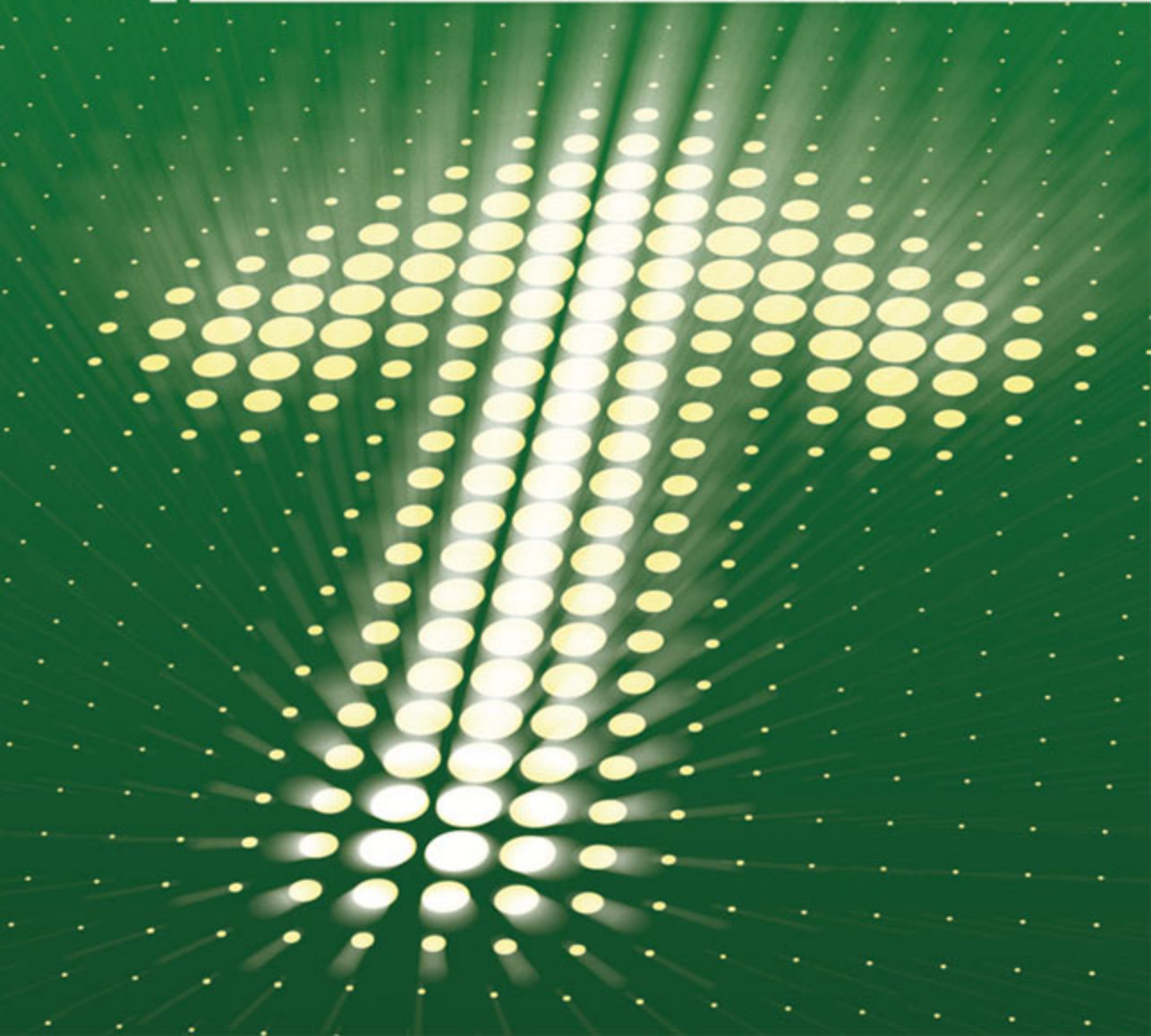Ulf Pillkahn

Using Trends and Scenarios as Tools for Strategy Development

Shaping the Future of Your Enterprise

SIEMENS

Ulf Pillkahn   Using Trends and Scenarios
as Tools for Strategy Development

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Using Trends and Scenarios as Tools for Strategy Development

Shaping the Future of Your Enterprise

by Ulf Pillkahn

The Future is Partly Made of Clay

Globalization, fierce competition, and the growing complexity of products, technologies and processes of change have become all-pervasive. They force us to think ahead to the medium and long term while we simultaneously concentrate on our day-to-day business activities. This task demands an ever greater degree of flexibility and adaptability on the part of managers at enterprises throughout the world.

Niels Bohr, the recipient of the Nobel Prize for Physics in the year 1922, once quipped, "Prediction is hard, especially if it's about the future." Indeed, we are not in a position to make precise predictions about future events, let alone plan these events. This, however, does not free us from the task of considering the future.

Considering the future is largely a matter of understanding the present and the past. Strangely enough, we live in a time of too much information and too little information. This predicament arises from the fact that growing complexity virtually bars us from fully comprehending our environment and all of the emerging changes. In light of these limitations, individuals and teams of individuals face a more demanding task when it comes to converting ideas into true innovations and viable market solutions. This task requires effective decision-making support.

The development of many innovations today is not only determined by what is technologically feasible, but by what creates the greatest benefits for the consumer, what is economically feasible, and what appears to be acceptable in societal terms. Despite this, science and technology remain the strongest drivers of progress and wealth in the modern world. Scientific discoveries and new technological developments, i.e. innovations, have an impact on our lives and change our behavior. Innovations arise from knowledge. Ikujiro Nonaka confirms this suggestion, "Successful companies are those that consistently create new knowledge, disseminate it widely throughout the organization, and quickly embody it in new technologies and products." Knowledge has become the most important raw material of our time: knowledge about technologies, knowledge about markets and consumers, knowledge about the complex relationships among the variables in our environment, and knowledge about relevant future trends.

It has become indispensable for enterprises today to have the means of detecting trends – which may signal risks or opportunities – at an early stage and to use this knowledge for strategic purposes. This book makes a valuable contribution in this regard by offering a systematic account of how one can create "pictures of the future." Such pictures offer various coherent views of the future – the future of individual markets, technologies, and other segments of society. While there is naturally no guarantee that what is depicted in the pictures (scenarios) will actually occur in the future, they nonetheless offer a basis for playing an intelligent and more active role

in developments – not least when it comes to communicating with one's internal and external partners.

While it is obviously not possible (or even desirable) to precisely plan the future, it is equally obvious that the future does not simply happen. Partly made of clay, the future is shapeable – and that is what matters. Enterprises have considerable responsibility in the shaping of the future. This book will be a companion to all decision makers who have a share of this responsibility and will help them to systematically detect opportunities in the future. Visions, perspectives, fantasies, and curiosity are matter of inspiration. Given that curiosity about the future is in all of us, this book should be of interest not only to researchers, strategic planners and innovators.

I wish all the readers of this book an enjoyable read – and much success in giving shape to their own ideas.

Prof. Dr. Claus Weyrich

Former member of the Management Board
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Introduction

A typical scene at the supermarket: three of eight cash registers are open. Around five people are waiting in each line to pay for their groceries. You want to avoid having to wait, so you select the line that you hope will be the fastest. Experience shows, however, that you will probably not be in the fastest line. People sometimes forget to weigh their fruit, price tags get lost and the rolls in the register have to be changed. You are often forced to wait longer than you had hoped and experience it as a nuisance – for one because of the delay and for another because you didn't pick the other line, the one that is so much faster.

In the world of business, the consequences of waiting too long are far more dramatic for customers, enterprises and employees, and the circumstances themselves are far more complicated.

It is a matter of the future. When facing the need to make a decision, who hasn't already desired to know exactly how the future will develop. This book cannot help you to make exact predictions about the future, but it can help you to deal with uncertainty.

In recent years, we have seen the following developments:

- Trends used as instruments

- Trend research and trend management

These are always used in the hopes of improving one's ability to detect future events and to thereby make uncertainty more manageable.

"But what exactly is a trend?"

For me, everything began with this question. Around three years ago there was a point at which it occurred to me that the use of the term "trend" had become inflationary. Everything was a trend, or related to a trend. The mystique of the "trend" seems to come from the fact that the things that are labeled such do not thereby become more comprehensible. On the contrary, they become more nebulous. My hunch back then was that the excessive use of the word actually came from the fact that most people didn't really want to concern themselves more closely with what was being referred to. Complex situations were reduced to "trends" and appeared therefore to have been explained. But it is precisely this hope for simplicity that is deceptive.

In the 1990s, we were informed, "The trend is going towards home offices." In the 1980s, we heard, "The trend is going towards the paperless office." Once a subject has been labeled a trend and blown up by the media, it takes on a life of its own and has to be reckoned with by nearly everyone. Added to this is the fact that the labeling of

certain phenomena as "trends" is often rather plausible. They quickly find their proponents and market criers and appear in *Time*, *Newsweek* and *People*.

"The trend is going towards ..." Such statements tell us the direction of a development, and include a claim about what will happen in the future. In short, such statements cross a metaphysical barrier. Clarity as to whether what is claimed is a supposition, a belief or a fact can only be established by a careful investigation. But who goes to such lengths? One assumes that the messengers (the trend scouts) have done careful work and know what they're talking about. And evidence to the contrary is also not always apparent.

The paperless office was a vision – drafted by technicians and formulated by theoreticians – or it was exactly a trend, depending on the source. Home offices – even when outfitted with modern office equipment – cannot replace the conventional workplace. We know that today. Although it was no more than a temporary appearance in the wake of the Internet boom (home and office workplaces are actually complementary), it was hyped into a trend that ultimately fizzled.

The examples offer a view of the gray zone one enters into as soon as one examines trends more carefully. One is faced with claims, conjecture, suspicions, wishes, conviction, and the search for security and orientation. Trends turn complex phenomena into something that looks simple. The wish to reduce the world to trends is understandable, but it is no replacement for knowledge.

The inspiration for this book was a desire for greater clarity in the trend fog. Linguistic precision and clear analysis are important prerequisites when it comes to an examination of the future. The same applies to scenarios. The referential scope of the term "scenario" is broad, ranging from A as in "assumption" to I as in "idea" to P as in "picture of the future."

The day-to-day business of enterprises is fraught with problems, and we are confronted by new challenges every day. As shown in Figure 1, we can use a matrix to represent the problems and possible solutions as known and unknown realms of possibility.

Solutions may already be available for known problems. These are then applied (below left) or a search is conducted for yet unknown solutions (upper left). For instance, when a customer complains about a service, the problem is clear – it is only the solution that is missing. The further development of technologies also belongs in this category: the problem is known and a search is conducted for the solution to it.

The situation is far more difficult when a problem remains undetected or cannot be represented or demarcated (below right). This situation occurs when new physical effects or technologies are discovered. The potential wrapped up in laser technology, for instance, was only realized gradually. In the beginning, there was a solution – but no problem (the push effect of technology). The search for applications essentially is a matter of searching for and detecting possibilities of improvement.

The area in the upper right corner of the matrix is reserved for "problem unknown/ solution unknown." This area is essentially characterized by uncertainty. Traditional
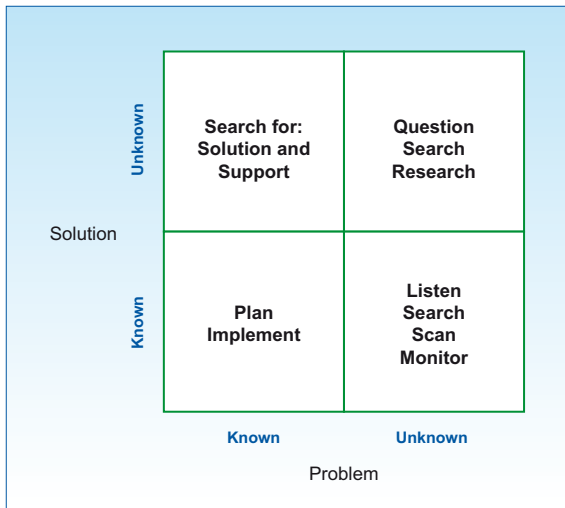
Figure 1 The problem-solution matrix: what one should do given various constellations

approaches to solving problems fail here because there is no known and clearly demarcatable problem. We do not yet know what the problems of tomorrow will be. No one would have hit upon the problem of global warming one hundred years ago. It is clear that the approaches and answers of today and yesterday do not present a solution.

We can only approach these types of problems and solutions relating to the future playfully. Clear answers will remain exceptions. In the beginning, there will be questions. One will approach the problem and its solution, although without ever really reaching them, via research, establishing hypotheses, and trial and error.

Dealing with uncertainty is something new for many enterprises. These enterprises have to first learn that it is no longer possible to contain uncertainty and to keep everything entirely under control. Ignoring such factors or sticking one's head in the sand is also a kind of solution, but it is a high-risk solution given the nature of competition. If, on the other hand, one accepts the fact that the future is uncertain and shows a willingness to cope with it, then there will be plenty of room to maneuver. In the present book, I am concerned to present ways of understanding uncertainty, broadening and sharpening our view of the future and learning to deal with uncertainty.

The future and investigations of the future are multifaceted. Chapter 1 of this book is devoted to an assessment of the current situation, a sketch of the use of trends and scenarios, and the provision of a thematic framework for the subsequent chapters.

Chapter 2 is concerned with an observation of the events taking place in the environment: What do we observe? What information is important for the enterprise? How do we manage this information?

Chapter 3 is concerned with the ways in which we analyze information. This discussion provides a basis for the subject of Chapter 4 – namely, looking into the future.

The strategic consequences of scenarios are treated in Chapter 5 and Chapter 6 offers a number of approaches to implementing the lessons learned in one's own enterprise.

This ideal sequence – from the gathering of information to informed decision making and execution – is shown in Figure 2. The application of this sequence is then illustrated in Chapter 7 with the use of a concrete example.
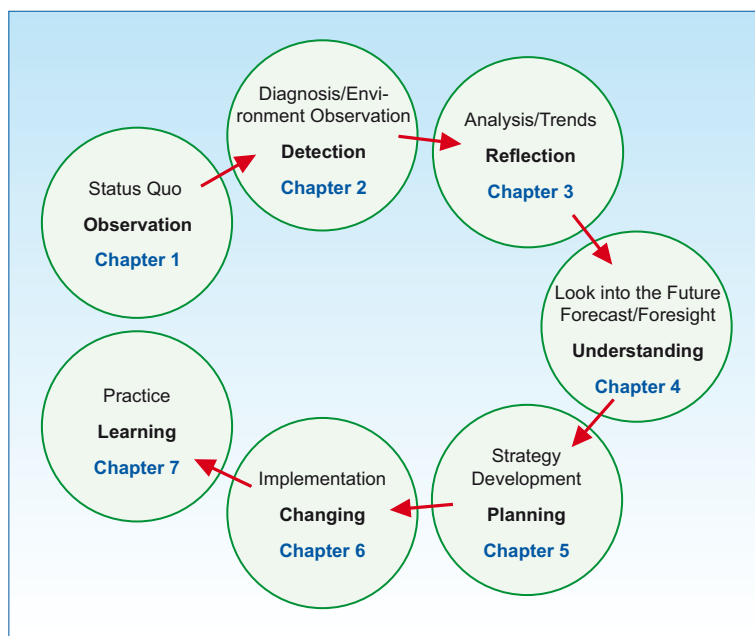
Figure 2   **The structure of the book: the ideal way to develop and use scenarios**

Figure 3 offers a guide from the perspective of strategic management for navigating one's way through the book.
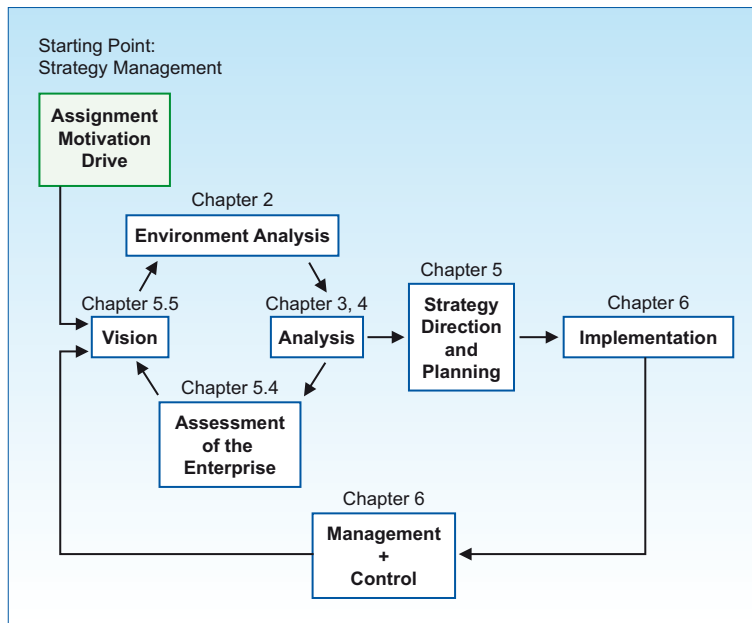
Figure 3 Flowchart: the real sequence for developing and using scenarios

Chapter 1

Venturing a Look into the Future

Moving from the Past into the Future via the Present
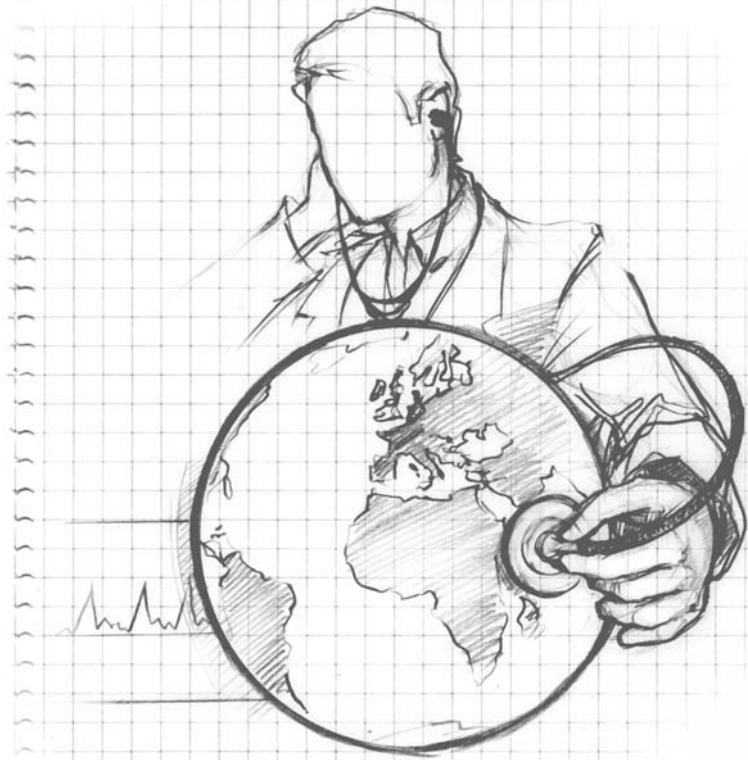
There once was a very ambitious city mayor who wanted nothing so desperately as to know how his city would develop in the future. A number of major projects had been planned, elections were coming up, and the city and its inhabitants were simply not flourishing as he had hoped.

No longer able to contain his curiosity, the mayor sends for old man, a wanderer of sorts, who was known throughout the land for his ability to see into the future. When summoned by the mayor, the clairvoyant says that he can indeed offer a very clear and, if need be, detailed description of the city's development for the next 25 years, but that his special service would cost a considerable sum of money. Now, although the mayor is a man of unmistakably rational persuasion, there is something about the clairvoyant's demeanor that he finds truly captivating, and he agrees to have the future of the city told – despite the steep cost.

The clairvoyant begins his account as follows, "The city will develop magnificently in the coming years. The investments will pay off handsomely, new enterprises will spring up, and talented and hardworking people will come to the city from far and wide to take part in and help to further expand its prosperity. With its generous funding, the city college in particular will become prominent. And the mayor will be reelected."

The mayor beams. For this is exactly what he wanted to hear. He is content and congratulates himself for having consulted the clairvoyant. The pending decisions were to be made exactly as he had planned.

But as the clairvoyant continues with his account, the mayor's ecstatic vision becomes clouded, "A global crisis will be upon us in nine years, triggered by speculation on the stock market. Your city, too, dear mayor, will be hit rather forcefully. The rate of inflation will skyrocket and many companies will not survive the crisis. Unemployment will increase dramatically, and with it a certain misery will prevail in the city."

The mayor stops short. This was not what he had in mind.

"After a few years, the situation will more or less return to normal. The city, too, will gradually recover and return to its former prosperity."

The mayor is instantly relieved, but before he has a chance to gain his bearings, the clairvoyant continues his tale, "The 13th year is the year of grave political change, and you will be powerless to do anything about it. A dictatorship will emerge at the highest level of the republic whose proponents will have no qualms about achieving their political ends by force. Despite the constraints of the political order, however, material development in the city will remain good. The mayor, however, will be forced to step down."

The mayor is devastated – and then it gets even worse.

1 Venturing a Look into the Future

"In the 19th year, all semblance of political life will have vanished, replaced by the iron rigidity of military rule. All of the city's resources are channeled into the arming of the country. And at the end of the year, the military regime will thrust the country into a war."

The mayor turns pale.

"The war lasts for a harrowing 6 long years. At its end – in the 25th year – your city will be destroyed in an aerial bombing."

Was it really such a good idea to let his curiosity about the future get the better of him? The mayor is no longer sure. He takes a seat and begins to brood. What should he do? What should he tell the others at city hall? Will they even believe him? Is the clairvoyant's tale a "true" vision of the future?

After a time, the mayor rose of a sudden and summarily dismissed the clairvoyant. He had resolved not to say a word about the unusual encounter.

The story of the curious mayor and the clairvoyant is, of course, not without a historical parallel. The mayor's city might have been the German city of Dresden in the year 1920, which has been bombed and destroyed during World War II.

This thought-provoking anecdote, drawn from a presentation by Arie de Geus [Burmeister 2004], raises a host of questions that will be the focus of my attention throughout the book. One such question is: How much sense does it make to concern ourselves with the future when it is clear that things will occur over which we have no control, and that precisely these things will have a profound impact on society. In the present chapter, I address this and other questions as I seek to establish a point from which to embark. After all, attempts to study the future are largely a matter of dealing with a lack of clarity, half-truths, facts, models, opinion, prospects and a lot of emotion. It will be helpful to establish a set of assumptions, a foundation, as it were, for the remaining chapters.

1.1 Reflections on the Future

Imagine that you could look into the future. What information would you find especially interesting and what would you do with this information?

The Motivation for Considering the Future

While curiosity, anxiety and uncertainty provide an obvious incentive for considering the future, there is also a desire to use the information available for purposes of more informed action, in particular, to use the information to gain strategic and tactical advantages – as well as personal advantages. The exact motivation behind our interest in acquiring knowledge about the future is likely to vary from person to person, with the spectrum ranging from caution or a protective instinct to a consideration of advantages such as power, wealth, influence and fame.

From time immemorial, human beings have been fascinated by the notion of looking into the future – probably because such a capacity would allow them to use information about the future to inform their decisions today, and thereby establish certain advantages, whatever these advantages might be:

- The interest of a scientist might be focused primarily on the question *how*?

- The interest of a philosopher might be focused on changes in accepted notions of consciousness, being and truth.

- The interest of a politician might be focused on constellations of political power.

- The interest of private individuals is likely to focus on their own well-being.

- The interest of an environmentalist might be focused on the state of various ecosystems and that of the environment in general.

- The interest of an economist might be focused on overall economic development, expressed in terms of buying power, consumer behavior, wealth, GDP, currency stability and the state of the world's stock markets, etc.

- The interest of a company executive is likely to focus on the well-being of the enterprise, i.e. its market positioning and capacity to outperform its competitors.

While the perspective in this book is largely that of a company executive, the methods outlined could just as well be applied to societal issues. Questions about how one should respond to change and which methods are the most promising form the focal point of the discussions in this book. To begin, we might ask ourselves what motivates entrepreneurs and company executives to consider the future.

Successful enterprises tend to want to build upon their success. They are on the uptake for investment opportunities promising the greatest returns at the lowest risk. Less successful enterprises place their hopes in positive market developments and are oriented towards short-term success.

Given that enterprises are not self-sufficient and are not only exposed to micro and macroeconomic developments, an interdisciplinary point of view will prove to be essential when it comes to answering these questions. Changes occur in all areas of an enterprise's environment, and this makes it necessary to broaden one's perspective.

One can observe of late that the acceptance of the discipline of future studies is closely correlated to economic development. This is why our interest in examining the future fluctuates – ranging from the implementation of a scaled-down strategic planning to the implementation of a broad based and long-term program of "corporate foresight."

In the last few years, future studies have enjoyed a kind of renaissance. This can be seen in increased budgets for strategic consultation and an increased interest in the notion of foresight. As a development, it can probably be traced to an increased uncertainty in the corporate world. The term "foresight" refers to any attempt to

establish a long-term orientation. In the corporate world, one speaks of "corporate foresight."

The Past of Future Studies

A concern with the future and an interest in predicting future events was common in ancient civilizations. Such supernatural powers were attributed to druids and shamans. The carcasses of animals and other natural occurrences were analyzed to arrive at a reading of the future. Well-known instruments for generating predictions – back then and now – include the crystal ball and the stars and other heavenly bodies. Many personal decisions and even decisions made at a political and societal level are based on superstition and prophesy, despite their utter lack of a scientific foundation. But however dubious the methodology, the advantage of such decision-making aids lies in the momentum they generate. Predictions – even if they are misguided – ensure some sort of response, and thereby allow us to overcome an intolerable state of merely waiting and wondering.
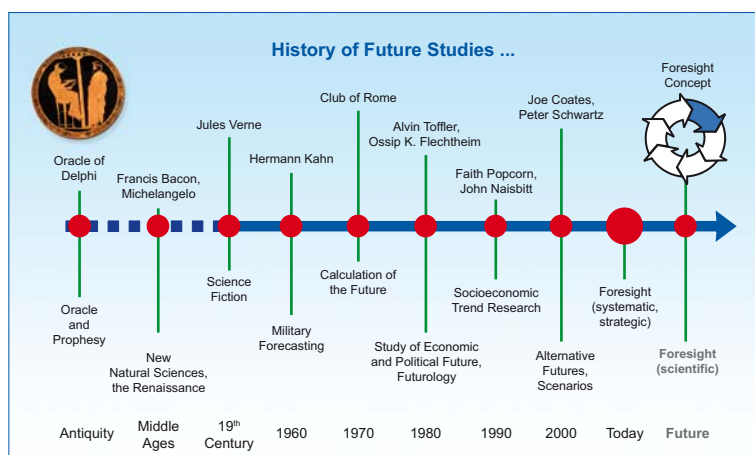
Figure 4 **From oracles to future studies**

Random action was supplemented in antiquity by an examination of concrete evidence and an evaluation of information. The history of Delphi can be traced back to well before 2000 BC. The fact that Apollo spoke through the Pythia – a priestess – and not through a priest at Delphi goes back to the ancient cult of Gaia. The Pythia sat on a tripod over a chasm. According to the myth, vapors arose from out of this chasm and put the Pythia in a trance. Although it has been handed down that the oracle answered correctly when asked by King Croesus what he was doing at the moment – namely, cooking lamb and turtle – one has to suspect that the oracle worked with spies. Nonetheless, the oracle in ancient Greece had tremendous significance for a period of more than a thousand years [Orrell 2007]. Politics was at work here – and kingdoms could be made to fall apart on account of an oracle.

Historical records indicate that the two expressions "Know thyself" and "Nothing in excess" were inscribed near the entrance to the ancient temple of Apollo at Delphi. The first, and more well-known of the two sayings, is particularly indicative of the actual intent of the cult (i.e. the deity that was the object of worship), namely, the resolution of problems and questions via an examination of one's inner self. Knowledge of the inner self thus served as the key to solving problems in the outer world. This approach has retained its validity to the present day – as we will see in the chapters to come.

The first attempts to take a systematic approach to studying the future go back to 1946 when the Stanford Research Institute (SRI) began to develop forecasts. The RAND Corporation and Hermann Kahn, who developed the scenario method, followed in 1948. These investigations, whose focus at the time was military-strategic planning, were later developed by the Royal Dutch Shell Corporation into a formalized method of supporting its corporate strategies.

The Club of Rome was founded in 1968. This non-commercial organization concerns itself with global development and gained much attention in 1970s when it published its *Limits to Growth* report, a book whose scope extends to the year 2100 and whose main tenet is that current rates of technical development, progress and resource consumption cannot be maintained indefinitely. The report's proponents viewed it as an argument in favor of initiating a quest for sustainable growth. Critics accused the Club of undue pessimism. However, the dominant view at the time (i.e. a belief in linear societal development) is questionable and the predictions derived from it have proven – particularly in the case of population development – to be false. Nonetheless, the note of social criticism contained in this projection warrants special recognition. Moreover, this brief look at the past and the comparison between projected and actual development also show how important such scenarios were in our examination of societal development.

The so-called trend researchers appeared on the scene later (in the 1990s) when societal development came to be regarded as rather uncertain or non-linear.

Futurists and Trend Forecasters

The need for reliable predictions is extremely high. Pressure to generate growth and unrealistic expectations make the situation even more difficult for enterprises, and tend to have an impact on risk behavior. Individuals and institutes whose work is devoted to future studies and trend forecasting promise to help.

With his book *Megatrends*, John Naisbitt [Naisbitt 1982] heralded a new epoch. Guidelines like, "It's a tremendous strength not having to be right" marked the beginning of a less absolute and much more flexible view of the future. While Naisbitt focuses on political and societal developments, Faith Popcorn [Popcorn 1991, 1996] devotes her attention exclusively to the customer and generates trends in the area of marketing. Cocooning, clicking and evalution (eva-lution – the new power of the feminine) are examples of the models she introduced. Whether it is really a matter of trends or, as in the case of cocooning, a creative re-labeling of something much more commonplace ("my home is my castle") is an open question. The fact is: Popcorn

ranks as the highest paid trend forecaster in the United States and she has left her imprint, with her theories and predictions, on the marketing departments of many corporations.

A further exponent of trend research is Gerald Celente who founded the Trends Research Institute in 1980 and gained a degree of recognition for his book *Trends 2000* [Celeste 1997]. In the book, he introduces what he refers to as the Globalnomic® Method – a term that is left rather loosely defined – and claims, "Our trends and our forecasts are based upon a synthesis of all the available information. The secret lies in putting together the relevant evidence and coming up with the correct big picture." While the Trends Research Institute regards itself as "the world leader in trend forecasting," one cannot help but wonder what synthesis is at work when one reads a few pages later in the book that China is likely to collapse in the year 2000 with "a billion people and millions of problems spilling over her borders – with none of her neighbors strong enough to stop her, especially Russia."

The question indeed arises as to the legitimacy of the methodology and whether trend researchers are really in a position to provide the guidance for the future that is demanded by enterprises. The methods that such forecasting institutes use to acquire and structure knowledge remain largely in the dark. Even if, for instance, scanning and content analysis are often referred to as methods – for instance by Naisbitt and Horx [Horx 1996] – the rather nebulous descriptions of these fail to dispel the considerable doubt. It follows that it is primarily those in need of guidance who – capable of no more than a limited and uncritical questioning of the methods – are inclined to give credence to the forecasts.

However, the discussions that are published in study reports and monthly trend newsletters are indeed a matter of keen interest for enterprises. One is given a quick overview of specific issues and one learns something about new or emerging phenomena. Moreover, one also learns the very latest terms of reference for events and products. Such naming [Horx 1996] of heretofore unknown things makes a decisive contribution to our understanding of new phenomena. That being said, it is important to avoid making the future of enterprises dependent on theories that are based on trend speculation. A willingness to do this is regrettably often evident when enterprises have already taken the step of outsourcing the task of reflection, or have lost the capacity to observe their environment, or when the critical thinkers and smart analysts within an enterprise fail to convey their important messages to the deciders (this issue will be addressed further in Chapter 5).

Given that trend research institutes make the results of their investigations available to a large circle of customers, such information is little helpful from a strategic point of view because the lack of exclusivity prevents any one enterprise from gaining a competitive advantage.

It is clear that most futurists have taken up their investigations of the future because they either hope or believe that it is possible to accurately project what will occur in the future so long as one has access to the right data, the right theories, the right methods and, naturally, the right amount of money.

Sadly, the approaches taken by trend forecasters tend to be just as unclear as the course of change itself. These approaches include pure fiction, whereby trends are simply postulated in the absence of empirical or theoretical explanation, compilation, whereby an attempt is made to combine facts, deductions, speculation and fantasy into a coherent whole, and reduction, an attempt to abstract clear and concise (or even bite-sized) trends, megatrends, or metatrends from the chaotic and unfathomable world we live in. Here especially, the "weak signals" and signs of trend breaches are often sacrificed in the name of clarity – to the point of triviality.

Trend research conducted in the 1980s and 1990s has been criticized for its lack of a scientific basis and for the deployment of farfetched methods. Naisbitt speaks of content analysis, and Horx and Popcorn speak of scanning while championing themselves as revolutionaries: "Trend research sees itself as an interdisciplinary metascience. It is less concerned with fulfilling the requirements of the traditional definition of science than with generating something new that is beyond the current thought horizon." [Horx 1997] Rust – one of the fiercest critics of trend researchers – describes their approach as nothing more than voodoo, "It involves a presumptuous disregard of all the criteria that are essentially linked in the academic world to the notion of research, including a clear statement of the subject of inquiry, clearly formulated hypotheses, and verifiability. None of these remain, and what is left is voodoo." [Rust 1997] Rust describes trend research as pre-scientific and concludes that such intellectual investments in intuition, conjecture and speculation lead to a certain arbitrariness. This can be seen in Popcorn's description of the utility of her clicking trend, "If you pay attention in the case of today's trends to where it clicks, then you will also learn how you can profit from it tomorrow." The question is whether trend analysis conducted at the level of popular science and its conclusions – dressed up for maximum media impact – represent appropriate sources of support when it comes to developing strategies and managing change in a corporate environment. From the point of view of the executive team, it would clearly be advantageous to be able to draw a sharper distinction between what qualifies as market research, trend analysis and futurology and what qualifies as a scientifically-based solution that can be integrated into the enterprise.

An intact and independent capacity for reflection and an ability to draw one's own conclusions is essential to the survival and flourishing of enterprises. The Delphic oracle admonishes us to rely on our own strengths. This admonishment has become more relevant than ever. In writing this book, it is not my intention to publish a manual or predict the next megatrends. On the contrary, my intention is only to encourage the development of a capacity to reflect (i.e. a certain posture that is geared to learning and discovery) as well as to sketch ways of interpreting signals in our environment, managing uncertainty and responding to change as it happens. An excessive concern with external phenomena is the wrong approach, and will sooner or later lead to a lack of orientation. Cultivating and developing of one's own strengths and simultaneously avoiding a myopic approach to the external world will lead to long-term success. But all our efforts to establish foreknowledge by which to orient ourselves and make wise decisions hinges on a single question:

Can we predict the future?

"No," says the chaos theorist.

"Yes," responds the astrophysicist.

"To an extent," says the economist.

"Usually," says the meteorologist.

It is apparently not an easy question. Let's carefully attempt to arrive at an answer to the question, and thereby also establish a foundation for the chapters to come.

Somehow all of the respondents are right. The chaos theorist makes a plausible case for degrees of freedom, complexity and the unfathomable dependencies of events. The astrophysicist can predict within a tenth of a second when a solar eclipse will occur one hundred years from now. The economist submits projections (e.g. of GNP growth) that exhibit more or less high rates of accuracy. The meteorologist regularly issues weather reports that are often, or usually – to put it more charitably – right, despite the occasional occurrence of rather surprising weather developments.

While the answers to our question may appear rather convincing when viewed from the perspectives of the various experts, all of the answers seem not to suffice when it comes to a final settling of the issue.
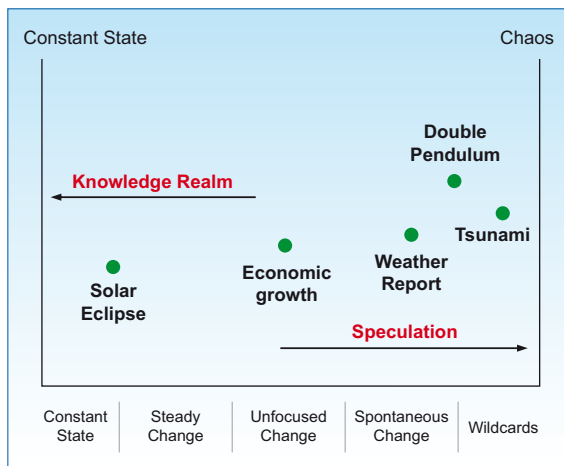

Figure 5   **Moving from a constant state to chaos: the continuum of change**

As shown in Figure 5 above, the types of possible change can be effectively illustrated by transposing the examples described above to a continuum of change that ranges from a constant state to chaos. The examples differ in terms of their structure and in the manner in which they are observed. There are phenomena on the constancy side of the spectrum that exhibit little or virtually no change and there are phenomena on