (Makridakis, Wheelwright, & Hyndman, 1998, p. 483), which leads to so-called ‘judgmental forecasting’. Still, the core competence of forecasts is predicting the likely near-future, based on knowledge from the past (cf. Fig. 4). In times of discon-

Table 1: Cloud Machine Learning Services Comparison

	Amazon	Microsoft	Google	IBM
	Automated and semi-automated ML services			
	Amazon ML	Microsoft Azure ML Studio	Cloud Auto ML	IBM Watson ML Model Builder
Classification	✓	✓	✓	✓
Regression	✓	✓	✓	✓
Clustering	✓	✓	✗	✗
Anomaly detection	✗	✓	✗	✗
Recommendation	✗	✓	✓	✗
Ranking	✗	✓	✗	✗
	Platforms for custom modeling			
	Amazon SageMaker	Azure ML Services	Google ML Engine	IBM Watson ML Studio
Built-in algorithms	✓	✗	✓	✓
Supported frameworks	TensorFlow, MXNet, Keras, Gluon, Pytorch, Caffe2, Chainer, Torch	TensorFlow, scikit-learn, Microsoft Cognitive Toolkit, Spark ML	TensorFlow, scikit-learn, XGBoost, Keras	TensorFlow, Spark MLlib, scikit-learn, XGBoost, PyTorch, IBM SPSS, PMML

Source: altexsoft, 2020; slightly modified representation.

Main Propositions

1. On the one hand, the data volume has never been so large and ways of analyzing it have never been so easy as today, on the other hand, systems have never been so difficult to understand (VUCA).
2. In order to deal with the resulting different futures (short, medium and long term), a well-thought-out combination of different approaches and related methods of future sciences is recommended.
3. Analyses of already existing data (e.g. of the past) provide probable scenarios for an imminent future by relying on time series analysis (often of Big Data sources) based on linear modelling and augmented by machine learning components.
4. The more uncertain and complex future prognoses become, the less it can be referenced to developments in the past and other approaches, such as, for example, Delphi Studies, Scenario Techniques, Artificial Intelligence, are needed to approach possible futures (foresight as strategic future assessments).
5. For very long-term future prognoses the development of clear visions and a corporate identity, as well as a holistic normative orientation, taking deontological, utilitarian and situational dimensions into account (normative futurology) in combination with backcasting methods, are necessary.

tinuities, black swans and wildcards, it might rather be time for foresight.

Foresight – Dealing with Uncertainty

The more uncertain and complex future prognoses become, the less it can be referenced to developments in the past and other methods, models and tools are needed to approach possible futures. The range varies from methods such as brainstorming, mind-mapping, environmental, horizon scanning (Miles et al., 2016, p. 56 ff.) and road mapping to more complex approaches such as patent analysis (Boller & Gollnhofer, 2018, p. 229 ff.; Niemann 2015, p. 87 ff.), system thinking (Saritas, 2013, p. 90 ff.), prognostic crowdsourcing or, Delphi studies and scenario techniques.

Delphi studies (nowadays commonly using real-time software) are a rather well-known approach for predicting possible futures. They are an “iterative process of data collection and analysis designed to search for consensus among the anonymous experts by means of a series of intensive questionnaires with controlled feedback.” (Kale, Ponnusamy, Sendhil, Meena, & Singh, 2017, p. 68 following Briedenhann & Wickens, 2005). Within such studies, identified relevant developments are presented to experts, the Delphi panel, who assess their relevance and justify it with qualitative statements. Developments are formulated as extreme positions in order to evoke clear rejections or assumptions on the part of the test persons and to obtain a higher degree of justification (Wittmer & Moser, 2015, p. 3). In a next step, experts are confronted with the judgements of other participating experts. Both the projections and the evaluated probabilities

must be viewed critically. On the one hand, the opinions given are snapshots, on the other hand, even experts cannot fully integrate all intervening aspects. The diversity among the experts counteracts this lack. Furthermore, the probability estimates given are not necessarily of primary relevance, but rather the comments and structured debate of the experts with the focus on the future (Wittmer & Moser, 2015, p. 4).

“Although strategic planning methods exist and planning processes are technologically supported, it is difficult to make predictions about the future.”

Menck, Weidig & Aurich

The iteration allows the experts to rethink their positions based on the views and comments of other experts participating (Kale et al., 2017, p. 70). Delphi studies are often referred to as a main tool for foresight intelligence (Miles et al., 2016, p. 95).

The **Scenario Technique**, as a strategic corporate planning method used in various application areas, helps to create multiple future development paths. It offers the possibility to identify and foresee drivers of change (Menck et al., 2013, p. 133 f.). The accompanying foresight process, a so-called ‘explanatory approach’ (Miles et al., 2016, p. 128), consists of the phases of: scenario preparation (setting objectives, decision fields and scenario fields); scenario field analysis (division

of decision field into subsystems, development of key factors); scenario prognostic (formulation of current state of key factors and validation of future projections per factor); scenario development (consistency proof of future projections and development of scenarios) and scenario transfer (interference of scenarios with decision fields, derivation of strategies) (Gausemeier, Fink, & Schalke, 1996, p. 125 ff. and Menck et al., 2013, p. 135 f.). In this context, not only one potential development path but multiple possible future visions are created. Based on these, estimations are developed (Menck et al., 2013, p. 135) and critically assessed by using, for example, cost-benefit or multi-criteria analysis, prioritized and road-mapped (Miles et al., 2016, p. 206 ff.).

In this context, an increasing automatization of foresights, by means of so-called ‘intelligent decision support machines’, can be observed. These machines are computer-based interactive tools that use decision-theoretic models (consisting of the elements of alternative prospects, state descriptions, relationships and preferences) under uncertainty and machine learning (**artificial intelligence**) with access to structured data bases (Gottinger, 2018, p. 10 ff.). They provide a move towards a ‘machine economicus’ (Parkes & Wellman, 2015, p. 267 ff.).

In addition to these descriptive and method-based components, Corporate Foresight has a normative component too (Leitner & Pinter, 2016, p. 158), that focuses on the identity of the company and its culture and will be treated separately in the following paragraph.

Identity of the Company Determines Futures

Unlike others, the method of **backcasting**, or **retrospection**, (Thorén &

Vendel, 2019, p. 299) first tries to envision a desired future in order to formulate backward-induced steps that have to be taken to achieve the formulated future stage (Robinson, 1982, p. 337 ff.). So, it is an explicit normative approach (Robinson, 1990, p. 820 ff.).

“However, when changes are detected, or if we can know when they are about to occur, human judgment is the only viable alternative for predicting both their extent and their implications on forecasting.”

Makridakis, Wheelwright & Hyndman

“Its core idea is creating a logical path from a depicted future back to the present, to share, to analyze and manage strategic challenges.” (Thorén & Vendel, 2019, p. 298). The vision of the future is worked out in detail regarding relevant aspects describing a desirable stage and, semantically, a state of being. So, the method sets boundaries and constraints in the development of the upcoming time. When a choice has to be made, alternatives are analyzed as to whether they fit into a desirable development, or not. It could be stated that the modelling process is more important than the result (Bagheri & Hjorth, 2007, 83 ff.). The process starts with a strategic problem definition; the development of a future vision; backcasting analysis; the elaboration of a future alternative; the definition of a follow-up agenda; the embedment of the results and an agenda to stimulate follow-up (Quist, Thissen, & Vergragt, 2011, p. 883 ff.). The non-prophesying approach is used for long-term futures and complex challenges and encompasses a wide field of con-

siderations (Robinson, 2003, p. 839 ff.) relying on a multi-systemic concept (cf. Kajikawa, 2008, p. 215 ff.). Moreover, it can involve stakeholders or panels (Miles et al., 2016, p. 49 ff.) in the model-building process (Bagheri & Hjorth, 2007, 83 ff.), which

draws parallels to Delphi studies. A set of possible, but desired different scenarios helps to deal with uncertainty (Quist & Vergrat, 2006, p. 1027 ff. and Thorén & Vendel, 2019, p. 298). The decision-making principles are quite easy to understand, but the concept is definitely not easy to realize in practice.

The starting point of the process is a clear vision that is strongly connected with the identity of the company, setting a clear frame of reference that has normative, strategic and operative implications (Bieger, 2015, p. 33 ff.). On the level of **normative management**, it is, therefore, primarily a matter of giving and conveying meaning, of general goals, principles and the company’s game rules. These are intended to ensure the development and viability of the enterprise system by permanently adapting it to changing context conditions (Ivancic & Huber, 2018, p. 144) and customer, respectively stakeholder, requirements and thus aligning it to a desirable future. A holistic, normative orientation of the enterprise towards the realization of a

vision requires perception and the intended design of deontological, utilitarian and situational dimensions (Schüz, 1999, p. 174 ff.).

A deontological sphere stresses orientation towards the demands of the target, whereby standards, norms, philosophy, visions and missions become central (Schüz, 1999, p. 177 ff.). In this way, orientation, support and a guiding line are conveyed to the inside, identity is strengthened, and a corridor of corporate development is demarcated to the outside, image is built up and stakeholder relationships are stabilized (Ivancic & Huber, 2018, p. 145). Thus, a kind of purpose management institutionalizes the self-obligation of the company and fundamentally aligns behavior and stakeholder relations on the basis of fundamental values and ideas. The structure of formulations of

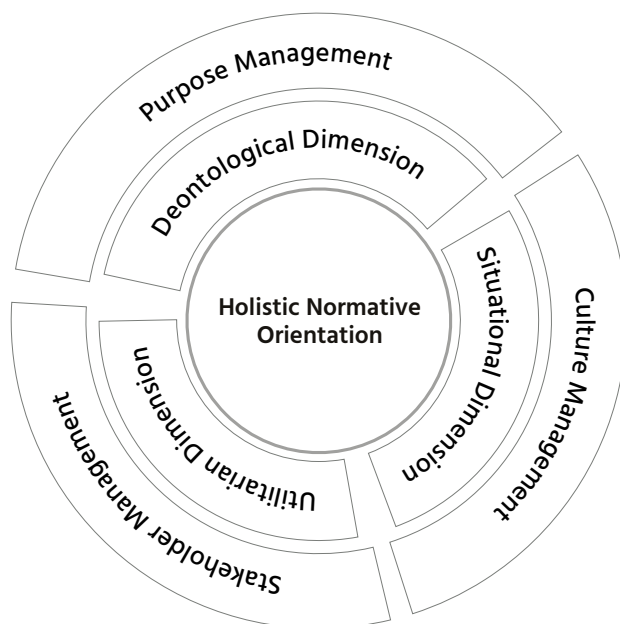
meaning, visions, missions and goals, as a kind of living document that is constantly evolving, sets the path for long-term developments (Ivancic & Huber, 2018, p. 148).

An utilitarian dimension deals with the consequences of actions from an ecological, social, economic, technological and cultural point of view, which must be broken down into individual stakeholder groups in order to map a totality of potential interactions, repercussions and distant effects (Ivancic & Huber, 2018, p. 145). This requires, among other things, the already discussed methods of foresight and forecasting. A prudent stakeholder management, which also takes into account inhuman demands, such as the environment and technology, focusing on a sustainable future (van Leeuwen, Nijkamp, Akgün, & Gheasi, 2013, p.

238 ff.), consists of the following steps: stakeholder exploration; stakeholder relationship analysis; stakeholder interest management and stakeholder integration management. In this way, it ensures a comprehensive balance of diverging interests while observing a quadruple-bottom line of responsible development, i.e. the consideration of ecological, social, technical and economic interests (Ivancic & Huber, 2018, 148 f.).

All these processes take place under situational conditions within, and outside, the complex and dynamic system of the enterprise (Ivancic & Huber, 2018, p. 146), whereby structure and behavior (Giddens, 1984), supplemented by a cultural dimension (Ivancic & Camozzi, 2016, p. 19 ff.) function as the basic tonality of interaction with stakeholder groups. The culture of the enterprise refers to a kind of behavioral dimension of normative management (Bleicher, 1994, p. 487) and can be described as a 'lived structure of convictions' that finds expression in a wide variety of rituals, symbols and actions. An appropriate, sustainable culture understands mistakes as an opportunity for improvement and learning (Hengstschläger & Strugl, 2015, p. 70) and is characterized by openness (Wiener, 2018, p. 3 ff. and 132 ff.). Cultural changes are not directly controllable but can be fostered through the dualism of structures and behavior, as well as context management of design elements (Rieckmann, 2005, p. 74 ff.) and feedback mechanisms. In addition, appropriate recruiting and human resources management are of crucial importance (Ivancic, 2019, p. 22 ff.), taking into account a mixture of a variety of talents (Hengstschläger, 2018). Essentially, the focus is on a future-oriented design of the triad of structure, culture and behavior (Ivancic & Camozzi, 2016, p. 19 ff.).

Fig. 3: Holistic Normative Orientation



Source: Ivancic/Huber 2018, p. 147; slightly modified representation.

Accordingly, the question arises as to whether “(t)he best way to predict the future is to invent it (?)” (Alan Kay cit. after Hengstschläger & Strugl, 2015, p. 94).

Application and Conclusion

Managers must know “how to solve their information acquisition problem under specific uncertainty” (Makadok & Barney, 2001 cited after Moser, Kuklinski, & Srivastava, 2017, p. 235) and how to shape the future. Therefore,

“(T)he best way
to predict the future
is to invent it.”

Alan Kay

a combination of different methods of visioning, foresighting, as well as forecasting, is highly recommended. It should be attempted to merge these wings of possibilities of predicting the future into one system. This integration is often referred to as modelling using qualitative modelling approaches, such as, for example, gaming, system mapping, relevance trees and morphological analysis, cross-impact analysis or quantitative ones, such as computer simulations, limits to growth and global models (Miles et al., 2016, p. 169 ff.), or even combinations of them (Lüdeke, 2013, p. 62 ff.). In this way it would be possible to create a balance of sensing the future, thinking the future and shaping the future (Hengstschläger & Strugl, 2015, p. 2 f.).

The global, Swiss company Bühler, which is busy in the fields of technologies covering needs for food, mobility and more, is an example of this, in that it has given itself the vision:

“Innovation for a better world”. Consequently, they strive for building up a sustainable value chain by reducing waste and energy consumption to 50% and aligning their business to the UN’s 17 Sustainable Development Goals by focusing on seven of them. Therefore, eight global challenges are formulated into business opportunities. All organizational units have to align with the vision and challenges, by backcasting their implications into today’s situations. A small-sized Swiss company based on a strong vision is the vegetarian restaurant tibits. Because of their idea developing a vegetarian fast food restaurant based on pleasure and freshness, seasonality and environment as well as organic products and quality the founders won a business plan competition organized by McKinsey and ETH Zurich. From their recruiting, human resources management, purchasing, marketing and selling, everything is adjusted to these values forming a corridor of intended development, that is based on the strong believe of a more socially, environmentally and economically balanced future.

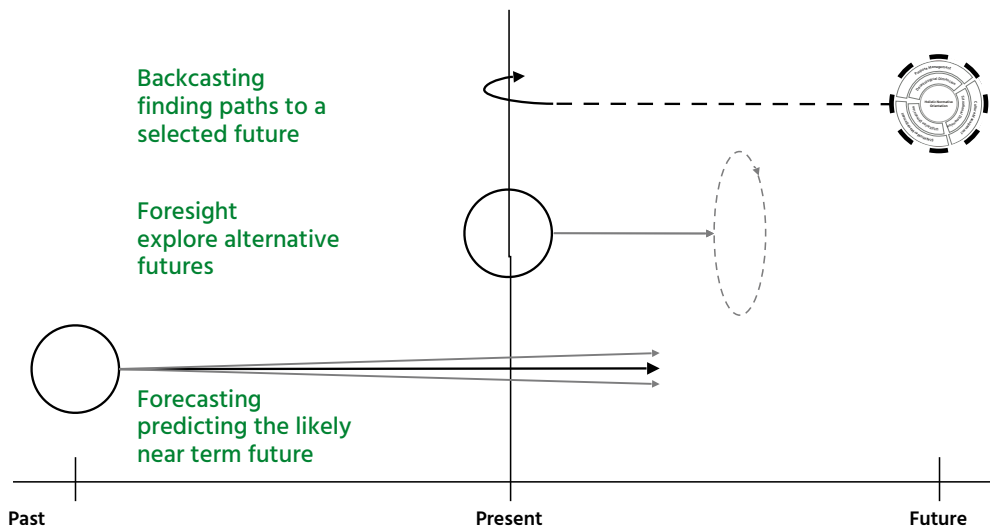
The basic principles of developing a reasonable vision and normatively aligning the company with it, is something every company can implement with the necessary will.

BASF, one of the world’s leading chemical companies, maintains a central unit for futurology called Strategic Planning & Controlling. This division emerged from the market research department in the 1990s and is responsible for what is known as ‘futuring’. In addition to a set of methods, the company uses scenario techniques and

Delphi studies for strategic development, promoting a strategic dialogue involving a broad range of people. Depending on the subject area, the planning horizon, taking a broad range of relevant developments into considerations, is 10 to 15 years (Müller & Müller-Stewens, 2009, p. 103 ff.). As part of a student consulting project with the University of Applied Sciences St. Gallen, Auto AG Truck former Nater AG Nutzfahrzeuge conducted a real-time Delphi Study to test the acceptance of an online platform for the purchase and maintenance of commercial vehicle fleets. A planned implementation of a cyclical execution of such a study was interrupted by the successful sale of the business and withgoing challenges but is part of future discussions.

Scenario Techniques and Delphi Studies can be carried out by companies of any size in regular cycles. A broad and thought-out selection of stakeholder groups must be included in the process.

The retailer Amazon offers a tool called ‘Amazon Forecast’, which is based on the same technology used at Amazon.com. It works with any historical time series data and can be used to forecast business data such as retail product demand (e.g. products selling on a website), supply chain demand, resource requirements (e.g. energy needed), operational metrics (e.g. IoT sensor usage) or business metrics (e.g. cash flow, sales). Amazon Forecast provides a set of forecasting algorithms, from classical ARIMA and Exponential Smoothing to so called DeepAR+, which is a supervised learning algorithm using recurrent neural networks

Fig. 4: Possibilities of Prognosing the Future

Source: DOM Research 2011 cit. after Hengstschläger/Strugl 2015, p. 95 and Thorén/Vendel 2019, p. 300; modified and extended representation.

in a multivariate approach to train a single model jointly over a number of different time series (Amazon Web Services, 2019, p. 54). Prognosix AG is a Swiss-based start-up, which was developed from a collaboration between a University of Applied Sciences (ZHAW) and the business community (Migros and others). By integrating an ML component into the planning cycle, it has been possible to significantly reduce the forecast error, which is associated with an EBIT potential of up to 5% (Kauf, 2018, p. 16 ff.).

Classical and ML-based forecasting techniques are increasingly offered by companies of different sizes and are gradually penetrating all areas of economic reality. Therefore companies of any sizes can relatively easily find a customized and fitting solution.

Concluding, it can be said that a combination of all three approaches increases the probability of being able to act successfully in the future. "Useful foresight tools are challenging tools, decision-making tools, aligning tools, learning tools and the ability (sic!) to combine these management tools in the practices of corporate foresight and management systems." (Kaivo-oja & Lauraeus, 2018, p. 27).

Within this futurology system, artificial intelligence will directly support management decisions by permanently analyzing customer relationships and prognosing their development (Gentsch, 2019). For example, neural networks have already established themselves in fields of real-time data mining (Nitsche, 2016, p. 18 f.) and accordingly, analysis by machine learning algorithms (Gentner, Stelzer, Ramosaj, & Brecht, 2018, p. 5 ff.). Automating forecasting and foresight frees up resources that can be put to


good use in the areas of visioning, identifying and backcasting, strengthening the organizational attention that relies on organizational slack (Schoemaker, 2018, p. 7 ff.).

"(T)he future depends on what you do today."

Mahatma Gandhi

Alongside a focused vision, the development of a peripheral one that helps to recognize unsuspected developments is beneficial too (Schoemaker, 2018, p. 3 and Day & Schoemaker, 2004, p. 117 ff.). Otherness of the employees, the integration of lateral thinkers and rule breakers as well as individuality and flexibility, promote success and, paradoxically, ensure the stability and security of the system

(Hengstschläger & Strugl, 2015, p. 71). In other words, flexicurity (Adriaansens s.a.) – a combination of flexibility and security – and a sophisticated knowledge management (Bootz, Durance, & Monti, 2019, p. 80 ff.) are needed within organizations.

Therefore, responsible leadership, a combination of transformational, servant and authentic leadership is needed (Sarkar, 2016, p. 10). This is also of outstanding relevance due to the role of top management in designing corporate culture (Wiener, 2018, p. 87 f.). “The main focus of responsible leadership is a leader’s exchange with followers, team, organization and society at large” (Sarkar, 2016, p. 11), and the focus of leading a company into the direction of a desired and sustainable future because, “(t)he future depends on what you do today” (Mahatma Gandhi). 

Lessons Learned

In order to remain fit for the future, a company faces the challenges of shaping the triad of structure, culture and behavior accordingly, based on a clear vision and responsible stakeholder management considering both, inhuman demands and a quadruple-bottom line of sustainable development (ecological, social, technical and economical). In addition, regular cycles of foresight based on professional methods and permanent forecasting must be implemented, with learning machines and artificial intelligence increasingly being used for forecasting tasks.

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