Exploring the Future of the U.S. Pharmaceutical Industry – A Supply Chain Perspective

by

Loïc Lagarde

Ingénieur Polytechnicien
École Polytechnique, 2005

Submitted to the Engineering Systems Division
in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Technology and Policy

at the

Massachusetts Institute of Technology

June 2007

Signature of Author……
Technology and Policy Program, Engineering Systems Division
May 15, 2007

Certified by……
Yossi Sheffi
Professor, Engineering Systems and Civil and Environmental Engineering
Director, Center for Transportation and Logistics
Thesis Supervisor

Certified by……
Mahender Singh
Research Associate
Project Director, Supply Chain 2020 Project
Thesis Supervisor

Accepted by……
Dava J. Newman
Professor, Aeronautics and Astronautics and Engineering Systems
Director, Technology and Policy Program

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Abstract

This thesis uses an innovative approach to explore the much-analyzed U.S. Healthcare system. To be sure, we are fully aware of the challenges involved in making robust system level policy recommendations and how local inefficiencies and hidden uncertainties undermine attempts proposing sweeping changes. Hence, we propose to investigate the Healthcare system using a supply chain perspective, which is inherently cross-functional and typically involves numerous different stakeholders. This holistic view will force us to think beyond artificial functional boundaries that promote local inefficiencies in the Healthcare system. Since the future is increasingly uncertain, we chose to use the scenario planning technique to guide the research process of developing effective system level policies. We will also leverage our insights to recommend new research directions to investigate the redefined system boundaries suggested by our scenarios.

Since a Fortune 50 pharmaceutical company was used as a case study, the research focused primarily on a subset of the U.S. Healthcare system namely the U.S. pharmaceutical industry. The research also benefited from a series of workshops with supply chain executives from a variety of industries. These workshops helped us refine and validate the scenario planning methodology as a tool to think and plan for the long-term future in uncertain times. Furthermore, the analysis of U.S. Healthcare inefficiencies through a supply chain perspective resulted in some promising policy recommendations as well as exciting future research ideas.

Thesis Supervisor: Yossi Sheffi
Director, Center for Transportation & Logistics
Professor, Engineering Systems Division and Civil and Environmental Engineering

Mahender Singh
Research Associate
Project Director, Supply Chain 2020 Project

Acknowledgements

I feel honored to have had the opportunity to be part of the Supply Chain 2020 project under the valued guidance of my advisors Pr. Yossi Sheffi and Dr. Mahender Singh. A research of such broadness would be a patent failure without the support of a dedicated team. Romain Levy and Roberto Perez-Franco, by their inputs and thoughtful questioning, definitely helped us to bring our research to another level of interest. I thank you all.

On a more personal basis, I would like to thank Dr. Mahender Singh for making me believe in me and value my thoughts. Our long discussions on various topics have been one of my most enjoyable moments at MIT. They helped me to grow as a human being and will still guide me for many years to come. You gave me back my critical thinking that a long education had unfortunately managed to tame.

Finally, it is impossible to find the words that would express my love and gratitude for my parents, Renaud and Arlette. They taught me the most important lessons in my life. Their wisdom and values shaped my very personality. This small milestone would not mean much without you. It was a true teamwork! This thesis is hence dedicated to you.

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1. Introduction

There is at least one consensus about the U.S. Healthcare system: it is in poor health. According to the international rankings and ratings by independent agencies, the quality of the U.S. Healthcare system is not commensurate with its very high price tag. And, to make matters worse, the trend is on the up in terms of cost going forward. Both, individuals and government are expected to pay significantly more for securing medical coverage and treatment. So what is the remedy?

Countless policies and solutions have been suggested in the past to address the crippling inefficiencies rampant in this otherwise well functioning complex system. An often-quoted source of the problem is the heavy focus on local objectives which prevents the system from reaching global stability, and be efficient. Thus, in this thesis, we propose to explore the U.S. Healthcare system from a new holistic perspective –a supply chain perspective. Supply chains by definition interact with each and every aspect of product delivery mechanism from source to sink. Supply chains are complex and intricate systems that involve numbers of different stakeholders. The premise is simple: looking at the U.S. Healthcare system through a supply chain lens will reveal new research directions to resolve prevailing inefficiencies.

Unfortunately, it is already too late to solve inefficiencies plaguing the current Healthcare system. In short, inefficiencies are consequences of past strategies; hence, the future should be our main concern today. Furthermore, the ageing of the population, the steady increase in drug development costs and the globalization of health issues are among the numerous challenges that are bound to exacerbate the problems in the future. Not only do these trends paint a darker future, they also present new sources of uncertainty. How can we think and prepare the future in highly uncertain times where forecasting is increasingly difficult? We will argue in this research that accuracy of forecasts is less important and we can prepare for the future without leaning on accurate forecasts. To this end, we chose to revive and adapt a 30-year old methodology called Scenario Planning.

By combining the two approaches to think about the future of a very challenging industry, we aim to gain deep insights and propose directionally new solutions. In order to provide some background information about the different components of the research, we will discuss in some detail various concepts, ideas, and research projects that directly or indirectly supported this research.

1.1 The Supply Chain 2020 Project

The Supply Chain 2020 (SC2020)[1] project is a multiyear research effort launched by the Center for Transportation and Logistics (CTL) to identify and analyze the factors that are critical to the success of future supply chains. This pioneering project will map out the process innovations that will underpin successful supply chains as far into the future as the year 2020.

According to the project description, SC2020 is divided into three phases:

> Phase I: Understand excellent supply chains and the underlying strategies, practices, and principles that drive them.
>
> Phase II: Develop supply chain principles and leverage what is learned during the first phase, to project the future using scenario generation and planning methodologies.
>
> Phase III: In this phase the learning from previous two phases will be leveraged to outline a process for organization to develop supply chain strategy and prescribe actions that organizations should take to help ensure supply chain success in the future.

A key finding of Phase I of SC2020 project was the importance of alignment between the business and supply chain strategy (Lapide, 2006). Indeed, the supply chain is also affected by the general business conditions that may or may not affect the business strategy directly as well. As a consequence, business macro factors tend to impact supply chain strategies twice directly or indirectly as shown in Figure 1.

[1] www.sc2020.net

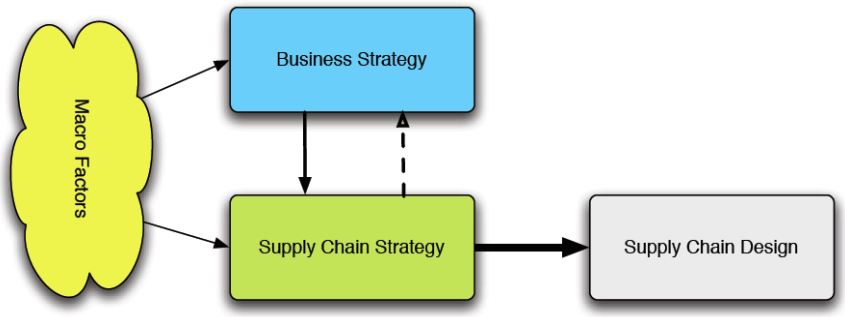
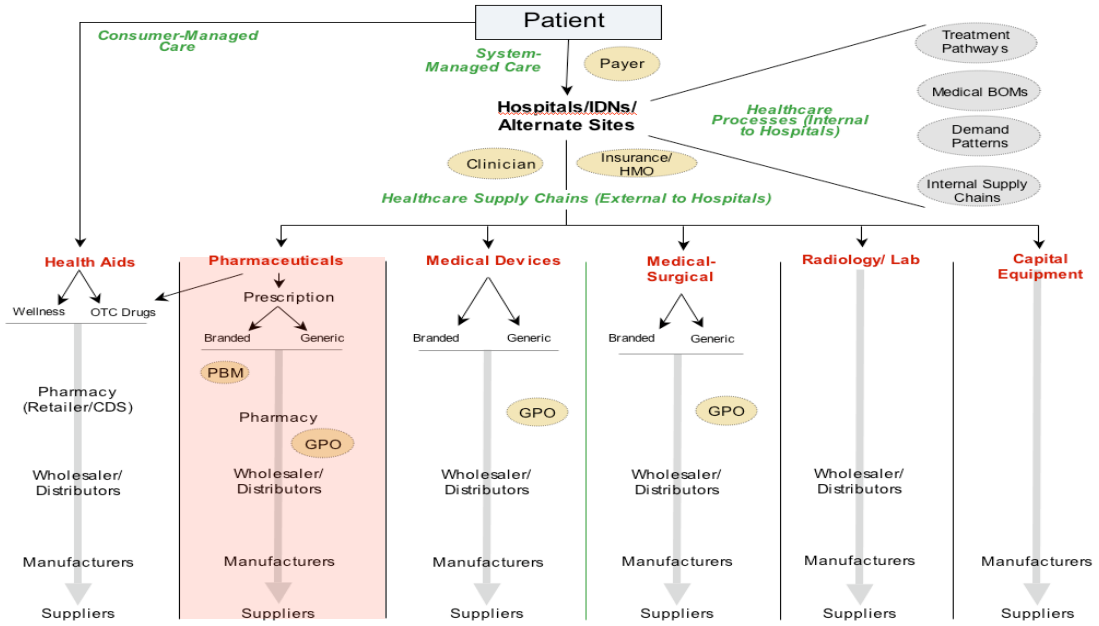


Figure 1 What drives supply chains?

1.2 The MEHD Project

In Summer 2006, the Center for Transportation and Logistics (CTL) launched another research initiative called the MIT Efficient Healthcare Delivery Group (MEHD Group)[2] to drive innovation in the Healthcare supply chain management sector. The research team decided to leverage its expertise in large-scale complex supply chains to study a domain that has traditionally been addressed in an operationally focused and fragmented ways. The project is focused on gaining a deeper understanding of the driving forces and challenges in the Healthcare industry by looking at the six different supply chains that span the system – see Figure 2.



Source: MIT-MEHD Website, http://ctl.mit.edu/index.pl?id=7405, accessed 04/05/07

Figure 2 Simplified Model of Demand Flow in the Healthcare Supply Chain

[2] http://ctl.mit.edu/mehd

1.3 Research Scope

Clearly, the dependence of supply chain strategy and design on external business macro factors poses significant challenge due to the presence of uncontrolled uncertainty. So, how can we plan for the future supply chain challenges in a dynamic and fast changing world? A typical approach to deal with this problem is to forecast the future macro factor trends, which has not proven to be reliable. To avoid problems associated with forecasts, SC2020 considered alternate approaches to investigate the future of supply chains in the long run before settling on Scenario Planning.

A key objective of this research was to support specific aspects of SC2020 and MEHD. We decided to leverage scenario planning methodology for developing supply chain strategy under the SC2020 project to explore the future of the U.S. Healthcare system, which is at the core of MEHD. Our partnership with a Fortune 50 pharmaceutical company led us to further narrow our focus to consider only the future of the U.S. pharmaceutical industry (Figure 2) in this research. As part of the research process, we have conducted multiple scenario planning workshops and some of the results presented here are the direct outcomes of these efforts.

1.4 Thesis Overview

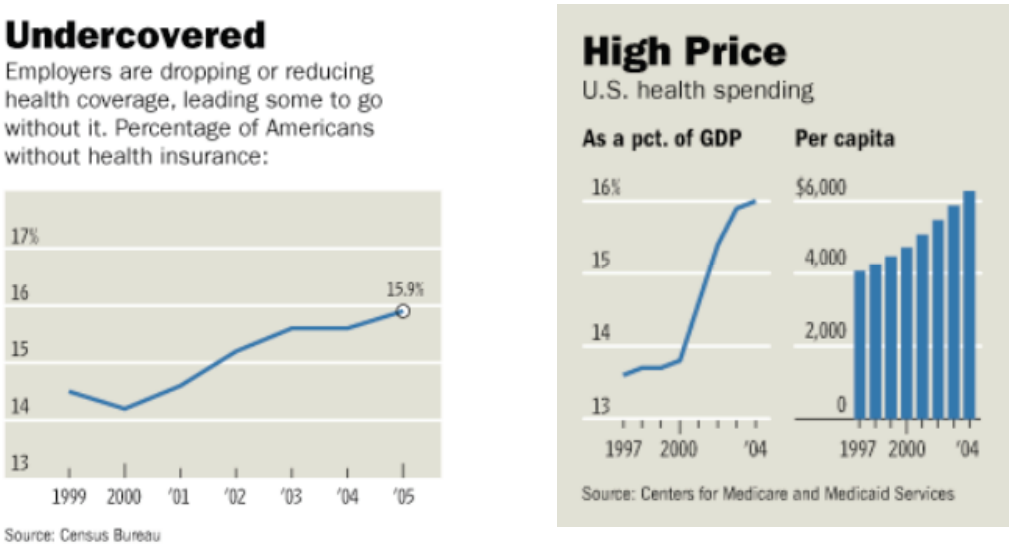
This thesis will first answer why the U.S. Healthcare and more specifically the pharmaceutical industry presents a challenge to long-term planning and why we chose scenario planning as the methodology to tackle this challenge in Chapter 2. In Chapter 3 we will analyze the current state of knowledge of both the U.S. Healthcare system and Scenario planning by presenting a review of the extant literature. In Chapter 4, we will leverage this knowledge to describe the state of the art in scenario planning. Chapter 5 will discuss in detail our methodology to develop scenarios focusing primarily on the supply chain function in general as a case study. In Chapter 6, we will then apply our internally developed methodology to generate scenarios for the U.S. pharmaceutical industry from both a supply and a market perspective. Finally, we will propose potential next steps and present our key learning vis-à-vis the future of the U.S. pharmaceutical industry in Chapter 7, followed by key conclusions in Chapter 8.

2. Problem Description

2.1 The U.S. Healthcare System – A Future Full of Uncertainties

The U.S. Healthcare system is not state-controlled unlike most other developed nations. It can be argued that it is primarily driven by a competitive private market, although the state plays a major role in the functioning of the overall Healthcare system i.e., controls approval of drugs, certification of medical professionals, as well as the biggest single payer of medical services. In other words, government does not appear as an active agent of change.

According to economic theories, in a well functioning market, competitive forces through innovations etc. will drive the cost down and quality will rise over time. Yet, the U.S. Healthcare system is far from delivering what we could expect from any healthy competitive market as shown in Figure 3. The fact that the United States spend the most amount of money on Healthcare of all countries and still rank low on the service coverage and quality makes one question the justification of spending 16% of its 2004 GDP in Healthcare.



Source: Wall Street Journal, "Health-Care Gold Mines: Middlemen Strike it Rich", September 18, 2006

Figure 3 U.S. Healthcare Underperformances

A majority of the problems in the U.S. Healthcare emerges due to the complexity of interactions between numerous stakeholders as shown in Figure 2. In the United States alone, the Healthcare supply chain involves more than 650,000 different organizations ranging from the manufacturer to the patient (Singh, 2007). In addition, the pharmaceutical industry is inherently uncertain due to the unique nature of pharmaceutical R&D process and the long FDA certification process. In such conditions, exploring the future of the U.S. pharmaceutical Industry is a significant challenge? So, how should we go about exploring this future opportunities and problems to improve the effectiveness of the U.S. Healthcare system?

2.2 Tackling Future Uncertainties: Different Approaches

From the ancient times in Rome when Priests, the augurs, observed birds' flights to the more recent craze about astrology, predicting future has been a central human preoccupation. In the business world, "hints", trends or forecasts are regarded as potential sources of competitive advantages. To be sure, anticipating the unfolding future is considered a key to strategic advantage in our fast-changing world.

Business decisions are usually differentiated in terms of scope and time horizon. They are often sorted into three main categories namely strategic, tactical and operational. A strategic decision requires considering the evolution of the world in the long term (multiple years) with a very wide scope of influence. A tactical decision on the other hand focuses mainly on the medium term horizon (few months to a couple of years) with a narrower scope of influence. And finally, an operational decision is centered on the future activities in the short term (few days to few months) and very specific scope. Different time horizons inevitably imply different levels of forecasting precision. Decades of experience have revealed that the accuracy and effectiveness of various forecasting technique is very subjective and depend on a multitude of factors but these dependencies can't be rationalized. A key lesson for us is this: regardless of the forecasting technique employed, with longer time horizons, the level of accuracy plummets dramatically.

We believe most of the approaches used to plan for the future can be categorized into three main categories, namely point forecasting, risk management and scenario planning (Figure 4). Indeed, this is a very well studied topic and it will be difficult to propose a comprehensive classification

of various techniques used for planning for the future, but it is our opinion that these three groups captures the differences between various techniques in an effective manner. In the following paragraphs, we will then explain the main points of difference and convergence of these three approaches.

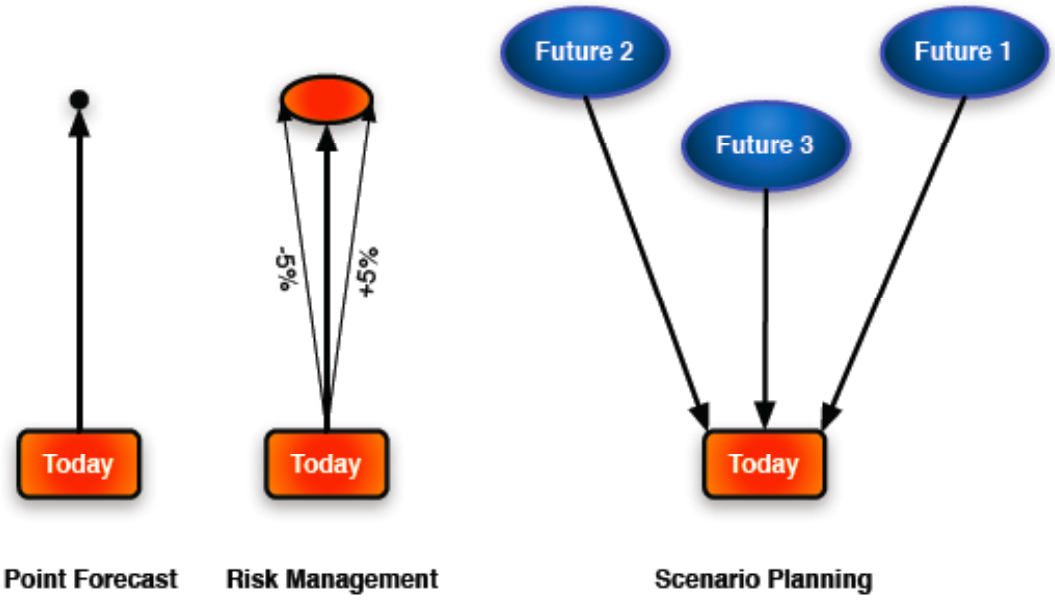


Figure 4 Planning for One Future vs. Planning for Multiple Futures

2.2.1 Point Forecasting

When it comes to preparing or planning for the future, point forecast is a natural input. Based on the current situation and some historical data, point forecasting techniques attempt to provide a limited but precise description of the future end state (Figure 4). This approach is usually described as 'looking at the future through your rearview mirror.' Effectively speaking, these techniques suppress most uncertainties by making strong assumptions and "freezing" some variables. Interestingly, these assumptions can be easily challenged and changed which affect the accuracy of the forecast.

While techniques such as the Moving Average or other Exponential Smoothing can offer some interesting insight in the short-term future, long-term predictions using statistical techniques are bound to fail. The primary reason for this claim is the fact that it is impossible to include the effect of all events in the forecast that may take place in the future using historical data. That is

why focusing on a single point picture has enjoyed limited success in general and specially at the long-term strategic level.

2.2.2 Risk Management (Range Forecast)

Recognizing the presence of uncertainty and the limitation of point forecasting techniques, some organizations expanded the idea to include a small range of values that are possible instead of a single number. This can be treated as an attempt to manage the risk arising due to uncertain future. Although it relies on historical data, the uncertainties are not set to a specific level; instead, they are rationalized by limiting the values a variable/uncertainty can take. The possible fluctuation between a predetermined range allows decision makers to explore different projected end states (Figure 4). In most cases, the range is arbitrarily defined by considering a ramp up or down amounting to +5%/-5% of the target value. Nevertheless, risk management methodologies remain heavily dependent on the quality of the historical data since this tool still relies on the extrapolations of current trends.

2.2.3 Scenario Planning

Scenario Planning has been used by the military and large organizations to explore the future in the last few decades. The philosophy behind this method is applicable to different time horizons but scenario planning is particularly effective for long-term strategic decisions.

The scenario planning methodology is motivated by the patent failure of forecasting tools to predict major disruptions such as oil crises or even the fall of the U.S.S.R. As a result, instead of focusing on one likely future, it proposes a few very "colorful" alternative pictures of the future to stimulate strategic thinking (Figure 4). Needless to say, the real future ends up being a mix of these multiple pictures but that is not the main objective of the scenario planning methodology any way, as we will discuss in the subsequent chapters. Acknowledging that the future might not unfold the way you thought is a key concept which challenges the current strategy and invites organizations to seek more robust solutions. In simple terms, scenario planning forces us to embrace uncertainties and make them a part of the decision making process rather than rejecting or limiting their influence.

2.3 Scenario Planning Approaches

From simple numerical variation on "spreadsheet models" to complex sensitivity analysis, developing and interpreting scenarios may seem to be a well-developed business practice. To the contrary, there are numerous ways to create scenarios. We will explore various methods and techniques in this space but remain focused on those that strive to acknowledge and integrate uncertainty to bring awareness and stretch boundaries (this is our informal criterion for filtering out methodologies that define the scenario planning domain).

Despite the "methodological chaos" that surrounds it (Bradfield et al., 2005), scenario planning follows a very strict and simple philosophy: open your mind, challenge your current vision of the future and try to "think the unthinkable" as Herman Kahn, the father of scenario planning, used to say (ibid.). Indeed, classical misinterpretations of scenario planning are common and usually lead to nothing else but fancy forecasts. As mentioned earlier, the key difference is that both forecasts and risk-management strongly rely on the perception of current trends and their extrapolations whereas scenario planning considers them as one of many inputs.

In simple terms, Scenario planning advocates out-of-the-box thinking. Since a "best candidate" scenario is not identified and all scenarios are weighted equally. Accumulating alternative pictures forces decision makers to undertake a structured evaluation of complex uncertainties that directly or indirectly affect strategy. In fact, this is the first step towards resiliency and robustness; this "what if" type of thinking challenges core assumptions and shed light on rigid weak points.

The recent shift in CIA's approach to explore the future further corroborates our belief. In 1997 and 2000, the CIA published the results of two major studies on the future: Global Trends for 2010 and Global Trends for 2015 (CIA, 2000; CIA, 1997). These reports were based on extrapolations, which led to the identification of key potential trends; yet, both studies did not anticipate major disruptive events such as the 9/11 attacks, which undermined their validity and interest. That is why, in 2004, the CIA published its new long-term vision entitled 'Mapping The Global Future' based a scenario planning approach (CIA, 2004).

During the course of this research, we found out that scenario planning is a common practice in very uncertain times and rapidly transforming industries. Hence, this methodology seems appropriate for investigating the future of the U.S. pharmaceutical industry as it is undergoing rapid transformations on multiple fronts.

3. Literature Review

3.1 U.S. Healthcare Overview

In our opinion the Healthcare system is characterized by great confusion especially due to one key issue: Who is the final decision-maker? Is it the patient, the doctor, or the pharmacist? Who is paying? Is it the patient, the Health Management Organization (HMO), the employer, or the U.S. government? In fact the word Healthcare itself is loosely defined as it encompasses both what we refer to as disease cure (post-symptoms intervention) and health care (pre-symptoms intervention) (Glouberman and Mintzberg, 2001a). In this thesis, we will focus on the cure of diseases and more precisely the related pharmaceutical business as mentioned in Chapter 1.

In the Healthcare literature, numerous papers explain how and why the U.S. Healthcare system has failed to deliver high quality at a low cost as some other markets seem to be accomplishing e.g. computers, consumer goods etc. In some ways, the U.S. Healthcare system is a true enigma. Why does it behave so differently? Why does it not follow the same evolution as other competitive markets? Porter and Teisberg argue that competition is at the root of the problem because competition does not occur at the right level; competition should be at the disease level not at the level of coverage (Porter and Teisberg, 2004). Instead of competing to reduce cost by all means, the market should have a simple common objective: "to increase value at the individual disease level." It is unclear whether market or government failures have led to this sub-optimal state. Indeed the government intervenes through Medicare and Tricare but more as a player than a rule-maker. Therefore, in this thesis, we choose to focus on market failures as the main drivers for inefficiencies treating the government primarily as a follower.

3.2 The Theory of Scenario Planning

Countless papers present numerous ways to implement scenario planning; practitioners' experiences have been adding up for the last thirty years. Only recently have some papers proposed a structured listing of the different methods (Bradfield et al., 2005). Specifically, our approach to scenario planning capitalizes on the decades of work done in the Intuitive Logics domain popularized by the Royal Dutch Shell (Wack, 1985; Schwartz, 1996) and the recent compilations of practitioners' knowledge (Fahey and Randal, 1998).

3.3 Scenario Planning: General Examples

Examples of current scenario planning projects are easily available and fairly diverse ranging from major corporate actors (Shell, 2005; UPS, 2005) to entire industrial sectors (Penker and Wyrtzens, 2005) and governmental agencies (CIA, 2004) as mentioned earlier.

Royal Dutch Shell has a long history of scenario planning and their Scenario Planning Group regularly publishes their research. Their latest exercise (Shell, 2005) provides scenarios of the world in 2025 in the form a book. These scenarios are built upon trade-offs situations between the three main world actors: governments, markets and communities. The book is divided into three parts: the first part presents the analytical framework whereas the second and third parts focus on the scenarios and the trends that will shape the future of the world.

UPS also develops scenarios on a regular basis (UPS, 2005). The purpose of their scenario exercise is to provide an effective framework to develop effective strategies for UPS in the future. Guided by scenario planning consultants, UPS has gone through the whole process of scenario generation to develop scenarios to prepare for the world till 2017. Given the nature of their business, the scope of the exercise covered the entire world but for the purposes of developing actionable ideas, UPS has detailed the consequences of those pictures in key world regions: Americas, Europe and Asia.

CIA has turned to scenario planning as well to develop its latest futuristic exercise "Mapping the Global Future" (CIA, 2004). This report is based on interviews with nongovernmental experts around the world. The four scenarios that were developed cover the entire world in 2020 but remains U.S. centric. These scenarios rely on a strong analytic framework supported by valuable data resources on future trends, which makes this report a great source of information.

More importantly, these three examples of scenario planning are consistent in their approach: they all provide multiple pictures of the future by considering key uncertainties. They also provide valuable examples along with reliable sources of data on the future trends that might influence our future.

3.4 Scenario Planning: Pharmaceutical Industry Examples

While global views like UPS, Shell and CIA scenarios fit the expected broadness of supply network scenarios, understanding the future U.S. pharmaceutical industry requires more focus and in-depth coverage. This observation is important since the pharmaceutical industry is inherently very uncertain due to very specific and local factors such as the low acceptation rate of the FDA drug approval process. At the same time, many macro factors can completely transform the future of this industry rather quickly e.g. active government involvement in the Healthcare. The diversity of drivers and high level of uncertainty explains why scenario planning was chosen as a methodology in two prominent projects in this space namely, Pharma Futures (Pharma Futures, 2004) and a Deloitte Research report (Deloitte, 2002).

The Pharma Futures project (Pharma Futures, 2004) is a British scenario planning project under the aegis of three pension funds: Algemeen Burgerlijk Pensionenfonds (ABP Netherlands), the Ohio Public Employees Retirement System (OPERS, US) and the Universities Superannuation Scheme (USS, UK). These three pension funds are major stakeholders in the pharmaceutical industry and "were aware of the limited utility of the traditional tools available to manage risk." Therefore, Pharma Futures gathered fifteen private sector stakeholders (pension funds, sell and buy-side analysts, pharmaceutical executives from ethical/branded and generic firms) to develop pictures of the sector in the next ten to fifteen years. As a result of this exercise three scenarios were developed: *the Producers Scenario, the Patient Scenario* and *the Political & Public Health Scenario*. Each scenario is a chronological story told from one key stakeholder's perspective namely the producers, the patient and the public sector.

The Deloitte Research report titled "Strategic Flexibility in Life Sciences" presents four scenarios to propose a framework on how to build flexibility in the Life Sciences business (Deloitte, 2002). The four scenarios are purposefully "basic" as they just exist to illustrate the overall framework. They are built on 2 by 2 matrix defined by two axes: "industry maintains pricing power?" - Yes or No - and "bio-science advances translate to clinically useful products?" - Yes or No. Despite the simplistic process of scenario generation, this report provides many insights by investigating the major uncertainties on the demand-side, the supply-side and the socio-political side. Some pharmaceutical companies use scenario planning on a regular basis.

4. Scenario Generation: A State of the Art

A quick scan of the literature will suggest that there is an abundance of publications that would provide enough guidelines for any beginner to start his/her own scenario very easily and quickly. Yet, to gain an in depth understanding of the scenario planning field demands an extensive information gathering effort through a detailed literature review. Our experience suggests that practitioners' perspective outnumbers the few papers that propose a structured view of scenario planning.

Indeed, the methodology focused literature is colored by the respective experiences of the writer and thus unique in character. Even though each scenario planning exercise is unlike any other because it has to be tailored to fit a specific objective, there are some common patterns that should be leveraged to make use of the existing knowledge instead of reinventing the wheel each time. To this end, we argue that a normalized approach to scenario planning will produce great results and yet easily replicable.

Interestingly, there is no clear consensus in literature about how to define the term scenario. As the next sections will prove, there is no general agreement on what should be the output of a scenario generation exercise. This flexibility of interpretation invited us to rigorously define the terminology to facilitate understanding. Before proceeding further, we would like to make a distinction between an 'end state' and a 'scenario.' We define an end state as a static picture of a future situation. It is like a painting and provides a snapshot of the events taking place at a given moment in time. On the other hand, a scenario is a dynamic picture of a plot, a sequence of events that tells a developing story.

It is our core belief that scenario generation requires a clear understanding of the drivers of change that will shape the end states. Thus, in our approach, a scenario can either be a path of events leading up to a particular world or an end state coupled with the understanding of driving forces guiding its evolution.

4.1 Three Main Schools

Some research teams have attempted to propose a classification of scenario generation methodologies to defog the prevailing confusion. The latest intent (Bradfield et al., 2005) is worth noticing for its clarity and comprehensiveness. Based on a thorough literature review and the analysis of the origins and growth of scenario development models, they identify three main schools of scenario planning: the Intuitive Logics, The Probabilistic Modified Trends and La Prospective.

- *The Intuitive Logics* approach is based on the work done by H. Khan. Pierre Wack promoted this approach during the early years of Shell Scenario development process. A detailed discussion of this school is provided in the next section.

- *The Probabilistic Modified Trends (PMT)* approach incorporates two distinct methodologies: Trend-Impact Analysis (TIA) and Cross-Impact Analysis (CIA). TIA and CIA can be classified as probabilistic forecasting tools; nevertheless, "they generate a range of alternative futures rather than a single point naïve extrapolation of historical data, and when combined with judgments and narratives about the events in these futures, they constitute scenarios" (ibid.)

- *La Prospective,* also known as the French School's approach, relies on the quantitative and qualitative analysis of trends and the risks of discontinuities (breakdowns or breakthroughs) to develop scenarios (Godet, 1997).

4.2 The Intuitive Logics Approach

The initial objective of our team was to adopt a process minded approach to scenario planning that would allow us to identify the activities that can be easily standardized and focus resources where value is really created. Furthermore, the process had to be adaptable to all types of industries and supply chains.

As mentioned earlier, our informal criterion for filtering out methodologies was twofold: the increased awareness and the stretching of mental boundaries. Therefore, we feel strongly about

the commonly accepted practice requiring that all scenarios shall be coherent, comprehensive, internally consistent and logical. A key differentiation of this approach from risk management domain is the assignment of equal weight to all scenarios. We assert that quantifying the likelihood of various scenarios amounts to picking a winner between scenarios, which indirectly undermines our objective of broadening decision maker's perspective and challenging current business assumptions. Moreover, to emancipate ourselves a little bit more from the popular forecasting practices, we chose a primarily qualitative approach to force a data independent thinking.

To select a suitable approach based on our pre-requisites, we analyzed different potential methodologies. Table 1 summarizes the factors we considered before selecting our approach.

	Intuitive Logics	*La Prospective*	PMT
Scenario Architecture	Coherence, comprehensiveness, internal consistency, logical underpinning		
Scenario Evaluation	All scenarios are considered equally plausible.	Scenarios are plausible and verifiable in retrospect. Probabilities are attached to future events.	
Methodological Orientation	Process-oriented. Insights gathered along the process are more important than the output.	Outcome oriented. The reliability of the end results is critical.	
Scenario Output	Qualitative	Quantitative and Qualitative	Quantitative
Identification of Key Driving Forces	Intuition, sets of usual macro factors and research	Interviews and comprehensive structural analysis using computer tools	Trends identified in historical time series data

Table 1: Factors that shaped the methodological lock-in

Thus, the Intuitive Logics Methods with its flexibility and its clear emphasis on process and insights best suited our needs. As expected, several variations of this method are described in the literature, however, it appears that most of them can be categorized into two main groups, namely the inductive or bottom-up approach and the deductive or top-down approach (Figure 5.)

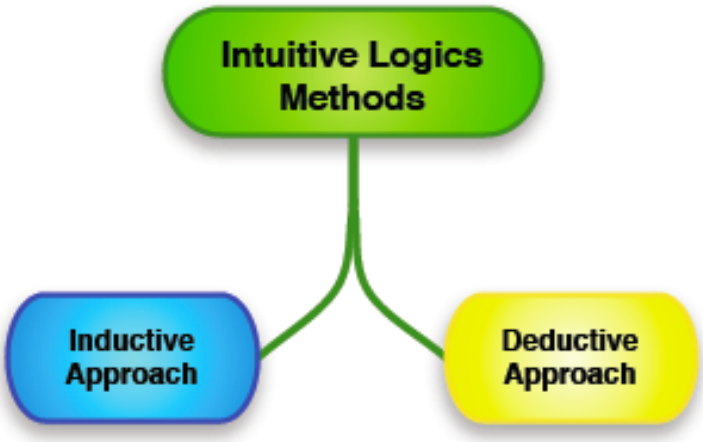


Figure 5 Different Approaches to the Intuitive Logics Method

4.2.1 The inductive or bottom-up approach

This method consists of "project[ing] sets of plausible futures based on analysis of present forces and their likely evolution" (Fahey and Randall, 1998, Chapter 1). Five key steps of inductive approach are (see Figure 6)

STEP 1. Define what is precisely the question you want to answer e.g. what will the competition look like in twenty years from now?

STEP 2. Identify what factors impact or will impact your activity; those can either be internal or external to your organization. Identifying those factors is critical to the rest of the process.

STEP 3. Analyze and sort factors in Step 2 in terms of strength of impact and degree of uncertainty.

STEP 4. Aggregate critical factors (high uncertainty and high impact) to create axis that scenarios will explore.

STEP 5. Narrow down the possibilities to two main axis i.e. 4 scenarios overall.

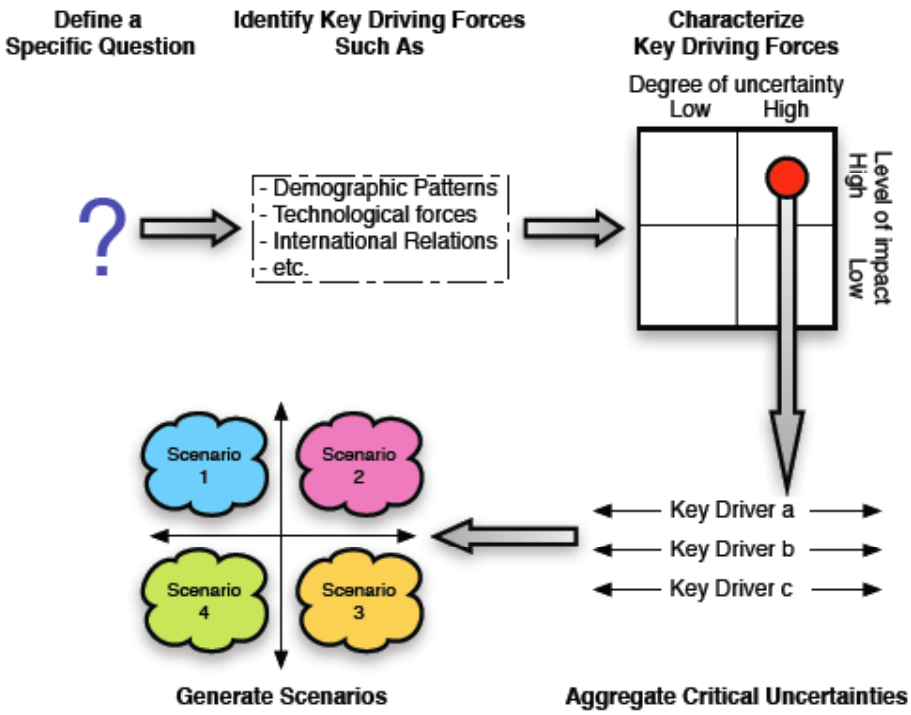


Figure 6: Inductive Approach

4.2.2 The deductive or top-down approach

This method consists of "select[ing] several significant futures and try to discover the paths that lead to them" (ibid.). The deductive approach can be divided into five major steps (see Figure 7)

STEP 1. Develop a precise definition of the question you want to answer.

STEP 2. Identify key assumptions, premises and beliefs that will dramatically shape your future e.g. major supply disruption. Based on that, envision events that would embody these assumptions e.g. China drifts away from WTO, the European Union collapses or even a major worldwide pandemic.

STEP 3. Build provocative short stories around the previously identified "events". This will constitute a set of end states -snapshots of the world in the future. This step is surely constrained by both the creativity and the bias of the group in charge.

STEP 4. Present the end states to insiders i.e. organization's members external to the team that developed the end sates. Invite them to focus on what would happen if the world unfolded as in each end state.

STEP 5. Guide the group discussion to develop plausible paths that could describe the evolution of the world from today to each end state. This step increases insiders' exposure to all the uncertainties that could threaten the company's vision of the future. It forces them to identify the drivers of change in their current and future environment and increase the overall company awareness.

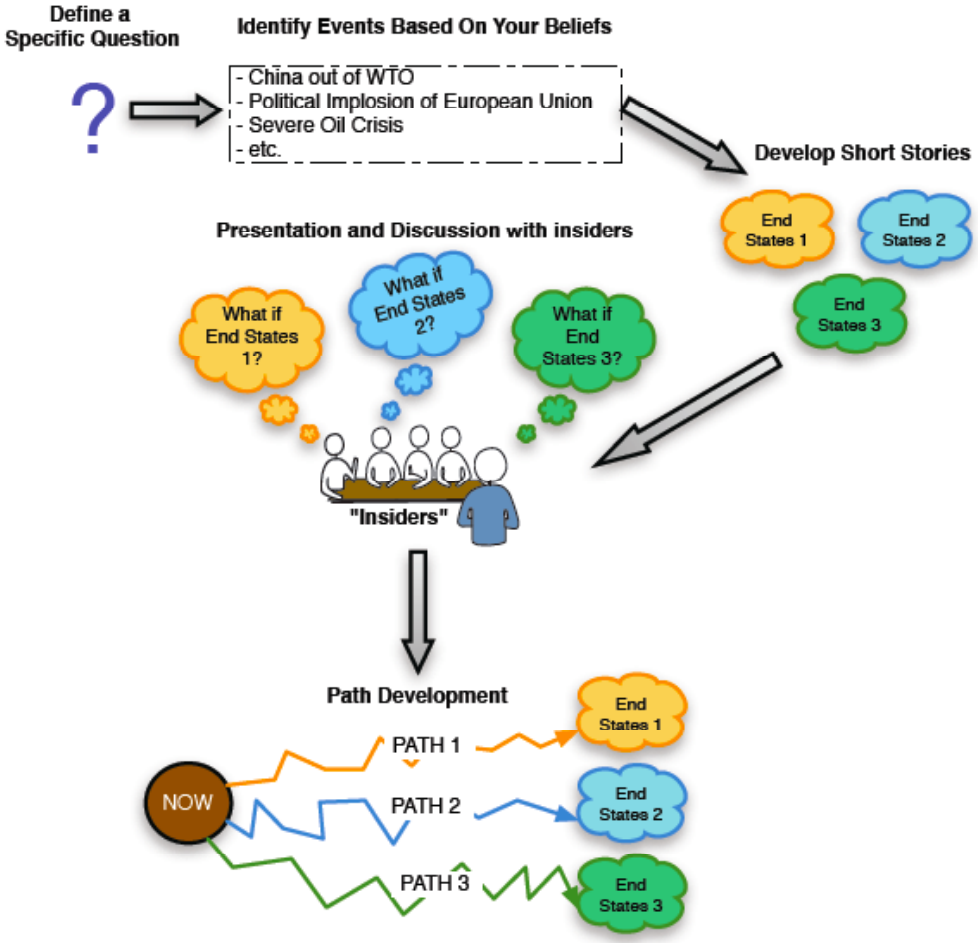


Figure 7: Deductive Approach

4.3 Infinite Possible Variations

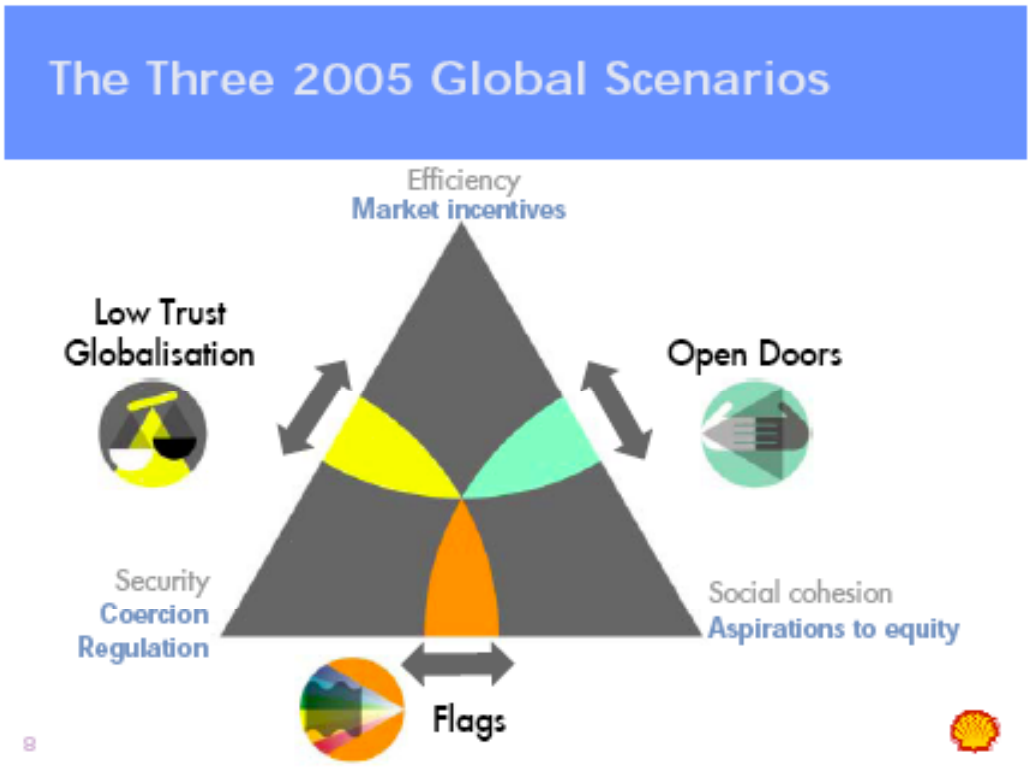
One should notice that the distinction between inductive and deductive approaches is mostly academic. Indeed, they both have the same threefold objective: to identify "driving forces", to take into account "predetermined trends" and to spot "critical uncertainties" as proposed by Peter Schwartz (Schwartz, 1996). In the end whatever method we use to undertake scenario generation, it is all about understanding and analyzing:

- What we know we care about – *the driving forces*;
- What we know, we know – *the predetermined trends*;
- What we know, we don't know – *the critical uncertainties*.

In other words, the inductive and deductive approaches are just two paths to get to the same place and practice reveals that those paths are highly intertwined. A close examination of two large scenario generation exercises (Shell, 2005; UPS, 2005) demonstrates that practitioners consciously or unconsciously mix these two approaches to enhance the output.

For example, the 2005 Shell Scenarios are built on the assumption that the world is facing a dual crisis of trust and security and this crisis will shape the future of the whole world. Shell identifies three main forces whose interplay will generate answers to the crisis: "Market incentives", "Coercion / Regulation" and "The force of community". These forces are likely to express through trade-offs three potential end states (Figure 8).

It may appear that Shell chose a deductive approach; yet, a closer examination highlights a more complex construction. Effectively, the fundamental rationale that led to the creation of end states is inductive: Shell spots a major driving force (the dual crisis) and then considers uncertainties around it. Shell concluded that the selected forces will interact in different ways to solve this crisis. If we eliminate the three utopias (one force outweighs the two other) we are left with three situations of "two wins-one loss" trade-off each.

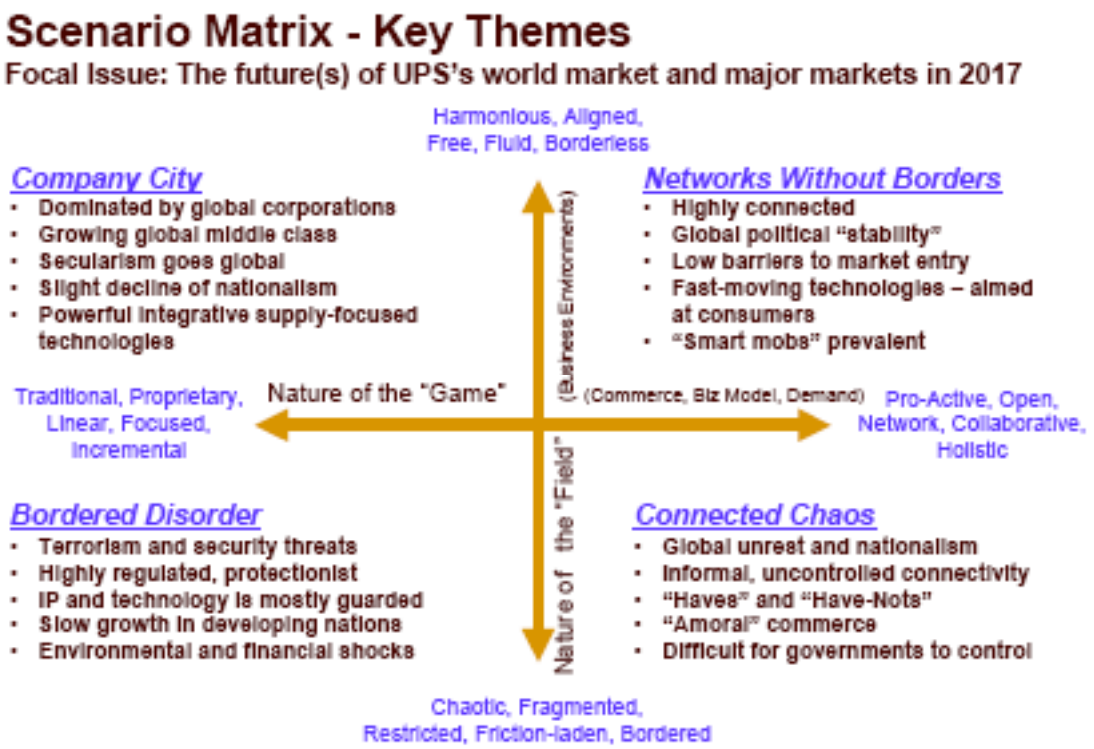


Source: Shell Presentation at Davos 04

Figure 8: Shell Scenarios

Likewise, the UPS Horizon 2017 seems to follow a pure inductive approach. The key driving forces are determined first, followed by the uncertainties and then, the aggregation of the latter into two major axes namely the "Nature of the Field" and the "Nature of the Game" (Figure 9).

Yet, a deductive methodology comes into play when the short stories are developed. Even though the direction is clearly given, the content of the stories crystallizes UPS biased assumptions about the future. Those biased stories are then studied by following the classical deductive framework (STEP 4 and 5 – Section 4.2.2.).



Source: UPS Presentation, MIT SC2020 Symposium, 11/29/05, Cambridge, MA

Figure 9: UPS Scenarios

Hence, one can argue that Shell exercise is mainly deductive and UPS's mainly inductive. But, these examples prove that it is neither necessary nor easy to develop a pure inductive or deductive approach. Furthermore, given the architecture of the human brain, cultural biases and people's relative sensitivity to future or present is bound to make these two approaches blend in any scenario generation.

Philosophers such as Charles Sanders Peirce decompose the human logical system into three stages: abduction, deduction and induction (Yu, 1994). Peirce introduces the logic of abduction as a prerequisite to any qualitative or conceptual understanding of phenomena. Abduction explains how we decide to select hypothesis that are worth studying. Abduction consists of spotting patterns in a phenomenon and suggesting a hypothesis. The objective is to decide which hypothesis or proposition to test. For instance, why did Shell decide to take the dual crisis of trust and security as premise for their scenarios? In all likelihood, the observation of recent

events such as the 9/11 attacks and the Enron scandal led them to hypothesize that a dual crisis will emerge and shape our future. Then, in the Peircean system, the plausible hypothesis is refined through logical deduction. Deduction draws logical true consequences from premises, given the premises are true. Finally, induction provides the empirical justification by inferring a general law based on numerous cases and empirical evidence.

Following this approach, broadly speaking, at the stage of abduction, we explore data, look for patterns and suggest a plausible hypothesis; deduction builds logical and testable hypothesis on plausible premises and induction is the approximation towards the truth in order to fix our beliefs for further inquiry (Yu, 1994). In short, abduction, deduction and induction are all part of the same logical phenomenon.

In summary, there are nearly as many methods as scenarios generation exercises presented in the literature. Although a classification of the main characteristics remains valuable, any attempt to report those methodologies in an aggregated fashion (i.e. mainly inductive vs. mainly deductive) would be futile.

4.4 SC2020 Approach: Market and Supply Network Analysis

It is our core belief that scenarios targeting supply chain function or having a supply chain perspective should paint a rich picture of both the demand and the supply side. As mentioned earlier, the supply chain strategy alignment is one of the key learnings of the SC2020 project (Lapide, 2006). As a result, a good understanding of the market forces affecting demand and business strategy is necessary before developing an effective supply chain response. To this end, we propose a two-step framework to generate global scenarios that will allow decision makers to explore rich demand and supply issues.

In step one, we develop market and supply network scenarios followed by step two which involves the merger of these two scenarios into multiple global scenarios – see Figure 10. Note that objectives of market and supply network analysis are quite different. The market scenarios present challenging pictures of the future to stimulate discussions around potential business strategies and different competitive advantages at the company level. The supply network

scenarios present a broad array of possible supply investment opportunities and threats. Being very different in scope and objective, we decided to use two different methodologies to generate these scenarios.

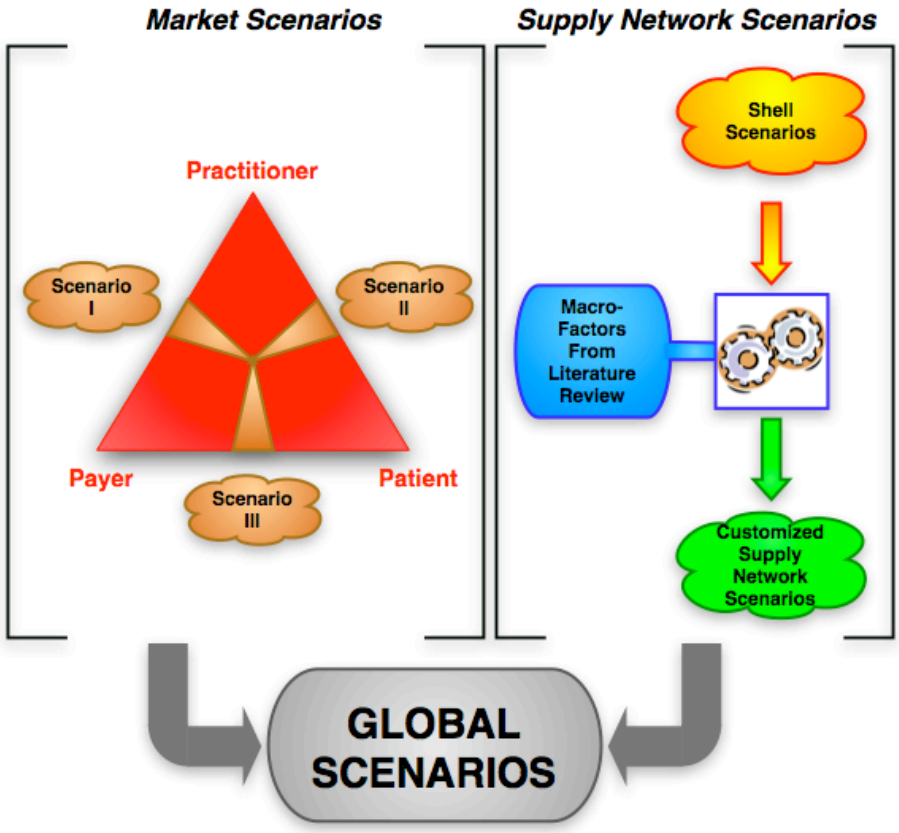


Figure 10 Overall Framework

In Chapter 5, we will describe the supply network analysis process, which leverages our existing supply chain scenarios. In SC2020, the supply network analysis chronologically came first and constituted a learning experience that allowed us to develop a better-suited methodology for the market analysis.

Next, in Chapter 6, we will explain the process followed to develop market scenarios for the U.S. Healthcare. The understanding of the broad challenges of the Healthcare system allowed us to identify key uncertainties that are likely to shape its future; these uncertainties were the main input to the scenario generation exercise.

5. Supply Network Analysis

In this chapter, we will describe the process used to develop SC2020 generic supply network scenarios in Phase II of SC2020. These non-industry specific supply chain scenarios were leveraged to develop three supply network scenarios for the U.S. pharmaceutical industry.

5.1 A Modularized Scenario Generation Process

5.1.1 Why a new approach?

In order to explore the future supply network environment, we need to identify and understand the macro factors that go well beyond the current boundaries of the business domain e.g. security crises in the world, pandemics, etc. Scenarios for supply network analysis should be non-industry specific to be as challenging and exhaustive as possible. Thus, the scope of these scenarios was very broad, yet the scenarios had to be granular enough to allow effective strategizing. Given these requirements, we decided to utilize both the deductive and the inductive methodologies to exploit their respective strengths. A comparison of the strengths and weaknesses of these methodologies is provided in Table 2.

	Strengths	***Potential Weaknesses***
Deductive Approach	- Broad perspective; - All inclusive; - Easy way to engage people.	- High degree of abstraction needed to draft the end states; - Overlooks specific issues that might become more critical in the future; - Possible influence and limitations due to the constructing team bias.
Inductive Approach	- Focus on the critical forces; - Customizable to fit company/activity; - Possibility of detailed scenarios with high granularity.	- High degree of abstraction needed to create stories from a set of driving forces; - High risk of missing macro factors that will shape the overall market.

Table 2 Deductive and Inductive Strengths and Weaknesses

Our objective was not only to develop scenarios for the project's purposes but also to identify a framework that would facilitate the supply network scenario generation. We observed that scenario generation is a very time and resource consuming activity because people tend not to leverage the resources already available in the public domain. Thus, we developed a process-minded approach called the Rapid Scenarios approach. This methodology utilizes both the strengths of the deductive and inductive approaches.

5.1.2 The Rapid Scenarios (RS) Approach

The RS approach consists of steps that refine already existing scenarios to incorporate the critical factors relevant to the question under investigation.

Indeed, the selection of preexisting scenarios clearly reduces the time and resource constraints. These scenarios are used as the end states described in the deductive approach. Then, it shifts the focus to steps that really create values. Yet, to increase the relevance of these scenarios, macro forces are identified as in the inductive approach. The selected scenarios are then processed to emphasize the importance of the key driving factors.

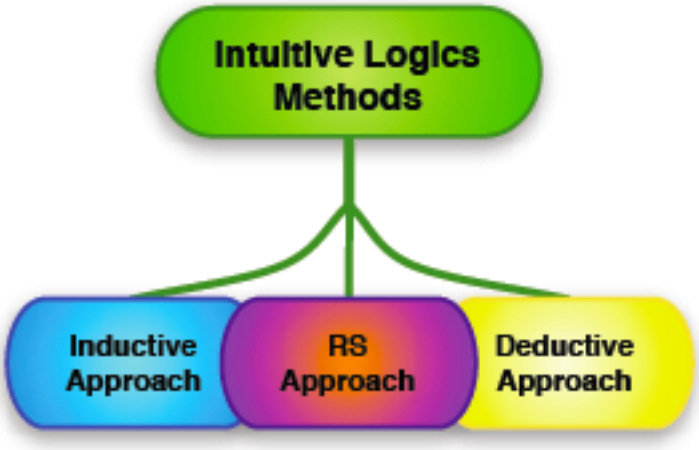


Figure 11 A New Approach to the Intuitive Logics Method

The RS approach benefits both from the momentum generated by the deductive methodology and the high degree of granularity extended by the inductive methodology. The deductive methodology relies on a strong dynamics of causality but overlooks the identification of the

factors that should be monitored. On the contrary, the inductive methodology really focuses on "what we care about" but the analysis of those factors is burdensome, which decreases people's interest in the scenario generation exercise. Thus, the RS approach benefits from the strengths of both logic methods while avoiding their main disadvantages.

5.1.3 "Building Blocks"

The RS approach finds its roots in process analysis i.e. looking at scenario planning through an engineering lens. The key objective was to design a flexible framework that could be easily applied everywhere by everyone. Hence, the process must be straightforward and clearly state the inputs and outputs of each step. We adopted a modular structure using building blocks based on five simple steps described below.

- Definition of the Objective

First and foremost, it is important to precisely define the question we want to answer (Step 1 in Figure 12). Then, search for scenarios in the public domain using some of the resources suggested in Chapter 3. After analyzing potential candidates in terms of geographic and macroeconomic scope, timeframe, general relevance for your industry, etc. choose the "off-the-shelf" scenarios that best fit the stated objective (Step 2 in Figure 12).

- Filter Creation

Create the filter that will allow identification of relevant information vis-à-vis the question under consideration as described above (Step 3 in Figure 12). Simply put, this filter is a list of major points that should be covered in the scenarios. Interviews and/or some literature review can help develop this list. This step is equivalent to the Step 2 of the inductive approach: identify the driving forces (Figure 6).

- End States Creation

Process the scenarios using the filter developed above (Step 4 in Figure 12). After highlighting the major factors identified previously, rewrite the scenarios as a description of the future to obtain a set of end states.

Ideally, these end states should be presented to insiders i.e. organization's members external to the team that developed the end sates. Invite them to focus on what would happen if the world unfolded as described in each end state. Guide the group discussion to develop plausible paths that could describe the evolution of the world from today to each end state. The end states along with possible set of events describing a possible path constitute a scenario (Step 5 in Figure 12).

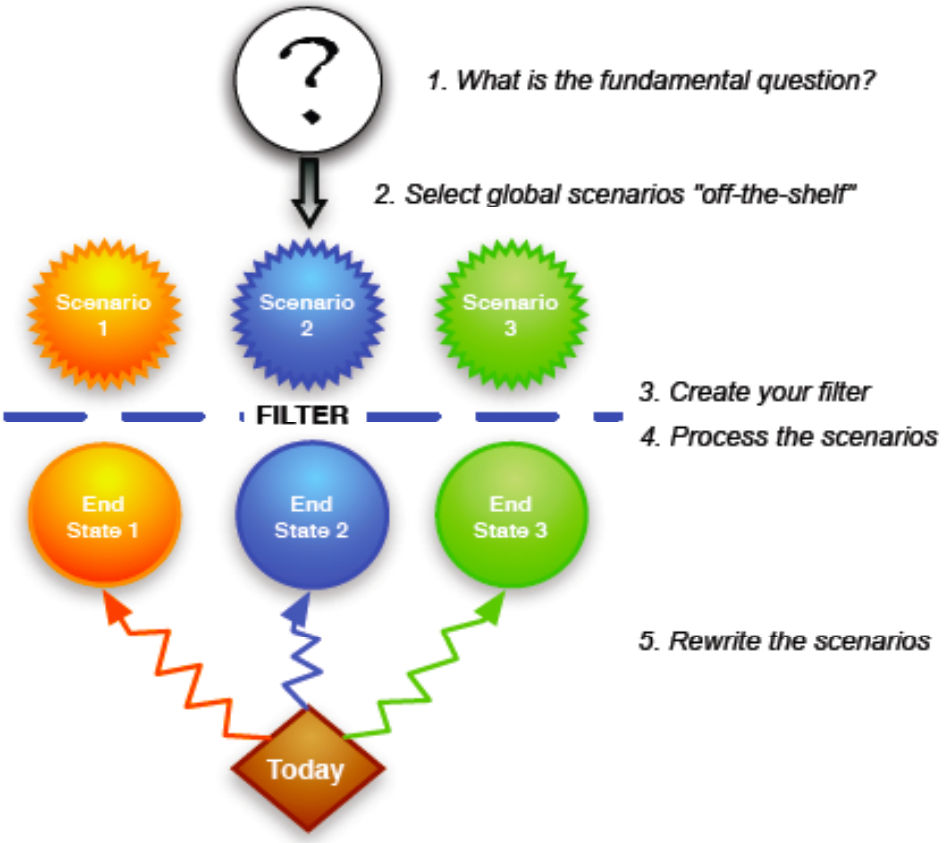


Figure 12 From the Definition of the Objective to the Scenario Finalization

We previously acknowledged (see beginning of Chapter 4) that the identification of a path of events was sufficient but not necessary. Indeed, reflecting on possible paths serves a particular purpose as it helps the team identify a set of key variables that should be monitored as the future unfolds. We refer to these variables as "sensors in the ground." These "sensors in the ground" can also be discussed with end states to assess the effects of such a world on a supply network. Our experience corroborated the fact that such "enriched" end states can also be rehearsed as effective scenarios

- Scenario Finalization

End states or scenarios are usually well received but they never answer the critical question that is in every manager's mind: So what? To answer this question and ensure a good understanding of the challenges and opportunities that such a new environment can create, a list of challenging questions is presented to the participants in order to stimulate their thinking and encourage engagement. These questions also serve the purpose of prioritizing and clarifying potential ideas for strategy development.

Once participants have a better understanding of the direct effects of future uncertainties and macro forces on their strategy, it is an opportune time to ask what events can possibly lead to such a scenario? To be followed by a question on the drivers that should be closely monitored? This discussion is an alternative to the path creation process presented in the previous section.

In essence, this step is an application of the Socratic method. Thus, it either requires a very well designed questionnaire or a facilitator who has mastered inquiry methods to reveal mental models such as the one described in Peter Senge's book "The Fifth Discipline" (Senge, 1990).

5.2 SC2020 Three Supply Network Scenarios

This section describes how we applied our Rapid Scenarios approach to explore the future of the U.S. pharmaceutical industry supply network.

5.2.1 Definition of the objective

What will the U.S. pharmaceutical Supply Chains look like in 2020? We set out to explore this question in a non-industry specific manner using the ideas developed under SC2020. Indeed, as discussed earlier, supply network concerns are global and mainly non-industry specific. The scenarios developed through the RS approach offered a broad array of situations as they provided a glimpse of the future of the supply network in almost any industry.

We decided to use the scenarios developed by Shell (Shell, 2005) as our 'off-the-shelf' scenarios as these scenarios are developed based on extensive research and built on detailed information from a variety of sources. Moreover, a company like Shell is present all over the world and the

performance of their business is directly affected by the situation in any geographical area or any section of the economy. Hence, their scenarios contain an insightful picture of how macro-forces such as demography or terrorism may shape the future of the world. These scenarios constitute one of the best publicly available resource as far as macro pictures are concerned.

5.2.2 Filter Creation

Following the RS approach, we needed a filter to recast the Shell scenarios to make them more relevant for our purpose. To this end, we used the information on drivers of supply chain design and key challenges based on an extensive literature review by Singh (Singh, 2004). This review represented the consensus within the supply chain community about what the future driving forces or macro-factors will look like and how they will shape supply chain design. This analysis underlined some common patterns that needed to be embedded in our scenarios to be effective. As a result, the ideas expressed in literature were used as a "supply chain filter" to process Shell scenarios by highlighting the factors that will be critical to supply chain design.

But, incorporating external supply chain concerns into existing scenarios without undermining the integrity of the base stories is not easy. The RS approach proposes the customization of already existing scenarios by incorporating the respective concerns of a company or activity and certainly a challenge (Figure 13). This step requires creativity and ingenuity on part of the scenario development team and more or an art than science.

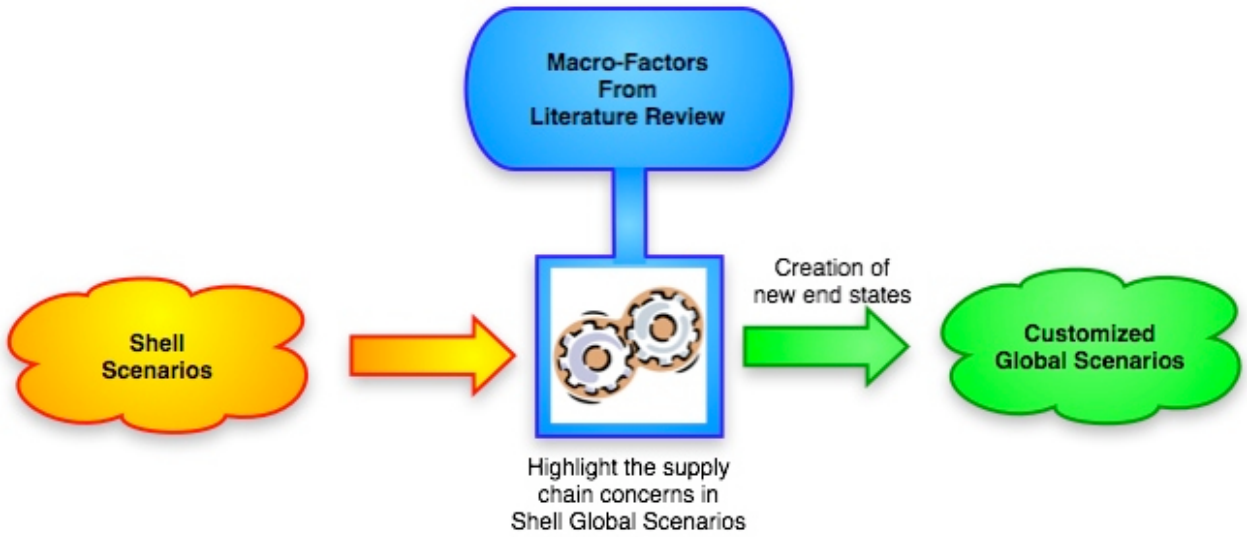


Figure 13 The Processing of Shell Scenarios

The SEPT (Social Economic Political Technology) framework (Fahey and Randall, 2004, p. 87) inspired us to classify the most prevalent supply chain concerns (Singh, 2004) under eleven macro-factor categories as presented below:

- Trade and Protectionism
- Global Security and Trust
- Market Forces
- Competition and Alliances
- Financial Market Forces
- Social and Lifestyle Factors
- Labor Forces
- Environmental Constraints
- Technological Forces
- Natural Resources
- International Political Environment

Finally, the supply chain filter took the form of a 3 X 11 matrix where every macro-factor is re-interpreted to match the three Shell scenarios storyline i.e. “Open Doors”, “Low Trust Globalization” and “Flags” (Shell, 2005). If the supply chain concern reflects the scenario storyline, it is captured in the matrix. Due to the limited information in the literature, we were not able to fill every cell for every scenario. Some rewriting was generally required. In other words, the information filled in the matrix relied on our interpretation of extant supply chain concerns (Singh, 2004) according to the general plot of each scenario (Table 3).

	Trade & Protectionism	Global Security & Trust	Market Forces	Competition & Alliances	Financial Market Forces	Social & Lifestyle Factors	Labor Forces	Environmental Constraints	Technological Forces	Natural Resources	International Political Environment
Open Doors	Extraction & interpretation of supply chain concerns (Singh, 2004) in the three scenarios (Shell, 2005)										
Low Trust Globalization											
Flags											

Table 3 Supply Chain Filter From Literature Review

5.2.3 End State Creation

We used the eleven macro-factors as "reading grid" for the three Shell scenarios. We recast the final result of our analysis into another 3 X 11 matrix. This information was a collection of quotes from each Shell scenario that gave a direct description of a given macro-factor (Table 4).

	Trade & Protectionism	Global Security & Trust	Market Forces	Competition & Alliances	Financial Market Forces	Social & Lifestyle Factors	Labor Forces	Environmental Constraints	Technological Forces	Natural Resources	International Political Environment
Open Doors	Extracted information on each macro-factor in each of the three scenarios (Shell, 2005)										
Low Trust Globalization											
Flags											

Table 4 Supply Chain Filter From Re-Reading of Shell Scenarios

Then, we merged the two matrices and used the combined information as a canvas for the rewriting of three end states (Table 5). After we were done with the process the new end states or snapshots of the world in 2020 bore little or no direct resemblance with the Shell scenarios except a close storyline (Figure 12). The end states were then re-titled to ensure the necessary scenario ownership.

	Trade & Protectionism	Global Security & Trust	Market Forces	Competition & Alliances	Financial Market Forces	Social & Lifestyle Factors	Labor Forces	Environmental Constraints	Technological Forces	Natural Resources	International Political Environment
Open Doors	Merged information from the two previous matrices. Each cell is a fact to be woven in the new story.										
Low Trust Globalization											
Flags											

Table 5 Final Supply Chain Filter

A quick summary of the resulting end states namely, “Synchronicity”, “Alien Nations” and “Spin City” is presented in Figure 13. The complete story is available for a curious reader in Appendix I. We would like to express our gratitude to Ken Cottrill, MIT-CTL Global Communications Consultant, for developing compelling stories.

Source: Senior Executive Workshop, Cambridge, MA, January 4, 2007

Figure 14 Three Supply Network End States – Story Line

Spin City

Terrorism and tensions between countries have reached such a pitch that trust and national security issues dominate political and corporate agendas. Globalization remains a powerful force, but hamstrung by a complex web of conflicting regulations. Governments are intervening more and more to strengthen security and paying less attention to their markets in an increasingly complex trading environment. As a result, markets are not as efficient as they could be, and managing change is a major challenge since the ground rules for trade are in a constant state of flux. Trust is a distinct competitive advantage. To compete globally, companies have to build solid reputations for being trustworthy. Highly innovative enterprises that can exploit the new, but fleeting, business opportunities around the globe that are a feature of this fast-changing world are also in a strong competitive position. The conflict at the heart of this world is: should regulation or market forces champion trust and physical security?

Alien Nation

Citizens of the Alien Nations world think and act locally. Foreign peoples and governments are mistrusted or even disdained; globalization does not even warrant lip service from a political establishment hemmed in by nationalism. Energy is a hot-button issue because countries are in competition for dwindling natural resources. Conservation and energy efficiency policies are being pursued with vigor. The lack of standardization across global trading and commercial systems makes international expansion risky and expensive. Trade barriers are strewn across the world. Not surprisingly, companies focus their endeavors on national markets and customers. A major threat to world stability is unsynchronized business cycles and investment strategies, a symptom of the lack of global unity. Nationalistic attitudes obstruct emigration, even though there is a high demand for younger migrant workers in many countries. In the Alien Nations world charity begins - and ends – at home.

Synchronicity

Democratic ideals have taken hold across the globe, and intrinsic to these ideals is the notion that all parties – whether they be individuals, companies or governments – must trust each other. In this world, trust does not impede business or societal relationships - it promotes them. As a result, untrammeled global commerce flourishes in Synchronicity world, to such an extent, that a major challenge for companies is keeping up with constantly shifting market demands and technological breakthroughs. Qualities such as trustworthiness and integrity are essential to business success. Life is rich but frenetic, and people like to sample as much of it as they can. They change jobs frequently, another challenge for companies that increasingly rely on "knowledge workers" to create the customized products and services that are in demand. Environmental protection has become universal aspiration.

Source: Senior Executive Workshop, Cambridge, MA, January 4, 2007

Figure 15 Three Supply Network End States – Summary

5.2.4 Scenario Finalization

To validate the effectiveness of the new scenarios, we tested them at three different events: two SC2020 Advisory Council workshops (IAC, Louisville, KY, 06/22/06 and EAC, Zaragoza, Spain, 04/07/06), and one Senior Executive Workshop held at Cambridge, MA on 01/04/07. In the latter workshop, supply chain executives from various industries used the Harvard case study on Sport Obermeyer Ltd. (Hammond and Raman, 1994) as the background to analyze the implications of each scenario on the company's supply network.

We provided the framework shown in Figure 16 to guide the brainstorming sessions. Although offering little practical insights, the workshop demonstrated the power of the scenarios in initiating rich dialogue between the participants. As expected, the answers varied by groups and a further analysis would be necessary to gain better understanding in an actual situation.

Scenario Finalization Framework

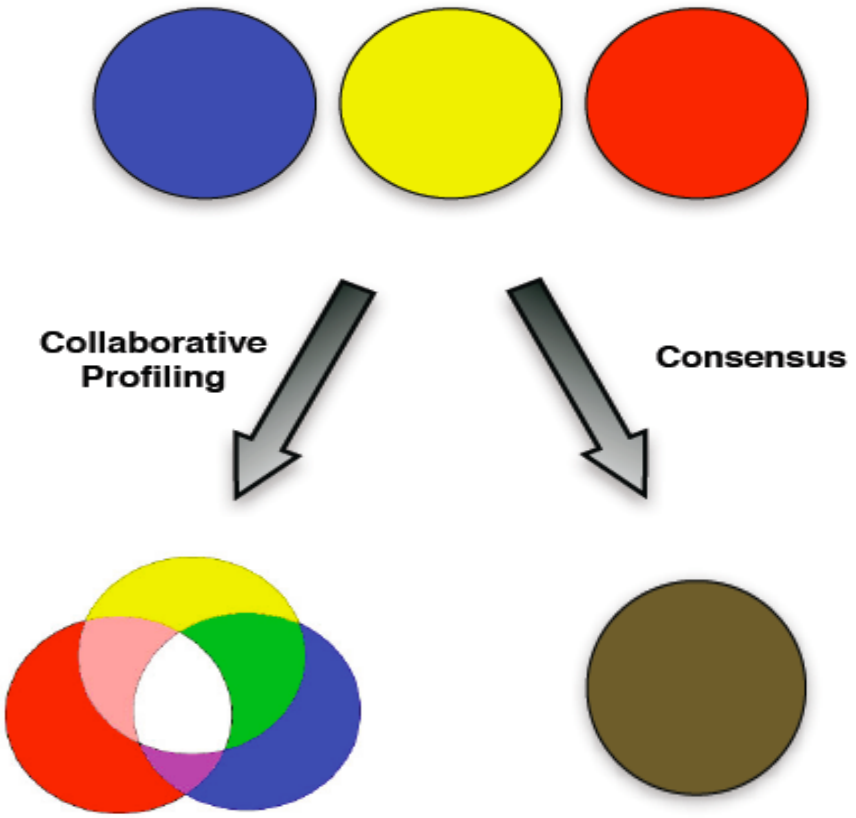
1. What are the key characteristics and features of the **supply network** to fulfill the type of market and demand discussed above?
    a. What will be the focus of the supply network design:
        i. Customer responsiveness
        ii. Asset utilization
        iii. Operational efficiency
    b. Supply chain organization:
        i. Vertically integrated
        ii. Horizontally integrated
        iii. Virtually integrated
    c. What should be the key strengths of this supply network?
    d. What are the key weaknesses of this supply network and what should we watch out for to avoid major problems?
    e. Other issues we should think about:
        i. Complexity
        ii. Resiliency

2. What will be your **supply chain investment strategy** keeping in mind the key capabilities needed to support the supply network design? (Which corporate function will be more important requiring investment to enhance capabilities?
    a. People
    b. IT tools and techniques
    c. Domestic versus international sourcing
    d. Outsourcing of components or insourcing

Source: Senior Executive Workshop, Cambridge, MA, January 4, 2007

Figure 16 Scenario Finalization Framework

Before discussing ways to analyze different responses from various groups to arrive at actionable outcomes, we would like to highlight a critical aspect of scenario planning and our proposed approach. Let us draw a pictorial analogy by showing each set of opinions from different groups in a different color as in Figure 17. Notice how each color (opinion) is different from each other in the top line and of limited value by itself. A focus on consensus building results in undermining the rich variety by creating an overriding new shade (opinion). Whereas using collaborative profiling, as done in scenario thinking, the coexistence of colors (opinions), leads to an enrichment of the different opinions instead of their replacement with a common view i.e. the official future. We will not discuss this process any further as it is well beyond the scope of this thesis.



Source: Senior Executive Workshop, Cambridge, MA, 01/04/07

Figure 17 Collaborative Profiling vs. Consensus

6. U.S. Pharmaceutical Market Analysis

In this chapter, we will discuss the analysis of the U.S. Healthcare market. We will utilize what we have learnt so far from the analysis of the supply chain described in Chapter 5. But given the high level of uncertainties and complexity that characterize this system, we propose a new scenario development approach to deal with the market shaping forces.

6.1 A Systems Perspective

To be sure, thinking about the future of a complex system requires us to first understand its past. Hence, we undertook a brief historical overview to grasp the forces that led us to the current situation and then envision the forces that may reshape the whole industry in the future.

6.1.1 The Cure of Disease: a Historical Perspective.

As mentioned in the introduction, this thesis will focus essentially on the cure of disease and not the care of health (Glouberman and Mintzberg, 2001a). Curing diseases is result of an intangible service and tangible products. The real value is not only in the product or the process that cure us but also in the knowledge that leads to pinpointing product or process as a potential solution.

In early ages, human beings used natural products to cure symptoms without even knowing the effects of such products on their metabolism. From Ancient Greek to current times, this knowledge of potential cures has been codified and transferred from one generation to the other. Overtime, the amount of knowledge became so important and complex that it required specialized training to master it. To put this in pure economic terms, the information cost became too high for an individual that efficiency and equity rationales prompted the need for a dedicated "knowledge keeper" namely the doctor.

Even though the introduction of knowledge specialists appeared logical, necessary and benign, it created confusion on who is really making the decisions. Is it the patient or the doctor? Instead of eliminating asymmetries of information, the foundation of the modern medicine generated concerns about imperfect consent. Do you, as a patient, have all the information in hand to make an educated choice?

The situation became even more complex with the development of competitive markets. Pharmaceutical companies and other insurers understood the power of doctors in the patient's decision making process and immediately saw the benefits of influencing doctors and surgeons through direct marketing (e.g. sales representatives), conferences and other means.

From a historical perspective, Healthcare is all about information and knowledge. The evolution that the U.S. system followed led to a more complex management of a simple information flow: which product or procedure for which symptoms or disease. Furthermore, complexity in an information market usually results in the triumph of middlemen. Middlemen identify asymmetries of information as business opportunities and if they are the only ones to understand this complex system and/or if they are the ones creating the complexity, they tend to gain a great deal of control (WSJ, 2006a,b,c,d,e). In such circumstances, seemingly rational behaviors of agents at the local level lead to a suboptimal outcome for society as a whole.

Needless to say, all this complexity creates an unduly convoluted health system. An interesting analogy could be drawn as follows. Person "A" goes to a local franchise restaurant and sits down at a table to eat. Person "B" arrives, looks at the menu, and places an order for "A". "B" orders a Diet Coke for "A", but it is told the restaurant only offers Diet Pepsi, not Diet Coke. "B" leaves, and "A" consumes his/her meal. "A" pays only 15% of the restaurant bill, then leaves. "C", from Aggregated Eaters, Inc. arrives, picks up the restaurant bill, demands a volume discount, and then pays the restaurant the discounted amount. *This is the U.S. health care!* (Source: Berndt, Ernst "What Differentiates Health Care from Other Industries? An Anatomical Overview")

Few people are capable of tracing the exact flow of goods and money in the Healthcare supply chain. Therefore, analyzing this market can be a challenging experience without a clear and simple framework. The cure of disease has always been about making an educated choice based on the best information available. Hence, we will first focus on market forces that prevent us form clearly identifying the decision maker. Indeed, the current decision-making process results from the trade-offs between three main players:

- The patient: he/she is supposed to make the final decision but asymmetries of information results in imperfect consent and incentives for adverse selection. It is worth noticing that patients are egoist since they are focused on their survival.

- The practitioners (e.g. doctors, pharmacists, surgeons, etc.) are the historical heirs of the medical knowledge. The Sermon of Hippocrates invites them to act in the best interests of the patients; they should be drivers of equity. Yet, patients and market lobbying sometimes blurs their judgment.

- The payer (e.g. insurers) funds the requested interventions and drugs. Their agenda varies but is often unclear as they have a hard time figuring who is their customer and what are their best interests (curing once and for all with an expensive treatment that may not work or alleviate pain using a long but low cost solution).

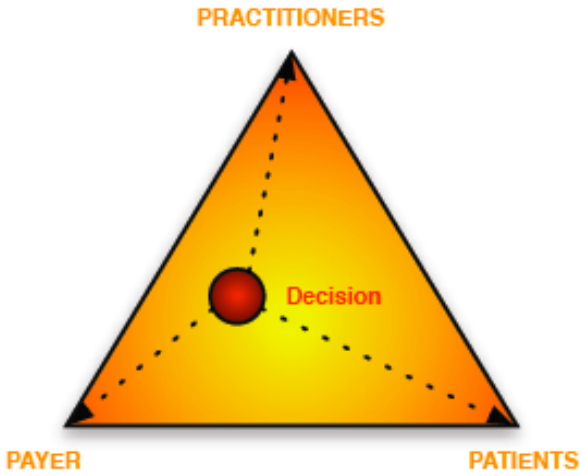


Figure 18 Healthcare Decision Triangle

6.1.2 Three Flows – A Supply Chain View

Interestingly, the triangle shown in Figure 18 also reminds us of the three flows that characterize a supply chain: money, information and physical goods (Chopra and Meindl, 2006). Each corner of the triangle represents a specific flow. Practitioners manage the information, the patients receive the physical product (i.e. the drug) and finally, the payer funds the transaction of information and physical goods. The U.S. Healthcare system, and specifically the pharmaceutical

business, present a peculiar situation wherein the three flows that define a supply chain are not intertwined as previously illustrated in our short story about U.S. Healthcare (see Section 6.1.1). This situation is unlike most other industries where the same players manage these three flows. As a result, a supply chain perspective is all the more valuable to our objective of analyzing this system.

Our historical overview revealed the crucial importance of information in the system. Therefore, we focused on the information flows between the key players to initiate the analysis. We will particularly highlight the importance of asymmetries of information, as we believe that Market failures are the main source of inefficiencies in the U.S. pharmaceutical market. Indeed, the U.S. government intervenes more as a market player (e.g. Tricare) than a market rule maker. It deliberately decides not to exercise the full extent of its bargaining power (NYT, 2007). Therefore, government failures are a weaker driver of inefficiencies as mentioned before. Furthermore, the Market failures are potential challenges to this system in the future so we will translate them into future uncertainties in the Section 6.4.

6.1.3 Market Failures Analysis

In reality, any relationship in this triangle is not efficient because of information asymmetry. We will identify and characterize information asymmetries that have the potential to undermine the efficient flow of information and knowledge.

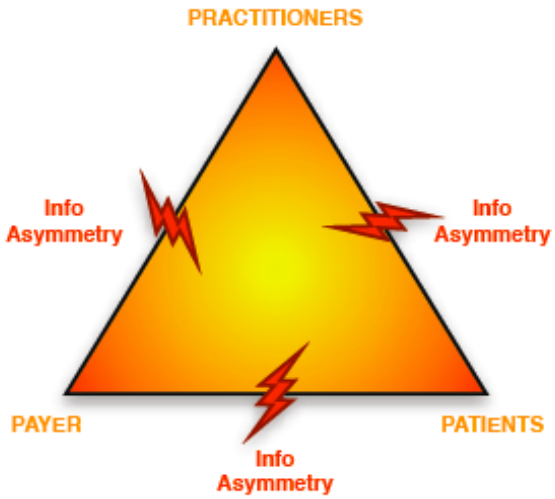


Figure 19 Healthcare Decision Triangle Crippled by Information Asymmetries

Information Asymmetry between Practitioners and Patients

This information asymmetry is driven by the fact that consumers know little about the practitioners' record (Porter and Teisberg, 2004). Except word of mouth, no information is publicly available to assess the quality of a particular doctor or surgeon. How many similar surgeries did he/she successfully perform? How knowledgeable is he/she on diabetes? The lack of public record prevents patient from making an informed decision; there is imperfect consent.

However, the progress in technology and access to information (e.g. the Internet) is inverting the asymmetry of information. For instance, patients have free access to HIV testing and are not obliged to share the results with his/her physician. In the past, some of the patients took advantage of this asymmetry of information to get their doctor's referral for life insurance without mentioning their HIV positive status (Dixon, 2007). The growing connivance between practitioners and employers or insurers give people's the incentive to hide critical information from their doctors. Why would you release information that will be detrimental to your insurance coverage or job?

Information Asymmetry between Payers and Patients

The payer / patient relationship is threatened by the risk of adverse selection and moral hazard. This issue is particularly significant in the insurance and health benefits market. To reduce the negative effect of adverse selection, insurance companies choose to shape their risk pool. They raise the rates of unhealthy patients and target low risk situations that only large payers and employers can propose. The threat of adverse selection has driven the disease cure system towards less equity and more ineffective incentives.

Providing discounts for big accounts does not make medical sense as well as reimbursement practices that encourage physician to quickly discharge patient and readmit them if needed (Porter and Teisberg, 2004). The compartmentalization in preferred network to control information and diminish risks raises serious issues of discrepancies in coverage and accessibility. This type of behavior drives health costs up and nurtures moral hazard: high insurance costs will invite people to adopt costly behaviors to justify the premium they pay e.g. going to the ER for a cold!

Information Asymmetry between Payers and Practitioners

The current incentives in the U.S. Healthcare system place payers and practitioners right in the middle of liar's poker game. Physicians have no incentive to spend extended time with a patient and truly cure their disease. On the contrary, they would be better off if the patient is readmitted to deal with the same problem! HMO and insurers have interest in assessing the quality of doctors, which further increases the health bill. This is a classic Principal/Agent problem. Hence, in the end, it results in a suboptimal outcome despite the rational behavior of all the agents.

All these asymmetries result in more complexity and golden business opportunities for third parties intermediaries. The complexity creates incentive to shift costs across the system so that nobody really knows who is paying what. Middlemen will propose to shield players form risks arguing that it is more efficient for one player to gather all the information given the high information costs. Pharmacy Benefit Management (PBM) companies offer their services to employers and HMOs to find the best price for a given drug. Last year, the big three PBM recorded a net income of nearly $2 billion (WSJ, 2006c). Middlemen are taking advantage of information asymmetry to build their business model.

Clearly, the current situation is very unstable. Demographics signals as well as technology breakthroughs (e.g. gene screening) threaten the continuation of status quo represented by the current "competitive" system. Governments have always strived to control abuses but the current policies: labeling, judicial protection through tort and pure command and control regulations (e.g. FDA drug approval) will not compensate for the extra pressure created by the aforementioned factors. Indeed, as recent legal cases proved, pharmaceutical companies tend to hide valuable information from patients to protect their investments. For example, the side effects cited in a TV commercial are only the truncated list of symptoms people should monitor after taking the drug. Governments tried to minimize those effects through labeling and strict tort law. Nevertheless, this shielding is not enough considering U.S. legal history; even the high penalties are not significant enough to force pharmaceutical companies to publish early warning signs on a blockbuster.

In short, a total rethinking of the system is necessary to make the system more efficient. But, how can we prepare organizations to change in the midst of such complexity and uncertainty? How can we go beyond the challenges of today to understand the true driving uncertainties and trends? How can we leverage the uncertainties and trends to develop effective future scenarios?

6.2 SC2020 Framework to Market Analysis

Given the specificity and the complexity inherent to the U.S. pharmaceutical industry, our previous approach to scenario planning, as described in Chapter 5 may not be effective although our objective still remains to challenge mental models. This will in turn requires us to obtain a deeper understanding of key uncertainties and trends that may re-shape the industry as we know it today. Hence our approach needs to be more inductive and driven by industry nuances.

To this end, we propose a new methodology based on the analysis of pharmaceutical industry trends and uncertainties. The following sections (6.2.1 and 6.2.2) describe the core beliefs that motivated this new framework. The key steps of this methodology are presented in Section 6.2.3. For a more a detailed treatment of this framework and related core beliefs we refer the reader to our working paper "A Framework to Plan for the Future" (Singh and Lagarde, 2007).

6.2.1 Leverage *Not* Control

From the Sun Tzu's "Art of War" to the invention of game theory, military strategists have heavily influenced the Western style of business management techniques. The word that comes to mind when thinking about military strategy is *control* - whether it is the control of your soldiers or your environment. This thirst for control is behind the fatal attraction to predict the future. Predictability is in effect achievable if one succeeds in controlling the causal decision making in his/her organizations e.g. if X happens, my units will do Y. Military organizations usually rely on heavy training to ensure high degree of control.

It is clear that this desire for control is predominant in the Western style of management as well. The industrial revolution combined with the emergence of management as a science provides several reasons fueling this desire for more control. In simple terms, the human factor has been slowly reduced to numbers; numbers have been factored into forecasts and systems reactions

have been cautiously converted into standards procedures e.g. an increase by 0.4 man-hour will lead to a 2% increase of productivity.

Although a control laden approach works well in a deterministic environment, it is counter productive in highly uncertain times. This desire for control has led many organizations to overlook potential new opportunities or act ineffectively in recent times. Control requires standards and replicable outcomes. Indeed, as the Indian saying asserts: "when you are a hammer, everything looks like a nail". That is why we advocate *leveraging* instead of *controlling*. In our opinion, going forward, leverage will be the key operative management phrase and not control.

To draw a simple analogy, leveraging is what distinguished great sailors from good ones. Leveraging our environment requires us to get "detached" from the past to reach the goal. One rarely wins a regatta by taking the shortest path or the same ones we usually take to win.

Furthermore, the desire to control is ingrained in the human nature. The need to control the environment makes uncertainties disappear behind a wall of assumptions. While this may be acceptable in the short to medium term, the high uncertainties inherent in long-term planning make this type of behavior particularly dicey. To overcome these shortcomings, we propose a framework around the understanding and leveraging of uncertainties.

6.2.2 Uncertainties *Not* Trends

When it comes to thinking about the future of an organization, most people rely on trends to provide them with the necessary insights. It is common to find many seminars where futurists come and present the trends that will shape the future of the company or the industry. Even before questioning the accuracy problems associated with trend predictions, we wonder if trends can be a source of sustainable competitive advantage.

Note that at the most, a trend will give you the direction of future state but not the actual path. Examples abound to prove that knowing a trend is important but of no value if you do not follow the right path. As an example, Apple was certainly one of the first companies to pick up the trend

of high portability: with the advances in computer miniaturization, people would soon be able to manage their business life with one palm-size tool. Apple launched Newton in 1994 (Figure 20) long before anyone else. This hand-held device featured hand writing recognition as well optional wireless capabilities. In 2006, CNET compared the Newton and the latest Samsung Q1 and the Newton was found better (CNET, 2006). Why is it then that Newton is not a player in this fast growing segment?

Source: Wikipedia, http://en.wikipedia.org/wiki/Apple_Newton, accessed 04/05/07

Figure 20 Apple Newton & Samsung Q1

Apple certainly picked-up the high portability trend before anyone. The direction was the right one and the final vision correct i.e. people will use hand-held devices to manage their business life. Yet, the high prices and poor preliminary quality of the handwriting recognition software failed to place them on the right path. Additionally, people were also not yet ready for such a device and education was first necessary to make them see its value. Later, Palm products succeeded by correcting the path that Apple took.

In other words, the value resides not only in knowing the trend but also in the understanding of the uncertainties attached to it e.g. are people ready to change the way they write? The analysis of the uncertainties that will shape the industry is thus of paramount importance for long-term planning as these uncertainties will act as constraints as well as opportunities.

6.2.3 Key Steps

Our methodology relies on two important inputs: the analysis of trends and uncertainties as well as the understanding of the trade-offs between the key decision players that will impact the future of the industry.

Step 1: Exploring the Macro Factor Environment

In Section 4.2.1, we showed that a characterization of the driving forces in an inductive approach was of paramount importance (Figure 6). In this case, the key driving forces are presented in the form of uncertainties and trends. A closer look revealed that these trends and uncertainties can be segmented into three categories namely, Short-Term Uncertainties (trends that we know will happen in the long-term but very uncertain in the short-term e.g. the "green revolution"), Long-Term Uncertainties (trends for which the short-term unraveling is fairly well known but the long-term end state is fairly uncertain e.g. price of oil) and True Uncertainties.

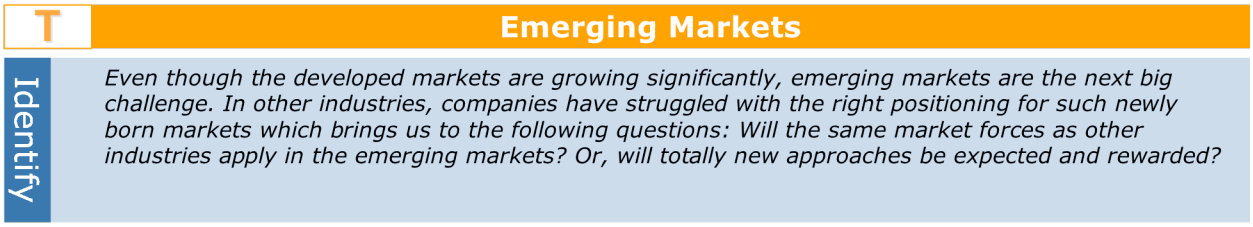
To implement this idea, we developed a three-step assessment tool as described in Table 6. This taxonomy forces organizations to explore the potential impact of each trend and uncertainty on their organization in significant detail. Incidentally, this is also the first step towards the identification of the "sensors in the ground" that a company should monitor as the future unfolds.

	Objective	*Methodology*	*Result*
Step 1: Identify	• Acknowledge the presence of uncertainties	• Literature review, interviews etc. • Be curious!	• Best remedy against blind spots
Step 2: Explore	• Assess the range of potential outcomes	• "Flip" the current beliefs - "Why Not?" *(Ayres & Nalebuff, 2003)*	• First steps towards "what if?" thinking
Step 3: Reflect	• Analyze and Characterize what it means to your	• Spider Web Chart • Sensors in the ground	• Moving towards "scenario thinking"

Source: Scenario Planning Workshop, Cambridge, MA, March 27-28, 2007

Table 6 Three-Step Trends and Uncertainties Assessment

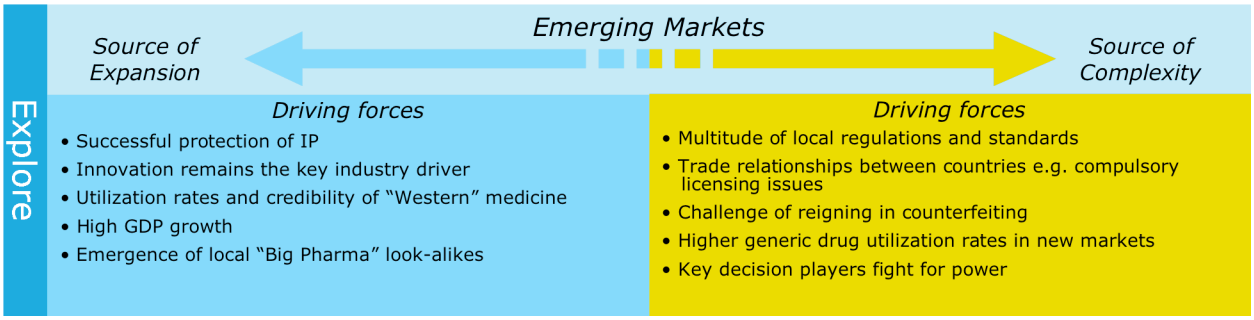
Identify: The scenario development team is responsible for identifying future trends and uncertainties. Both primary (e.g. interviews) and secondary research (e.g. external reports) constitutes key sources of uncertainties and trends. The team will write small paragraph explaining why this trend or uncertainty is worth considering. This it the *identification* step (Figure 21).



Source: Scenario Planning Workshop, Cambridge, MA, March 27-28, 2007

Figure 21 Trend Example - Identification step

Explore: The scenario development team will then propose two directions that the uncertainty or trend can take. Conventional wisdom is always a safe choice to get the most obvious side of the story. However, by "flipping" it, the team will create another very challenging direction (Ayres and Nalebuff, 2003). Then, the scenario development team can either explore these two directions on its own by considering the driving forces behind the uncertainty/trend or ask other scenario users to do it. This is the *explore* step (Figure 22).

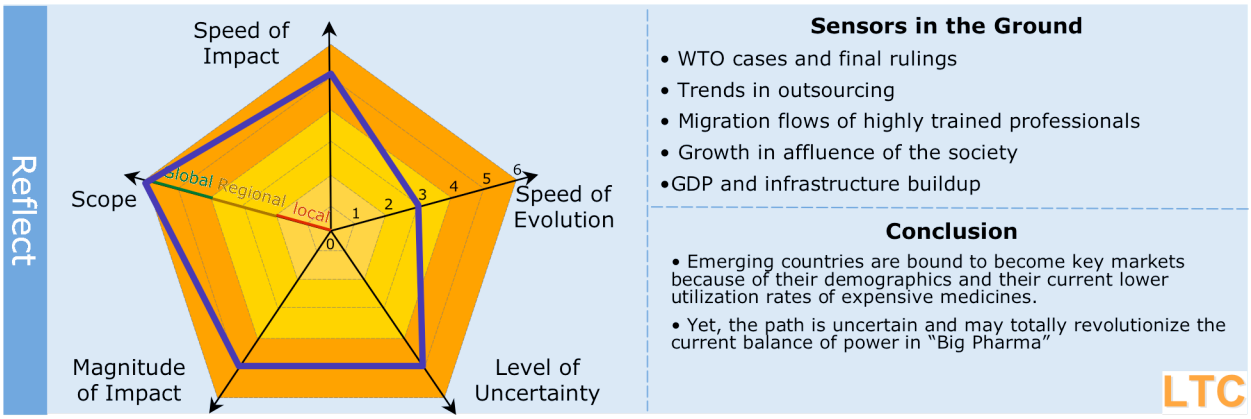


Source: Scenario Planning Workshop, Cambridge, MA, March 27-28, 2007

Figure 22 Trend Example - Explore step

Reflect: Finally, either the scenario development team or the other scenario users will fill out a spider web chart. This chart invites them to rate several factors namely: speed of evolution, speed of impact, magnitude of impact, scope and level of uncertainty. Potential "sensors in the

ground" will also be singled out in this step. A short paragraph will conclude the organization or team's position about this trend or uncertainty after brainstorming. This uncertainty or trend will fall into one of the three aforementioned categories. This is the *reflect* step (Figure 23).



Source: Scenario Planning Workshop, Cambridge, MA, March 27-28, 2007

Figure 23 Trend Example - Reflect step

These three steps are collectively shown in a single card called the factor card (Appendix II). It allows external users to capture all the relevant details about this trend or uncertainty at one place.

\Step 2: Market End States Generation

Exploring a market driver provides its share of insight. Yet, true complexity arises when overlaying of market drivers leads to unexpected results. Nevertheless, it is very easy to structure the previously created uncertainties into challenging end states or small scenarios.

The framework we developed for this step is inspired by the approach Shell took in its latest scenario development exercise (Shell, 2005). First of all, it requires the identification of key decision players that will shape the future of the industry. Is it the customer? the consumer? the manufacturer? or, the government? There is no exhaustive list of potential key decision players. It is the scenario team's responsibility to identify the key players through interviews and workshops etc. Our experience suggests that identifying three players is usually good enough to form a solid foundation to develop rich scenarios (Figure 24). The internal portion of the triangle represents all the possible futures for the industry based on the different levels of interaction amongst the three players.

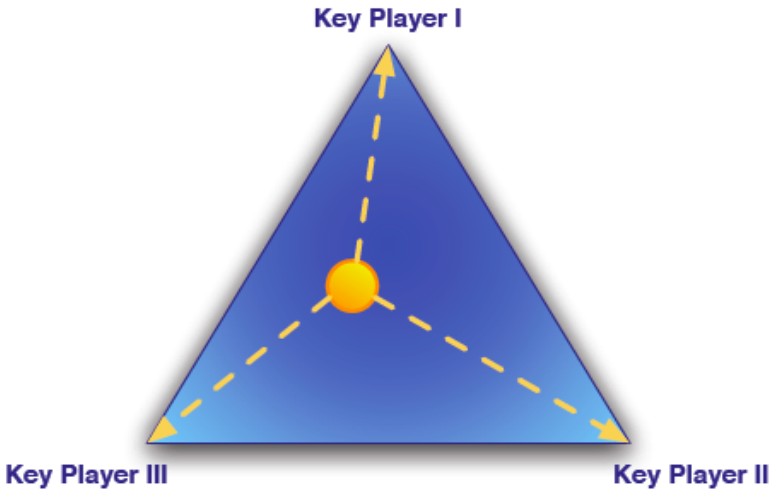


Figure 24 Triangle of Decision

It should be noted that this framework is merely a tool to channel and structure people's imagination. It will never ensure complete exhaustiveness but it will lead to the creation of rich and challenging situations, which is the first objective of Market analysis. After the construction of the triangle and selection of "two wins, one loss" trade-offs, we will overlay them with some of the previously analyzed uncertainties. Specifically, one side of the uncertainty will be picked and a story will be built based on those "what if?" situations (Figure 25).

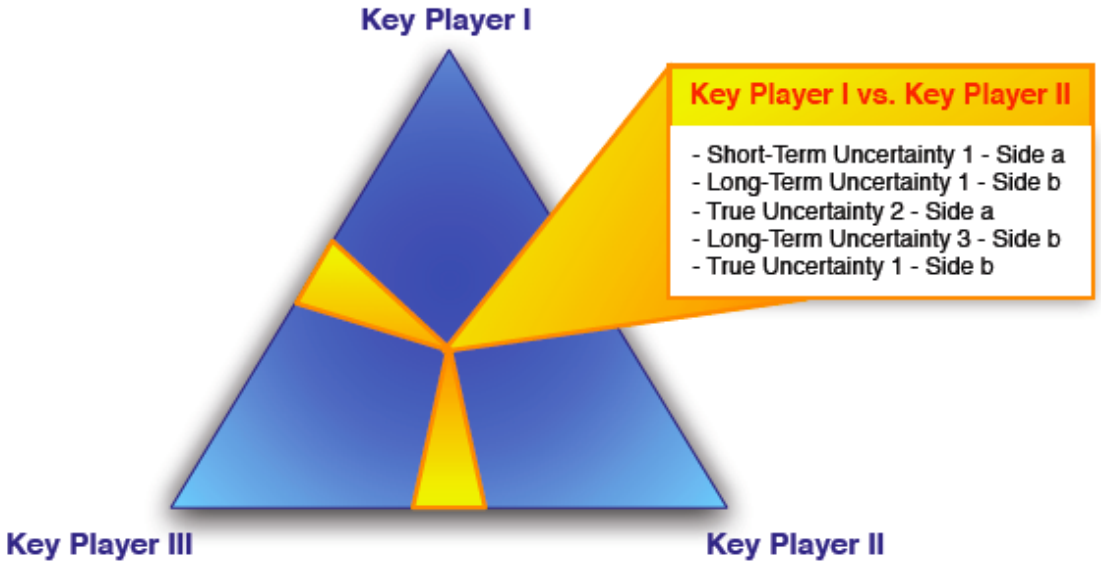


Figure 25 Trade-Off Analyses of Uncertainties

Step 3: Market Final Scenarios Generation

The scenario development team will then provide a list of questions to move towards strategizing and to identify the sensors in the ground that the scenario users will have to track. There is no pre-set list of question although some of them will be recurrent e.g. who is your consumer? What should be on your agenda? etc. These small scenarios can either be considered as segments of the market in themselves or combined to form a broader picture of the future market.

6.3 Results

The following sections describe how we used the proposed methodology to create different snapshots of the U.S. pharmaceutical industry in 2020.

6.3.1 Uncertainties and Trends

Our literature review and interactions with "Big Pharma" executives provided us with a few trends and uncertainties that we tested in two different workshops – with our pharmaceutical partner (Cambridge, MA, 01/23/07-01/24/07) and supply chain executives from various industries (Scenario Planning Workshop, Cambridge, MA, 01/27/07-01/28/07). We discussed these trends and uncertainties in the breakout sessions using the aforementioned factor cards (Appendix II) following our three-step framework i.e. identify, explore, and reflect.

Each uncertainty and trend is presented as a two-side uncertainty (Table 7). All the following material is a direct output from our workshops.

Description	Side a	Side b
Government Power	Rule-Taker	Rule-Maker
Emerging Markets	Source of Expansion	Source of Complexity
After-Patent Life of a Drug	Generic Blockbuster	Opportunity for Customization
"Big Pharma" Pricing Strategy	Price-Setter	Price-Taker
Hi-Tech Screening Devices	Discrimination Amplifier	Prevention Facilitator
R&D Environment	"Networked Pharma"	"Chinese Wall Pharma"
Biotech Revolution	Revolutionary Products	Deceiving Results
Community of Care	Highly-Certified Membership	"Open-Source" Community

Table 7 Pharmaceutical Industry Uncertainties and Trends

As an aside, we noticed that only a very few people were able to think about their industries in terms of uncertainties, in most cases the discussions about the future tended to revolve around trends.

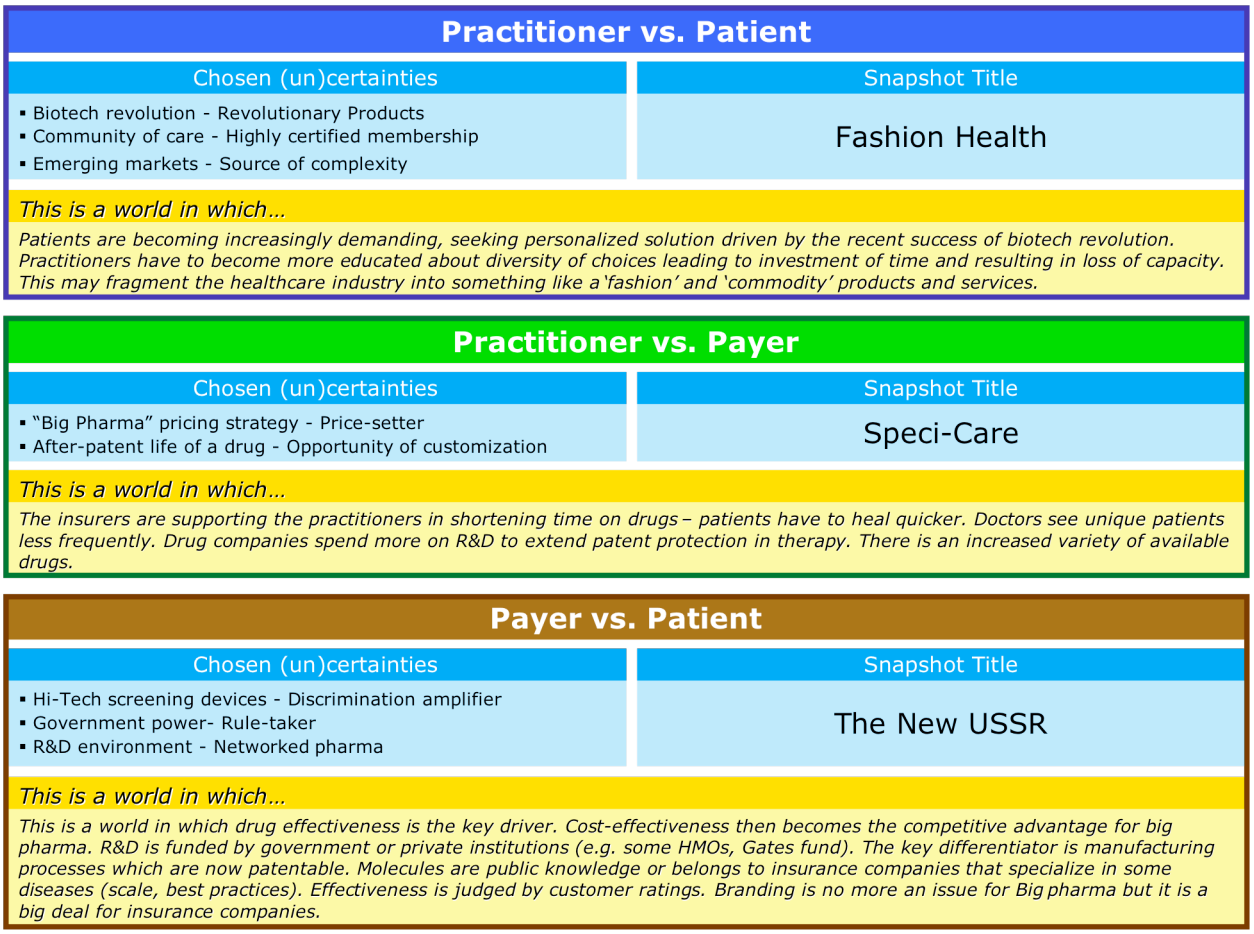
6.3.2 Market Snapshots

Who are the key decision players in the U.S. pharmaceutical Industry? Our market failures analysis demonstrated the power and robustness of the triangle of decision defined by payers, patients and practitioners (Figure 18).

Hence, we decided to use the same triangle to structure the snapshot generation sessions. In each workshop, we divided the audience into three groups; each of which received one particular trade-off "two wins, one loss" to study. Each group used the previously analyzed uncertainties to develop challenging future pictures of the U.S. pharmaceutical business environment. To promote healthy and in-depth discussion, we also provided them with nine questions that helped them explore the newly created worlds:

- Who is your consumer?
- Who has the most power in the value chain?
- Who are your competitors?
- What is the basis of your competitive advantage?
- Where do your margins come from?
- What skills and capabilities make you unique?
- What are the corresponding products and services?
- What are the top three opportunities and threats?
- What are three key supply network characteristics in this environment?

Finally, we asked each group to choose a title for their description of the world. For ease of use, we developed a Story Board card that allowed accessing all the necessary information at one place (Appendix III). The results of the breakout sessions are summarized in the following figure.



Source: Scenario Planning Workshop, Cambridge, MA, March 27-28, 2007

Figure 26 Pharmaceutical Industry Market Snapshots

6.3.3 Market Scenario

The stories created so far can be considered as scenarios. Yet, they lack story telling component and connection to the present times that makes scenarios very effective. Roberto Perez-Franco, a PhD student in our research group, leveraged different "bits of story" and wove them into a much more captivating story (Appendix IV.)

7. Synthesis and Recommendations

During the course of the research, we learnt a lot of lessons that changed the way we thought about the U.S. pharmaceutical industry. Each research activity led our thoughts into uncharted territories and helped us refine our ideas and understanding of the sector. The workshops were clearly the most challenging and unusually rewarding aspect of the whole project. In this chapter, we will summarize some of the key lessons we learned from different workshops and other research activities to carry out the investigation of the U.S. pharmaceutical industry. We also present the next steps and potential research directions to further this work.

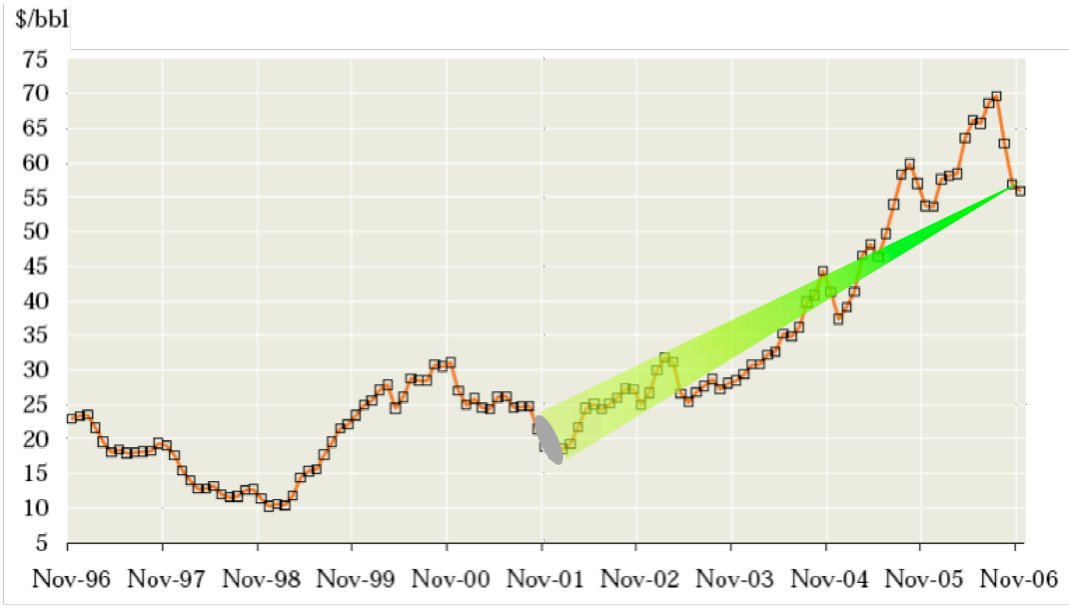
7.1 Towards Global Scenarios

Our experience during the course of this research has convinced us that scenario thinking is a simple and effective tool to stimulate forward thinking. Yet, for it to be of real value to organizations, concrete actions must follow this endeavor? Indeed, one question that questions its effectiveness is: why are companies reluctant to use scenario planning if it is so powerful?

In our opinion, the main reason behind the unimpressive record so far seems to be the fact that despite being highly qualitative in nature, scenario planning exercise requires rigorous analysis of huge amounts of current data to be effective. And, few companies can afford this kind of investment. Furthermore, organizations have to follow a highly disciplined approach to allow the process and terminology to become a part of the company culture. In many ways, the key benefits of scenario planning accrue over time - mostly intangible and indirect. As a result, absent direct and immediate results, it is quite easy for organizations to lose faith in scenario planning process and abandon it by declaring it ineffective rather prematurely. Nevertheless, we argue that scenario planning can be successfully used without going through the typical time-consuming process.

We also believe that many scenario planning exercises failed to deliver because they were just regarded as a “fancy” forecast experiment. Instead of having one end state, the organization had three or four of them. To draw an analogy, let us do a thought experiment about the future of the oil price. Suppose we can go back in time and find ourselves living in November 2001 and our

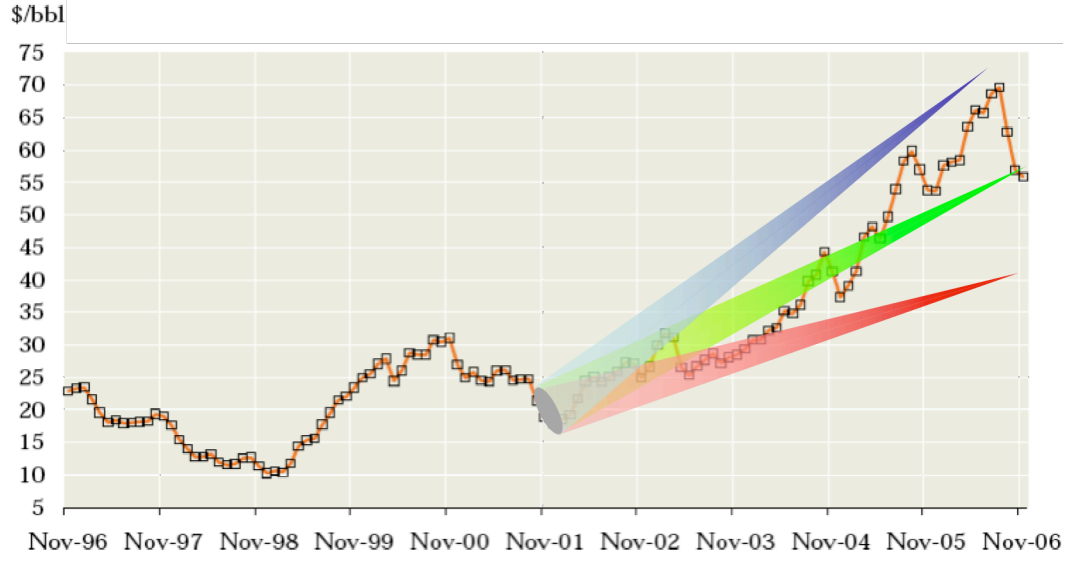
objective is to predict the future of oil prices in the next five years. After some sophisticated analysis of the historical data, suppose we arrive at an accurate "point forecast" of $55 per barrel in five years (Figure 27). But, herein lies the problem even with the extraordinarily "lucky" guess of $55: is there any competitive advantage attached to this forecast? Although we know the final point forecast with precision but what about the price volatility during the course of the five years? How will such volatility impact the revenues? costs? How can we take price volatility into account especially during highly uncertain times?



Source: IEA Oil Market Report - Average Cost of Imported Crude Oil - *IEA Total - 13 February 2007 © OECD/IEA 2007*

Figure 27 Price of Oil - Point Forecast

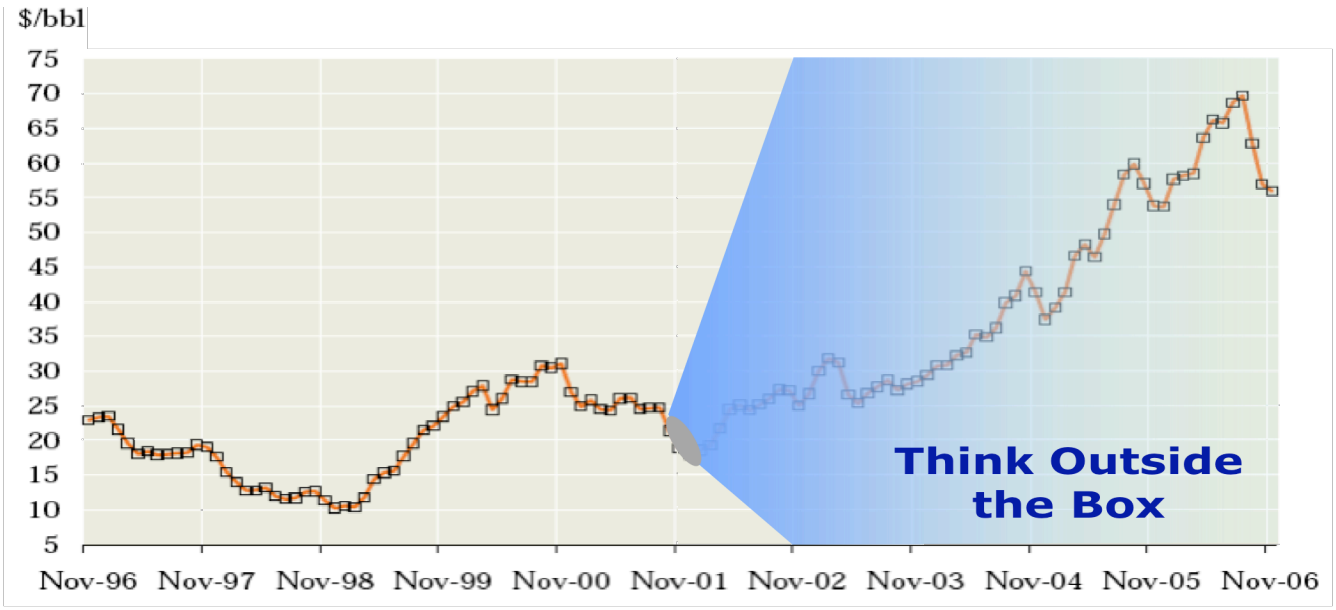
This is where scenario thinking comes to the rescue (Figure 28). By looking at three diverse pictures of the future, we are more likely to be better prepared for different possible price ranges. However, if the outcome of the scenario exercise remains limited to those three pictures, we have effectively created a "fancier" tool for point forecasting. The problem of variability is still unaddressed.



Source: IEA Oil Market Report - Average Cost of Imported Crude Oil - *IEA Total - 13 February 2007 © OECD/IEA 2007*

Figure 28 Price of Oil - Three Scenarios

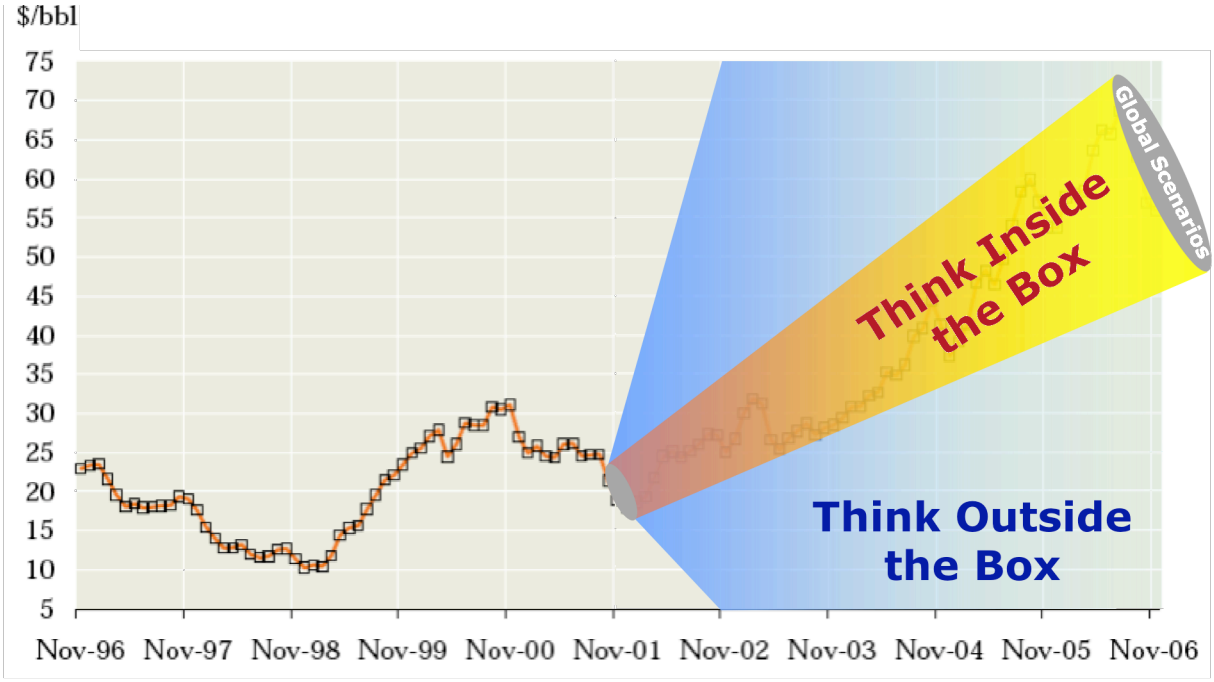
The key to success is instead the use of the scenario thinking concepts to challenge underlying beliefs and "thinking outside the box" (Figure 29). By forcing an organization to consider a vast range of possibilities, we can unlock hidden mental models and emphasize the importance of the path leading up to the future (as discussed in Section 6.2.2)



Source: IEA Oil Market Report -Average Cost of Imported Crude Oil -*IEA Total - 13 February 2007 © OECD/IEA 2007*

Figure 29 Price of Oil - Thinking Outside the Box

Nevertheless, “thinking outside the box” is not an entirely suitable mindset for decision-making. Unlimited options and possibilities often paralyze decision makers. Hence to be effective, we need to “think inside the box” (Ayres and Nalebuff, 2003) to narrow down the possibilities and paths to consider. To this end, the merged market and supply network scenarios into three or four comprehensive global scenarios help redefine the “box” with new boundaries to facilitate practical thinking (Figure 30).



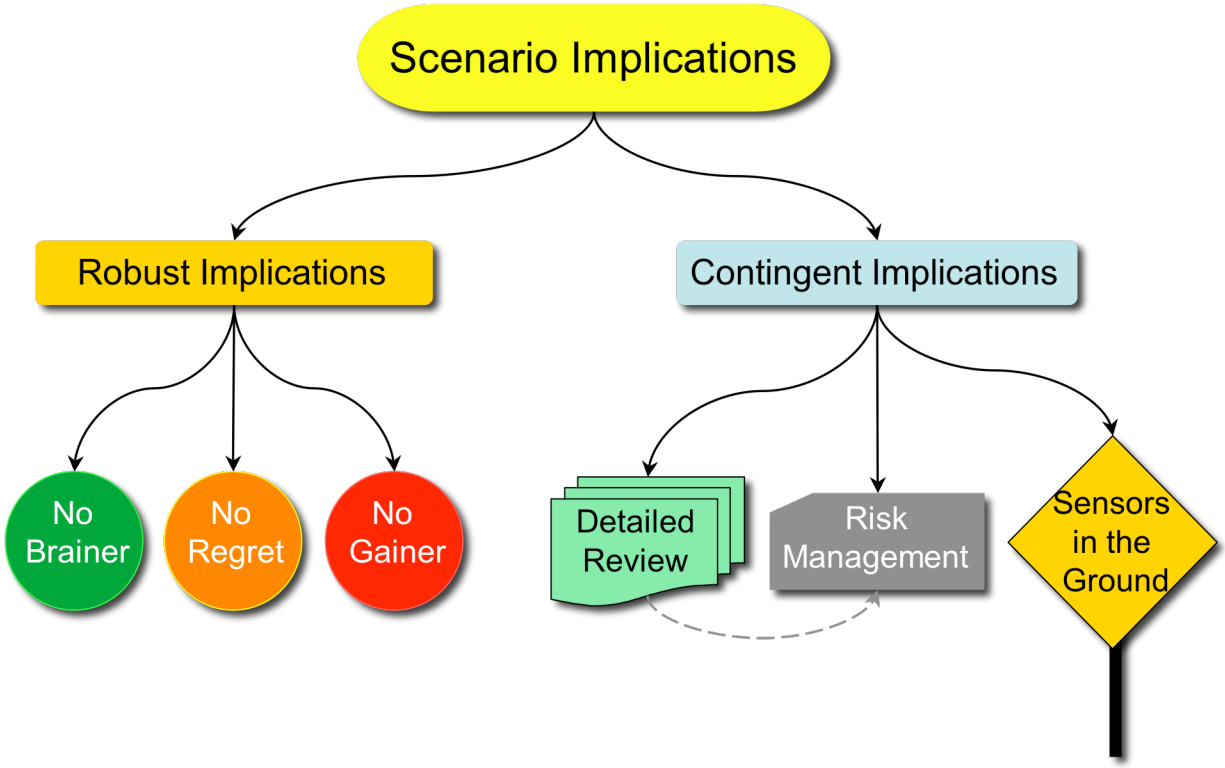
Source: IEA Oil Market Report - Average Cost of Imported Crude Oil - *IEA Total - 13 February 2007 © OECD/IEA 2007*

Figure 30 Price of Oil - Think Inside the Box

7.2 Evaluating Scenario Planning Implications

Each one of the global scenarios previously created is subject to a deeper analysis using a set of predefined questions. This analysis helps the decision makers obtain a better sense of the impact of different macro factor environment on key business aspects. Furthermore, the team is asked to think of response if the presented world were to come to fruition. At the end of the whole process, the team has a greater appreciation for the external forces and a good sense of options available to the organization under different situations. But in itself, this information is still not actionable.

To make better sense of the responses collected from the decision makers under different scenarios, often labeled as Scenario Implications, a simple process is deployed to analyze them (Figure 31).



Source: Singh M., Lagarde L. (2007), "A Framework to Plan for the Future", Working Paper, February 22, 2007

Figure 31 Scenario Implications Analysis

A simple way to categorize scenario implications is to group them into robust and contingent implications. Specifically, all the response (scenario implications) that didn't change when the external macro factor environment changed fell under the category of robust implications, all others are labeled contingent implications. Within the robust implications category, a strategic option that appears to be beneficial in every scenario is called a 'no brainer', a 'no regret' implication is a strategic option that will be beneficial in one or two scenarios but neural in the others. A 'no gainer' implication is usually a current strategy feature that will suggests that it has a negative impact in every scenario and thus should be abandoned immediately.

Typically, most scenario implications fall under the heading of contingent implications and present opportunities and threats of high impact without common pattern across the scenarios. Being contingent on a particular scenario, these implications force a more detailed review and a

comprehensive risk management approach before implementation. Sensors in the ground form a key part of the solution and should be further studied to secure a timely reaction to any change.

7.3 Healthcare Policy Recommendations

Although work on this project is still ongoing, our research has uncovered some interesting insights on the U.S. Healthcare system as a whole. We will now present some salient ideas based on our enhanced understanding of this sector.

7.3.1 Designing a New Healthcare Policy: Options and Dangers

In most cases, any attempt to correct the U.S. Healthcare system has resulted in unexpectedly poor outcomes. We believe that any major change should follow a holistic approach instead of being driven by a multitude of locally optimal solutions. As Michael Porter and Elizabeth Teisberg underlines in their papers, competition is the root of the problem but also the solution (Porter and Teisberg, 2004). Yet, given the current pressure on Healthcare spending, the government is bound to intervene eventually. Our current decision triangle does not directly cover such a case (Figure 18); yet, it can be easily tuned to analyze the first-order impact of any governmental action.

Involvement of government as a rule-maker is bound to generate divergent scenarios. Clearly, the active role of government will reshape our decision triangle through regulations or otherwise. Indeed, governments usually respond to information asymmetries through four different types of policies

- Laissez-Faire;
- Provide information on risks and precaution (labels);
- Judicial protection through torts;
- Command and control regulations.

At the same time, other main decision players will strive to shape the political outcome in their own best interests by influencing government's action leading to unexpected potential failures (Figure 32):

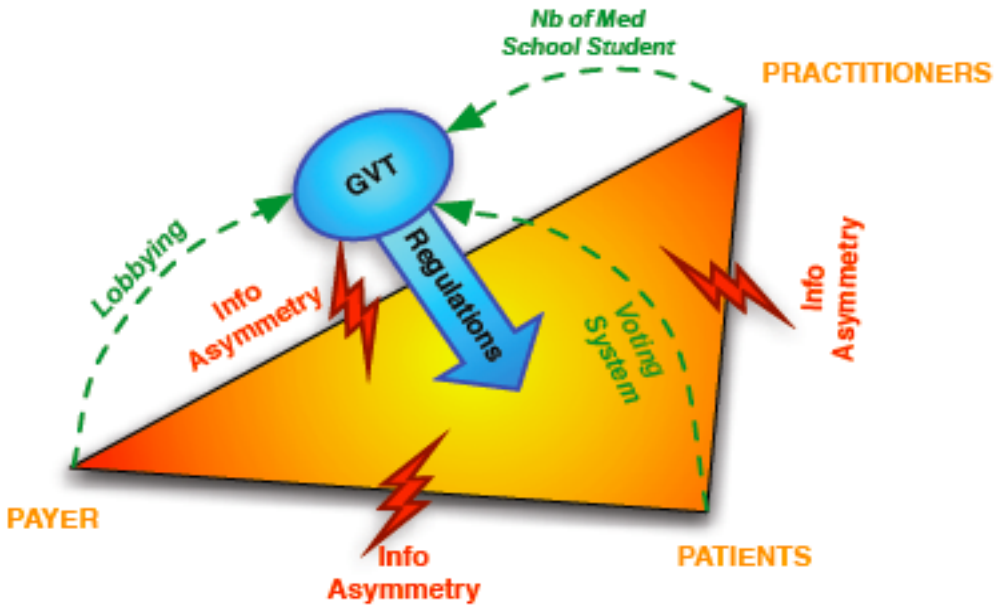


Figure 32 The Government Impact on the Healthcare Decision Triangle

- *Payer / Government Interaction*.

Especially in times of high uncertainty, markets and payers will pressure government to adopt regulations that will enhance their competitive advantage while protecting their current market. Lobbying and bargaining costs will also drive costs up. In political science literature, these cases are referred to as Stiglerian regulatory capture.

- *Patients / Government Interaction*.

Patients will advocate in favor of an equal access and coverage thanks to the power of votes. Yet, this is a classical collective action dilemma; individuals will push for equity but are only interested in their personal coverage. Health is a very sensitive and personal issue. In such a case, coordination costs are very high.

- *Practitioners / Government Interaction*.

Practitioners have only a limited direct influence on regulators. However, a society will always need doctors, surgeons, nurses and pharmacists. The attractiveness of these careers to young people is critical to ensure the health of the population.

Any design of public policy should keep in mind both the potential options as well as the related risks. The convoluted interactions between the forces and drivers at play (hidden as well as apparent) will decide the fate of any public policy. In effect, any regulation will trigger reactions from the market to reshape the outcome in favor of concentrated interests. It is also known in political science literature as a typical Olsonian case where the diffused interests of the patient population will struggle to overcome the over representation of the industry's concentrated interests. And yet, the diffused interests have to be considered. Finally, any regulation that may redefine the responsibilities or rights of practitioners bear the risks of lowering the number of interested students in health related careers.

7.3.2 Healthcare 2.0 – Towards a Seamless Flow of Knowledge

The challenge facing the Healthcare sector is fairly easy to describe: Reduce the Healthcare cost while increasing the quality of care? But this simple challenge leads to a host of other related challenges and problems such as how can we align the interests of counteracting interests inside the Healthcare nebula to prevent suboptimal outcome?

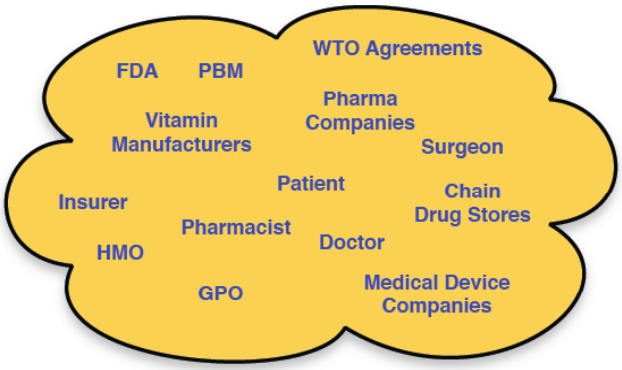


Figure 33 The Healthcare Nebula

This section should not be read as a pretentious attempt to lay the basis of a new Healthcare system. On the contrary, it should be treated as a presentation of interesting opportunities and dangerous pitfalls that recent advances in technology render possible.

In many ways, technology seems to offer a potent solution to most Healthcare challenges. Incidentally, the "Pandora Box" is already open. Advanced gene screening technologies are now

freely available and it is impossible to turn a blind eye to the promising advantages of such breakthroughs. But these technologies also bring scores of direct and indirect problems with them as well. The question then becomes how to integrate these double-edged solutions. The challenge is certainly not as insurmountable as it seems. The current Healthcare system is already using advanced monitoring methodologies to manage patient care: insurance companies keep track of drug expenses, diseases patterns. Employers also access the same information. Hence, instead of fighting against an inevitable change, we should think about ways to leverage these new opportunities to alleviate asymmetries of information.

We have repeatedly highlighted the decisive importance of information and knowledge flow in Healthcare systems. To this end, the recent revolution in the information technology has given us the capability to enable seamless and secure exchange of standard information between a number of stakeholders. In other words, we can now manage information directly at the patient level and make the Healthcare system patient centric and patient driven. The availability and transmission of medical knowledge in this way can open the doors to interesting opportunities such as:

- The continuous monitoring of patients health could shift our attention to prevention instead of last minute reaction. This change in focus is bound to drive costs down. But we have to be careful about selecting the information that should be monitored and how to protect this potentially dangerous personal data?

- Computerized standard operating procedures (SOP) could be available to patients. Following the same treatment can efficiently cure many common diseases. For instance, curing a cold does not always require the intervention of a doctor. Likewise, after a preliminary exam by a physician, treatments for chronic diseases such as diabetes can benefit from the existence of standard procedures. Of course, computerized SOP can be designed to point out any irregularity in effects that requires closer attention of a physician. Recently, two British doctors used Google to research the solution to the case diagnoses published in the *New England Journal of Medicine*. They found the right answer 58% of the time (Tang, Ng, 2006). The question is then: how to make this information accessible and understandable to

patients? Which diseases should be considered a candidate? Should the system go as far as proposing Over-the-Counter (OTC) drugs as potential treatments?

- Most of these improvements rely on the widespread existence of standard medical electronic record files that will permit data pooling on specific diseases. This is the direction both the U.S. and Europe are heading towards. A close monitoring of these projects' success will provide valuable insights about the feasibility of our propositions.

A lot of questions are still unanswered but the possible decrease in cost is unlikely to be enough to ensure voluntary participation of health insurance companies. Currently, insurance companies only respond to additional information by raising or decreasing premiums. They, however, tend to underestimate the value of such information. The pooling of personal data in an anonymous and aggregated fashion is likely to generate a better understanding of the prevalence of certain genes profiles in society e.g. 7% of the diabetes possess a certain predisposition that generates side-effects with molecule Y. Indeed, protection of this information will be of paramount importance requiring patient's consent. Yet, in an aggregated form, such a data market would be highly beneficial to the pharmaceutical companies as it would reduce R&D risks by giving a good estimate of the market size for a particular molecule. This could be especially useful for orphan drugs.

Moreover, the access to patients' genetic code, with their consent, opens the door to personalization of drugs. This development would trigger new revenue sources for companies and would increase drug efficiencies while decreasing risks of side effects. Safety tests would also be easier since the response curve to different doses will be better known for a given patient based on his/her genetic code.

It will be in the best interest of the insurance companies to leverage this new data by familiarizing people with various diseases they may encounter. Teaching what to eat to a potential diabetic would lower his/her risks of serious and costly complications at later stages of his/her life.

Pharmacist should also take a more active role in delivering effective Healthcare. More educated patient means more sophisticated conversations about the effects of some OTC drugs as well as generic drugs. Patients empowered by right knowledge and information can proactively take care of their health leaving doctors and surgeons time to focus on more complex cases.

We believe that going forward the insurance companies will specialize in insuring against specific diseases and hence patients predisposed by their genetic makeup. The potential of leveraging economies of scale by specializing on a single disease will underpin the shaping of insurance risk pool. In such a case, the insurance companies will not select patients based on their general good health as they do now. Instead they would compete to create the largest pools of patients with similar genetic code. Only in the long term can we expect a return to the current type of competition i.e. some horizontal consolidation to hedge risks and leverage economies of scope.

In such a system, the information is a key but the control of it is even more complex and important. What is the level of information that should be shared with the patient? How can we be sure that it is the "right" information? Porter and Teisberg envision a governmental agency that would design the format and ensure the quality of the medical information in the same vein as the SEC is currently doing for corporate disclosures (Porter, Teisberg, 2004). Building on the idea of looking for examples in industry of faster "clockspeed" (Fine, 1998), the current struggles around information privacy traveling across the Internet should be closely monitored to analyze future "dos and don'ts" in the Healthcare domain.

7.3.3 Final Recommendations

As mentioned earlier, the current structure of the U.S. Health system appears to be unsustainable. The powerful forces of information asymmetries are too strong and it is a matter of time before potentially harmful information such as gene screenings or other identified uncertainties start wreaking havoc on the fast crumbling system. We advocate in favor of more research on how to develop a new Healthcare system, we call 'Healthcare 2.0,' where information could be

collected, managed and tracked at the patient level. We have discussed key opportunities as well as potential dangers of such a system.

Despite the huge uncertainties that will have to be addressed in an "open transparent system," it may be our best available solution. Conscious of the significant amount of changes that such a system would entail, we still do not consider it as utopian. At a first glance, the proposed system is close to a laissez-faire mindset; nevertheless, it can only be successful if governments succeed in forcing everyone to play by the same rules i.e. full transparency. Command and control types of regulations will help the transition by creating standards and exchange protocols. The keyword in our approach is education. The value of educating patients can't be overemphasized. The U.S. government should start a national education campaign on health and wellness. For instance, health & wellness classes should be integrated in the curriculum of elementary schools.

A core feature of the new system will be the disintermediation of the middlemen. Although opening new channels of information flow points towards a direct model, it can be a breeding ground for middlemen unless governments steps in to push the adoption of open-source standards and protocols. Mintzberg argues for the creation of a connected community of care that would encompass both modern medicine and alternate options such as acupuncture etc. (Glouberman and Mintzberg, 2001b). Thus, governments should ensure that both the content and format of the medical information be decided inside the "community of care" as it is the case in the Linux or Wikipedia communities.

8. Conclusions

In this study, we investigated how the combination of a supply chain perspective and a scenario planning methodology could generate an insightful and challenging research agenda to explore the future of the U.S. Healthcare system. We voluntarily limited the scope of our research to the U.S. pharmaceutical industry to maximize the benefits of our partnership with a Fortune 50 pharmaceutical company.

We described the problem in detail to grasp the full extent of the issue. The U.S. Healthcare system is a complex system crippled by inefficiencies and the numerous uncertainties that render most planning attempts ineffective. We explored different conceptual approaches to think about the long-term future. Provided the high level of uncertainty, we chose the scenario planning methodology instead of the more classical forecasting techniques.

We carried out a literature review to pinpoint the latest recommendations for the U.S. Healthcare system. We also undertook a thorough review of the scenario planning literature. Given the "methodological chaos" we encountered in the scenario planning literature, we developed a new methodology for scenario generation based on the weighing of pros and cons from different scenario planning schools.

Leveraging our expertise in supply chain scenarios, we generated three scenarios for U.S. pharmaceutical companies. We completed the picture with market scenarios following a more uncertainty driven approach. Both sets of scenarios were tested in multiple workshops for effectiveness and relevance. The excitement as well as the quality of thoughts during various brainstorming sessions validated the power of scenario planning methodologies to think and prepare for an uncertain future. In the last chapter, we laid down the next steps to take the scenario planning experience to the next level to identify actionable items.

Furthermore, the market scenario exercise justified our supply chain perspective. In effect, a historical analysis emphasized the importance of considering the U.S. Healthcare system as a supply chain of knowledge. This framework sharpened our understanding of market

inefficiencies due to the constant tussle between the critical players that triggered most of our recommendations.

Currently, the U.S. government acts mostly as a market-player than a market-shaper. Yet, we envision the necessity and implications of potential government actions in the U.S. Healthcare system. Based on this new reality, we proposed a research agenda to enable a seamless flow of knowledge and information in the U.S. Healthcare system. We believe that stakeholders should leverage the inevitable increase in information availability and testing technologies to tear down the walls of inefficiencies. In short, we believe that the future success of the U.S. Healthcare will be determined by its ability to become patient centric and patient driven.

Needless to say, every transformation takes time and encounters numerous unexpected pitfalls. To overcome the barriers, our early conclusions invite thought leaders to seek inspiration from information-driven industries with faster clockspeed such as the e-Business. The U.S. Healthcare system will not recover with local band-aids solutions but only via a major surgery. Yet, as is the case in all surgeries, a lot of preparation and research as well as postoperative care will be required to make the procedure successful.

Bibliography

Ahlstrand B., Lampel J., Mintzberg H. (2005), *Strategy Bites Back – It is far more and less, than you ever imagined*, Pearson Prentice Hall

Ayres I., Nalebuff B. (2003), *Why Not? - How to use everyday ingenuity to solve problems big and small*, Harvard Business School Press

Boasson, Yishai (2004), *An Evaluation of Scenario Planning for Supply Chain Design*. MIT Library, MLOG Thesis.

Bradfield, Wright, Burt, Cairns, Van Der Heidjen (2005), "The origins and Evolution of Scenario Techniques in Long Range Business Planning", *Futures* 37 pp. 795-812

Chopra S., Meindl P. (2007), *Supply Chain Management: Strategy, Planning, and Operation*, Pearson Prentice Hall

CIA (1997), "Global Trends 2010", http://www.dni.gov/nic/special_globaltrends2010.html, Accessed April 24, 2007

CIA (2000), "Global Trends 2015: A Dialogue About the Future with Nongovernment Experts", NIC 2000-02, Government Printing Office

CIA (2004), "Mapping the Global Future", NIC 2004-12, Government Printing Office

CNET (2006), "Let the Battle Begin", Online Article, http://digitalliving.cnet.co.uk/specials/0,39030785,49282099-1,00.htm, Accessed April 25, 2007

Deloitte Research (2002), *Strategic Flexibility in Life Sciences*, www.deloitte.com/dtt/cda/doc/content/DTT_DR_StratFlex_LifeSci.pdf, Accessed April 19,2007

De Geus Arie (1997), *The Living Company – Habits for survival in a turbulent business environment*, Harvard Business School Press

Dixon P., "Genetic testing and genetic screening, Ethics of genetic testing for insurance", www.globalchange.com/genescreen.htm, Accessed April 19, 2007

Eriksson T., Ritchey T. (2002), "Scenario Development Using Computerized Morphological Analysis", http://www.swemorph.com/pdf/cornwallis3.pdf, Accessed April 25, 2007

Ernst R. Berndt, *"What Differentiates Health Care from Other Industries? An Anatomical Overview"*

Fahey, Liam, and Robert M. Randall (eds.), (1997), *Learning from the Future.* New York: John Wiley & Sons, 1997.

Fine Charles (1998), *Clockspeed – Winning industry Control in the Age of Temporary Advantage*, Basic Books

Fisher, Marshall L. (1997), "What is the Right Supply Chain for Your Product?". *Harvard Business Review*, March-April

Flowers Betty (2003), "The Art and Strategy of Scenario Writing", *Strategy & Leadership* 31 pp. 29-33

Glouberman S., Mintzberg H. (2001), "Managing the Care of Health and the Cure of Disease-Part I: Differentiation"*, Health Care Management Review* 26(1) pp. 58-71

Glouberman S., Mintzberg H. (2001), "Managing the Care of Health and the Cure of Disease-Part II: Integration"*, Health Care Management Review* 26(1) pp. 72-86

Godet, Michel (2001), *Creating Futures: Scenario Planning as a Strategic Management Tool*, Economica, London

Hamel G., Prahalad C.K. (1994), *Competing for the Future*, Harvard Business School Press

Hamel, Gary (2006), "The Why, What, and How of Management Innovation", *Harvard Business Review*, February 2006

Hammer, Michael (2004), *"Deep Change"*. *Harvard Business Review*, April

Hammond J., Raman A. (1994), *Sport Obermeyer Ltd.*, Harvard Business School Cases, #9-695-022

Lapide, Larry (2006), "The Essence of Excellence", Supply Chain Management Review, April, pp. 18-24

Miller K.D., Waller H.G. (2003), "Scenarios, Real Options and Integrated Management", *Long Range Planning* 36 pp. 93-107

New York Times (2007), "Negotiating Lower Drug Prices", Editorial, *New York Times*, January 12, 2007

Penker M., Wytrzens H.K. (2005), "Scenarios for the Austrian Food Chain in 2020 and its Landscape Impacts", *Landscape and Urban Planning* 71 pp. 175-189

Pharma Futures (2004), *The Pharmaceutical Sector: A Long-Term Value Outlook*, http://www.usshq.co.uk/downloads/pdf/all_sections/ri/PharmaFuturesWeb1.pdf, Accessed April 24, 2007

Porter M., Teisberg E. (2004), "Redefining Competition in Health Care", *Harvard Business Review*, June 2004, P66-76

Porter M., Teisberg E. (2006), *Redefining Health Care*, Harvard Business School Press

Porter, Michael (1996), "What is Strategy?". *Harvard Business Review*, November- December

Schoemaker, Paul J. H. (1993), "Multiple Scenario Development: Its Conceptual and Behavioral Foundation." *Strategic Management Journal* 14 pp. 193–213

Schwartz Peter (2003), *Inevitable Surprises*, Gotham Books

Schwartz, Peter (1991, 1996), *The Art of the Long View: Paths to Strategic Insight for Yourself and Your Company*. New York: Currency/Doubleday.

Senge Peter (1990), *The Fifth Discipline – The art & practice of the learning organization*, Currency / Doubleday

Shell (2005), *Shell Global Scenarios to 2025,* Royal Dutch/Shell Group; Spiral edition

Shell International (2003), *Scenarios: an Explorer's Guide*, London: Global Business Environment, Shell International. www.static.shell.com, Accessed May 4th, 2004.

Singh M., Lagarde L. (2007), "A Framework to Plan for the Future", Working Paper, February 22, 2007

Singh Mahender, "Transforming the Global Health Care Supply Chain", Working Paper, July 28, 2006

Singh, Mahender (2004), *A Review of the Leading Opinions on the Future of Supply Chains*. http://ctl.mit.edu/public/opinions_future_supply_chains.pdf, Accessed April 24, 2007

Tang H., Ng J.H.K., "Googling for a diagnosis—use of Google as a diagnostic aid: Internet based study", *The British Medical Journal*, Online Edition, November 10, 2006

UPS (2005), *Horizon 2017, Global Scenario Overview*, MIT SC2020 Symposium, 11/29/05, Cambridge, MA

Wack, Pierre (1985), "Scenarios: shooting the rapids". *Harvard Business Review*, November-December, pp. 139-150

Wack, Pierre (1985), "Scenarios: uncharted waters ahead". *Harvard Business Review*, September-October, pp. 73-89

Wall Street Journal (2006), "Health-Care Gold Mines: Middlemen Strike It Rich --- Rewarding Career: As Patients, Doctors Feel Pinch, Insurer's CEO Makes a Billion --- UnitedHealth Directors Strive To Please `Brilliant' Chief; New Questions on Options --- Selling Trout for 40 Cents a Pound", George Anders, *Wall Street Journal*, April 18, 2006

Wall Street Journal (2006), "Health-Care Gold Mines: Middlemen Strike it Rich --- Strategic Position: Selling Generic Drugs by Mail Turns Into Lucrative Business --- Benefit Managers Say They Save Employers Money, As Their Own Profits Rise --- Off-Patent Bonanza Ahead", Barbara Martinez, *Wall Street Journal*, May 9, 2006

Wall Street Journal (2006), "Health-Care Gold Mines: Middlemen Strike it Rich --- Double Bypass: Health-Care Consultants Reap Fees From Those They Evaluate --- As Insurance, Drug Costs Rise, Employers Seeking Advice Often Discover Conflicts --- A Superintendent's Surprise" , Barbara Martinez, *Wall Street Journal*, September 18, 2006

Wall Street Journal (2006), “Health-Care Goldmines: Middlemen Strike It Rich --- Book Value: How Quiet Moves by a Publisher Sway Billions in Drug Spending --- Lawsuit Forces Hearst Unit To Lower Prices on List Widely Used as Benchmark --- A 'Survey' of One Company”, Barbara Martinez, *Wall Street Journal*, October 6, 2006

Wall Street Journal (2006), “Health-Care Goldmines: Middlemen Strike It Rich --- Healthy Industry: In Medicaid, Private HMOs Take a Big, and Lucrative, Role --- Managing Care for the Poor, They Prosper by Cutting Beleaguered States' Costs --- Dr. Polack Seeks an Antibiotic”, Barbara Martinez, *Wall Street Journal*, November 15, 2006

World Economic Forum (2007), *Global Risk 2007*, www.weforum.org/pdf/CSI/Global_Risks_2007.pdf, Accessed April 25, 2007

Yu, Chong Ho (1994), “Abduction? Deduction? Induction? Is There a Logic of Exploratory Data Analysis?”, Paper presented at the Annual Meeting of American Educational Research Association, New Orleans, Louisiana, April, 1994

Appendix I

Supply Network End States

Alien Nations

Nationalism dominates the Alien Nations world. Economic, commercial and political self-interest is not a sub-text but the main plot for all countries. Citizens see the world through the prism of their own prejudices and values, and this is reflected in respective political systems. Such introspection inevitably breeds fear as each nation strives to assert and promote its own national agenda. International trade receives short shrift from governments and citizens alike, unless it confers some decisive national advantage. As a result, globalization is severely undercut in this divided world. It occurs haphazardly, and only when companies are able to navigate through the complex arrays of laws and regulations that fence off nations from each other. In short, trade barriers, both implicit and explicit, impede the flow of goods.

In such a compartmentalized world countries compete fiercely for natural resources. Citizens expect their governments to secure sources of energy that are reliable and cheap, regardless of the global implications. Domestic energy security and employment policies always take precedence over global ones. The price of oil follows a "long wave" cycle alternating between high and low volatility phases. But at least this preoccupation over the national share of non-renewable resources focuses attention on energy issues. Governments are actively pursuing policies to find alternatives to fossil fuels such as hydrogen. Energy efficiency has moved beyond political rhetoric and is now a real goal that commands serious attention. Recycling, remanufacturing and waste management are regulated rigorously.

The retreat into nationalism poses some unique challenges for companies. As countries have come to view their neighbors with growing suspicion, they have become fixated on the threat of terrorism and war. These fears are stoked by lurid stories of plots and counter-plots in the media. Governments have reacted by introducing more stringent regulations to protect citizens and the national interest, particularly in the safety area. This has made it almost impossible to develop international safety standards for products. Indeed, safety/security regulation is often used as a convenient guise for protectionism. Environmental standards are frequently deployed in a similar fashion. Consequently, efforts to address global problems such as climate change have collapsed as an increasing number of countries have chosen to adopt the "free-riding" stance of the United States, and pulled back their commitments from the collective international stage. Policy debates are centered on local air and water pollution issues, in much the same way as in the U.S. today.

Companies have no option but to shoulder high compliance costs and non-tariff trade barriers. The lack of standardization frustrates globalization. Foreign companies have to work harder to compete, and may be pitted against national champions. It is difficult to leverage synergies across international operations or take advantage of economies of scale since companies must juggle competing sets of risks and opportunities in different countries. Given these obstacles, enterprises have shifted their sights to domestic customers, leading to a geographic concentration of markets. There is much emphasis on customization, as graying consumers demand personalized products (see demographic trends below). However, competition is fierce even in

this myopic world, and controlling supply chain costs is a high priority for companies large and small. To this end, new technology is being used to achieve substantial operational savings.

Perhaps the biggest economic threat is the lack of synchronization between business cycles, as the world's economic powers pursue individualistic growth strategies. An ill-defined and inefficient architecture for international finance is not conducive to effective coordination between national authorities or markets. Investors are naturally skeptical about global markets – they need to be enticed by high premiums to overcome their bias towards domestic investments. This amorphous trading system opens up opportunities for global arbitrage, not just in the financial community, but also through the operations of multinational corporations, as risk profiles vary widely across countries and institutions.

Furthermore, disparate national rules and standards, protectionist measures, and security concerns, restrict the global mobility of migrants. Governments ensure that foreign workers return to their homelands when their allotted time in the country comes to an end. These restrictions make it difficult for countries to replace aging indigenous employees with younger, migrant workers, widening the demographic gaps between countries. So-called 'knowledge' workers are highly prized but foreign workers are viewed with deep suspicion, and immigration is an extremely emotive issue that frequently boils over into violent conflict. Countries that are the main sources of migrant workers resent these attitudes, further deepening the ideological divides that separate countries.

Synchronicity

Globalization, underpinned by the growth in democracy, has redefined the world map. Democratic governments have taken root in most countries, although they are still in their infancy in Latin America and Russia. The Middle East remains an area of uncertainty, but even here the notion of spreading democracy is no longer summarily dismissed as a Western plot to wrest power from Arab nations. All countries are prepared to enter into meaningful debate to reach a consensus on important issues.

With this strong culture of democracy as a foundation, the advance of market globalization has been swift, and trade barriers between companies and countries have crumbled. The concept of free trade permeates regulatory codes, regional development policies and aid programs. Trust is not simply a desirable asset, but a pre-requisite for doing business between companies and governments, and with consumers.

But this is by no means a laissez-faire world devoid of conflict or stress. Companies must have a reputation for being trustworthy to remain viable. Integrity is a business imperative. In addition to offering products and services that fulfill the promise of high quality and reliability, companies are expected to empower shareholders to take an active role in businesses. Enterprises must have a clear corporate mission and firm values to retain employees and maintain a favorable market identity. Citizens actively campaign for a better quality of life, forcing governments and enterprises to aim high when formulating standards in key areas such as the

environment, healthcare and safety. The media, itself under constant scrutiny from a discerning public, holds organizations and individuals accountable for their actions.

World financial markets are almost fully integrated. Short-termism is no longer an impediment to business planning. Investors seek to maximize value over the long term, and are prepared to give companies adequate time to re-structure and to strategize. Again, however, there is no room for complacency. Investors still demand increased profitability and improved capital productivity, and attach great importance to high ethical standards and social responsibility in the corporate world.

Given these imperatives and the prevailing culture of trust, companies are far more likely to enter into joint ventures and consortia in the Synchronicity world. Partnering and virtual teams are common. In this open environment the "value web", where entities work together to achieve commercial success, can reach its full potential. Co-production is a popular strategy for maximizing value. As a result, there are more opportunities for new entrants – including small- and medium-sized enterprises – providing they can establish the right connections.

Information and knowledge move quickly around the globe in standardized formats, giving markets more uniformity. This intensifies competition since consumers demand new products and services to be available almost as fast as they are communicated. Running a company is a perpetual race to keep up with the latest fashions and technological advances. Products become obsolete very quickly, putting market leadership positions under constant threat. Customization has almost become the price of entry into markets. Companies have to be resourceful to remain competitive in important areas such as choosing which raw materials to use. And they have to be extremely innovative and creative, particularly when integrating technology into their businesses to drive down supply chain costs while maintaining the quality of customer service. This is a never-ending process since technologies are constantly being refined and replaced by "new, improved" versions.

People in this world are remarkably mobile as a result of relaxed regulations on cross border movements of products, information, and people. The free flow of migrants has balanced the effects of unequal population ageing but it has increased the diversity in the population mix as well. The global distribution and diversity of highly competitive production resources, including skilled workforce, are influencing supply chain design decisions. Furthermore, companies have reconciled to the fact that they will receive only partial loyalty from employees.

The idea that a company's most precious resource is its workforce has been given new currency in the Synchronicity world. The services associated with a product are as important as the product itself. Most leading companies consider software element of the products to be its main competitive advantage, and the only way to retain that edge is to retain the employees who created it. At the same time workforces and companies have become more distributed, because frameworks exist that make operating across multiple jurisdictions just as cost-effective as operating across a single jurisdiction.

There is a global consensus on environmental stewardship. A Global Environmental Mechanism has been created that serves as a clearing house for data, technologies and policies pertaining to

the replenishment and conservation of scarce natural resources. The Mechanism is a ready source of effective practices in areas such as pollution control and the management of natural resources. As a result, embedding environmental factors into pricing strategies becomes a norm. However, since open markets and free trade are seen as essential to achieving security of supply, the allocation of resources is invariably left to market forces, and weighty energy decisions tend not to address long-term issues. The price of oil is volatile and relatively high; although in overall terms fuel is more affordable since citizens of the Synchronicity world are prosperous.

Spin City

In the Spin City world globalization is driving economic growth but at a slow and uneven pace. Government regulation reins in the global expansion of business. A lack of trust discourages the kind of openness that is essential for unfettered international trade to flourish. And although the merits of globalization are recognized and even lauded, in this climate of suspicion a hybrid form of world commerce has emerged that combines respect for market forces with a high level of state intervention. For example, the Internet functions much like international airspace. It is a universal communications medium but divided into a patchwork of jurisdictions as each country controls the traffic that flows within its sovereign space (think of the influence that China exerts over Internet traffic within its borders today, and imagine that system extended across the globe).

At a government level national security is a top priority. It could be argued that this is the case today, particularly in the United States, but in the Spin City world governments have become obsessive to the point where securing business transactions through regulation colors every decision and policy. Security issues and mistrust frame all geopolitical discussions. Governments have decided that markets are incapable of maintaining an adequate level of security and financial trust, and therefore must be scrutinized and regulated by state agencies.

However, not every nation is governed by the same iron hand. Managing the issue of trust differs from country to country. For example, countries that have a long tradition of state intervention such as Russia, China and Venezuela, reinforce the regulatory systems that were already in place without appearing anachronistic. In countries where state agencies have been less interventionist, Australia and the United States for instance, there is more emphasis on using private sector organizations such as accountants and audit firms to enforce regulation.

Despite these differences world issues are internationally addressed; supranational organizations and treaties such as the European Union, NAFTA and the United Nations remain important. Still, the fundamental lack of trust almost always frustrates consensus on a global level.

The lack of consensus extends to environmental regulation as well. The state of the environment and the non-stop depletion of natural resources, are major concerns. Various campaign groups including NGOs pressure governments and companies to promote sustainable development and more transparency in the use of natural resources. The Kyoto Protocol is still in force albeit in a stagnant form. But governments' natural response is to impose mandatory controls to protect the environment, mainly in the form of taxation. Recycling, remanufacturing and waste management activities are heavily regulated. Energy markets are governed by complex rules and regulations

that aim to foster competition, secure energy supplies and protect end-customers. Oil is more expensive in real terms than in any other world scenario, and although alternatives fuels have been developed, the inefficiencies created by government intervention tend to inflate the cost of energy.

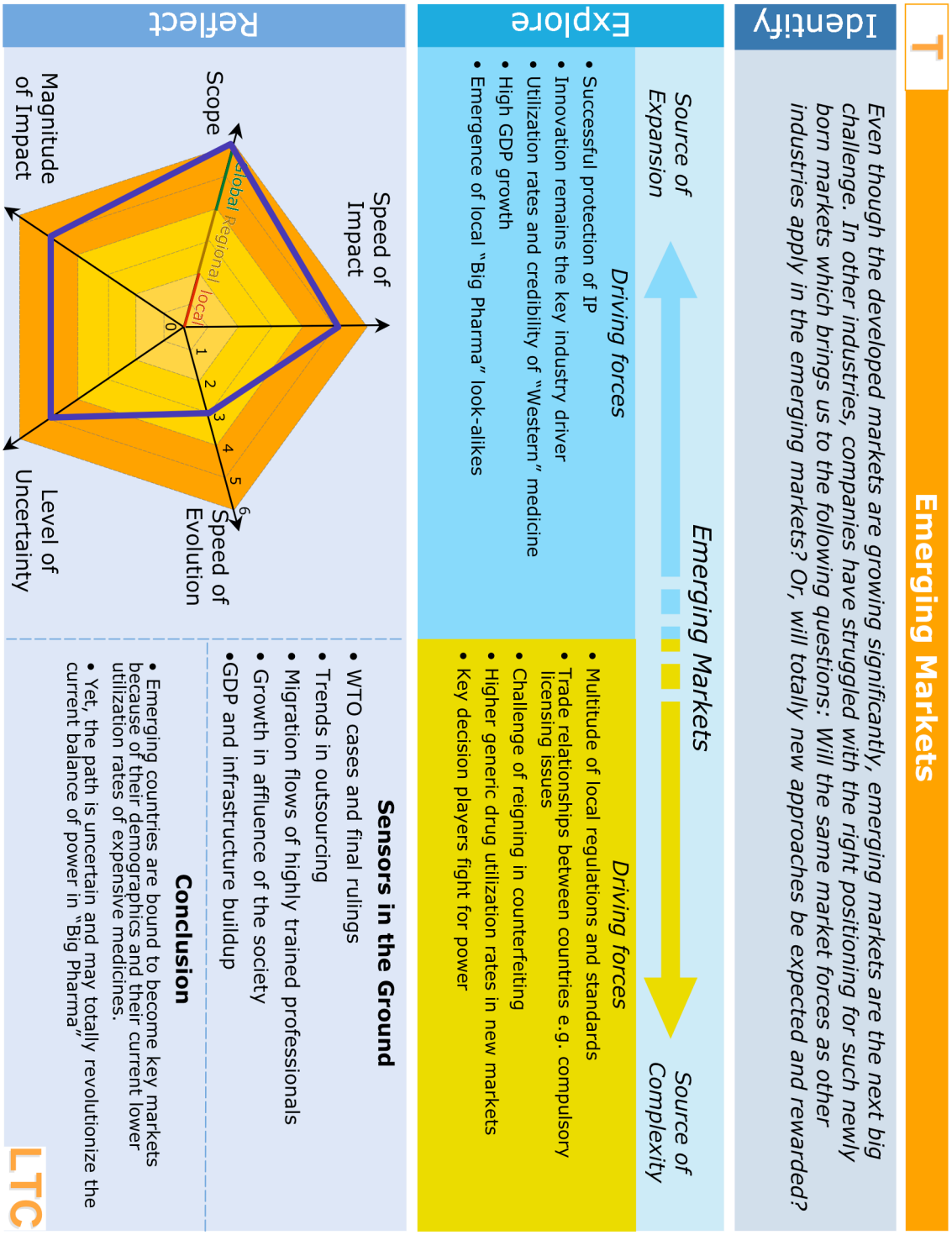
Companies have adapted to this uncertain and complex environment. In fact, on a macro level, there is competition between governments to develop regulatory systems that fulfill national security objectives while attracting private sector organizations. As a result, these systems are constantly changing, and companies devote a great deal of time and effort to monitoring the changes and re-assessing the competitive landscape. On a micro level, the lack of trust in this world shapes the way enterprises do business. Profitability and capital productivity are still fundamental metrics. The media still thrives on stories about corporate profits and scandal, and publishes rankings that keep companies under pressure to perform. But investments are also driven by companies' ability to inspire trust. In a world where trust is at a premium, those enterprises that establish a reputation for being trustworthy have a distinct competitive advantage. Enterprises that show a willingness to comply with regulations or even go beyond the call of duty also have an edge over less savvy competitors.

Research and development is crucially important. The tangle of regulation that ensnares the commercial sector makes supply chains less efficient and introduces more cost. A way to counter this is to use superior technology to increase productivity and speed up information flows. There is more collaboration between governments, research establishments and companies, and R&D budgets are less prone to cuts. Even so, technical excellence is not an easy target to hit. In the prevailing climate of suspicion the diffusion of ideas is slow, particularly when it comes to the transference of ideas and technology across borders. There are legal tools available to protect intellectual property, but these seldom afford full protection from unscrupulous government agencies and competitors. As a result, the sharing of intellectual property with companies across borders is frowned upon. In short, creativity and innovation are curtailed.

Mistrust also stymies the movement of people. Migration is restricted - ostensibly for national security reasons. As the flow of migrants is discouraged, it is difficult for countries to replenish their aging work forces with these workers. This has created demographic imbalances. In countries such as Germany, Italy and Japan, where the average age of the citizenry is relatively high, the easy availability of younger migrants is particularly troublesome. But even in comparatively young countries such as the United States, the limited number of immigrants is causing serious problems. Populations are graying, and a major issue is how to retain the knowledge base as older, experienced workers leave the workplace. These imbalances cause tensions between countries, feeding the mistrust that already exists. Ironically, restricting migration in the interests of national security has led to even more regulation. In an effort to address the imbalances described above, governments have introduced convoluted regulations designed to admit migrant workers in specific circumstances.

Appendix II

Sample Factor Card



Appendix III

Sample Story Board Card

Appendix IV

Market Scenario

Members Only

A Healthcare Market Scenario created based on the brainstorming sessions held during the 'Strategy Development Using Scenario Planning' workshop offered by the MIT Center for Transportation and Logistics.

Faculty Club, MIT
27th-28th March

«We're almost done here. Two more minutes until the FBS is completed.»

Steven walked to the room next door, while Mark remained in front of the transparent screen of the supercomputer, which displayed real-time 3-D projections of a patient's body. Inside the room next door there was a large cubicle, with a rounded, porcelain exterior. A tiny light on the roof turned from red to green, and the top of the cubicle opened, like a sarcophagus. There was a woman inside, maybe around fifty years old. A nurse offered her a white robe, and helped her get out of the device.

«What exactly is this thing you just did to me, Dr. O'Laughin?,» asked the woman, with a sleepy voice.

«It's called an FBS, or full body scan, Ms. Orwell. I know it's been a long afternoon for you, but this was the last test we had to run. You can get dressed now and go back home. Nancy, make sure to send Ms. Orwell's samples to the labs right away.»

«What's next?,» asked Ms. Orwell.

«Well, the analysis of your DNA sample should be complete before Friday. The results of all the other exams, including the FBS, will be in my desk tomorrow afternoon. I will have the whole therapy package designed by next Monday. The good news is that my colleague and I were looking at some preliminary images from your scan and it seems that the cancer has not spread to the lungs yet.»

«So this means that...»

«Yes, success is almost guaranteed, with the therapy we'll prepare for you.»

«Is it true that there are no side effects?» asked the woman.

«Well - said Mark, who had just entered the room - *nothing is free of side effects. But this therapy will be designed just for you, using the latest methods. It combines nanomedicine, which are like tiny machines that will destroy the malignant cells of the cancer, designed to match your genetic makeup, with special drugs tailored just for you, in order to minimize the discomfort during the healing period.»*

«My mother, you know... - said the woman - *she died of a similar cancer thirty years ago. I remember that back then, the therapy was almost as bad as the disease... if she had had the chance I have today...»*

Ms. Orwell thanked them both profusely once more, and left the room. She was one of the few lucky ones. Most people of her class usually don't get access to such advanced health care. It is year 2025, in Boston, and yes, I have just used the word 'class'. Here's what happened, in a nutshell: the challenges of a mature information society caught many Americans unprepared. Millions lost their jobs to automation and outsourcing. As those without specialized skills or higher education had to settle for lesser jobs, the middle class was squeezed towards the poor end of the spectrum, while the few rich became richer.

By mid 2020's, few aspects of life showed this divide more eloquently than health care. Amazing changes took place, sure, but very few had access to them. There was the 'biotech revolution' in the mid 2010's, triggered by the success of early tailored drugs for Alzheimer and diabetes. Encouraged by this, a myriad different efforts to develop genetically engineered drugs, both in universities and small private research firms, received funding from the government and large pharmaceutical companies. Albeit still not a totally fulfilled promised, genetic medicine and biotechnology scored some big-profile victories against certain types of cancer and infectious diseases in the early 2020's.

As a sponsor of the early research, the government held a good share of the patents for this technology. However, the prohibitive cost of producing tailored prescriptions for the public was beyond what the taxpayers could afford. Thus recently, many of the governmental patents had been licensed to private firms, who also owned another part of the patents. Thus, customized medicine became a reality, but only for those who could afford it. Top-class health care, like diamonds, was the privilege of a few.

For the rest, generic drugs and a do-it-yourself approach to health care were the best option available. They got their medical advice from the less sophisticated machines in smaller clinics, barely staffed with medical personnel that was, well, not in touch with the latest advances. The role of this staff, mainly nurses, was to give the patients general advice and show them how to use these sort of websites, where expert systems presented questionnaires to visitors in order to help them pinpoint their illnesses, and recommend a generic drug.

«Sometimes I feel like we live in a bubble, man,» said Steven.

Dr. Steven O'Laughin was feeling a little under the pressure today. He looked at his partner, Dr. Mark Thomas, who nodded sympathetically.

«What do you mean a bubble, Steve?»

«You know... disconnected from the real world.»

Mark and Steven didn't see eye to eye in some things. Both were educated in the best medicine schools of the country, but their life perspectives were very different. Mark, on his part, had no problem being a doctor for the elites. He felt he had worked very hard to reach his current position, and deserved a high compensation. In fact, the training of medical students had significantly changed in the last decade. As the cutting edge of medicine became both sharper and more inaccessible, the new doctors had to start training straight from high school, and graduated after more than a decade of training, already in their thirties. Mark felt like the member of a cluster of highly specialized experts, and billed their patients accordingly.

He had no problem with having the big pharmaceutical companies compete for his attention. His time was valuable as gold. To get his attention and endorsement for their drugs, the pharmaceutical companies had to 'dine and wine' him: his office was furnished with the most advanced diagnostic equipment, courtesy of a group of pharma companies. In exchange for this and for some share in the firm’s profits, Dr. Mark Thomas gave preference to their molecules for every case where more than one product would work (a call that was, at the end, up to him). The pharma researchers also got access to detailed information on the patients, stripped of all identifying marks, about their healing process and evolution, to measure how well the drugs were performing, in order to improve their processes. As new therapies were devised, success rates soared.

«I don't get you, Steven. Medicine has never been in a better place in its whole history!,» said Mark, trying to cheer his colleague up.

It was true. Biotechnology had revolutionized medicine in a way only comparable to the discovery of antibiotics and vaccines. As medicine had transformed, so also did the pharma companies. To compete, firms diversified their portfolios by investing in both ends of the spectrum: generics manufacturing for the masses, and biotechnology ventures for the few.

The high speed of change of the field forced the biotechnology and genetic medicine firms to develop very flexible, and yet efficient, supply chains. Similar to scouts recruiting talent for a major league baseball team, these firms hunted for the latest technological breakthroughs among the thousands of new biotech firms, licensing those products or techniques that seemed more promising and offer marketing and distribution capabilities in exchange. More adaptive manufacturing methods were developed, too, in order to produce a large array or drugs, while retaining the ability to ramp up or down quickly, to follow the customized and unpredictable demand.

One of the biggest challenges for the supply chain was to retain as much visibility as possible to prevent counterfeits, while maintaining effectiveness and innovation. The huge value to volume

ratio of personalized products, with clock-like delivery precision, posed another two enormous challenges for the supply chains of big pharma companies. They evolved to become sorts of clearing houses for knowledge, managing portfolios of intellectual property developed by third parties, and promoting these innovative products among physicians.

«I see your point, Mark - replied Steven - *But it is also true that the best health care has never been inaccessible to so many.»*

Steven was right, and Ms. Orwell was a good example of this. The patients of Mark and Steven's office were usually upscale, and very demanding of personalized therapies. Ms. Orwell, on the contrary, was poor.

It is an awful thing to say, but actually, if she had been rich, chances are she would have not developed cancer in the first place. Genetic screening tests were available long ago, to those who could pay for them. A simple screening could have alerted Ms. Orwell about her predisposition to cancer. With this early warning, prophylactic therapies could have been initiated, which would prevent the cancer from ever developing, or in the worst case, stopped it when it was in the earliest stages. But all this belonged to a different world, beyond her reach.

However, thanks to the advances of medicine, her prognosis was today much better than it would have been a decade ago. In the specific case of Ms. Orwell, her treatment was sponsored by the government, as part of an exchange program in which the pharmaceutical companies offered full treatment free of cost for a certain number of patients selected by the government. In exchange, the government allowed the pharmaceutical companies to continue to use some patents.

The government had political reasons for implementing this program: nicknamed the 'health green card lottery', it was seen by lawmakers as a way to ease the increasing social tensions betweens the haves and the have-nots in terms of health care. Some patients were selected based on the recommendation of social workers, and others were just selected at random. This, they thought, gave hope to some patients. Time had shown, however, that it had failed to resolve the increasing tensions.

«I don't think this system is sustainable, Mark. I really don't,» said Dr. Steven.

«Well... - lamented Dr. Mark - *what can I do? I'm just a simple guy trying to do my job.»*

Key Sensors-in-the-Ground

- The ratio of approved bio-tech and traditional drugs
- Level of investment made by venture capitalists and private equities in biotech firms
- Level of interest in biotech on Wall Street
- Acquisition profile of big Pharmaceutical companies
- U.S. political shifts in Healthcare policy
- IP trend
- Price protection trends
- Increase costs of R&D and time-to-market