A New Engineering Profession is Emerging: Decision Coach

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Abstract*—More than half of the decisions faced by corporate executives deal with expansion or investment in new and existing products, services, or geographies. These decisions are complicated technically and organizationally. As a result, the decisions tend to be made by teams from multiple functions: research, engineering, marketing, sales, manufacturing, public relations, and legal.*

Strategic decision making has become a team sport. Teams need coaches to help pick the right processes; apply the right tools; facilitate learning; and manage projects.

This article is about an emerging profession: decision coach. The article explains why most decision coaches will probably begin their coaching careers as decision engineers.

Key words: Business planning, decision-making, distributed decision-making, product development, research and development, strategic planning, systems engineering, technology planning

I. INTRODUCTION

IN 2008, McKinsey Consulting surveyed over 2000 executives from a full range of industries, regions, and functions. The survey revealed that half of the strategic decisions faced by the executives deal with expansion or investment in new and existing products, services, or geographies. See Figure 1 [1]. This includes decisions like, Do we develop an iPad? Or, do we manufacture the iPad in the US?

These decisions tend to be complicated both technically and organizationally. The decisions are usually made by teams. The teams involve people from multiple functions: research, engineering, marketing, sales, manufacturing, public relations, and legal. Often the decisions require participation by people from many different countries and cultural backgrounds.

Strategic decision making has become a team sport. The benefits of the team approach are well known. There is nothing as rewarding as working on a motivated, talented team that knows what it is doing, why it is doing it, and how it is going to measure success. There is nothing as frustrating as working on a team that does not know what it is doing, why it is doing it, or how it is going to measure success.

If you have worked on strategy teams you have probably seen some familiar failure modes. Lack of experience is a common weakness. People are good at their jobs but they are not good at working with a team on a fuzzy, complicated, cross-functional effort. They are afraid to leave something out. They fail to focus on the 20 percent of the issues that impact success or failure.

A. Illustrative Situation Let's take a situation that could happen in almost any company today. Suppose the executive team in your organization has just returned from a one-week whirlwind tour of Silicon Valley. The executives visited Google,

Facebook, HP, Intel, and Apple. They visited accelerators and incubators. They talked with venture capitalists and professors. They are convinced that your company has to "get on the bus." They want to dip into the Silicon Valley zeitgeist. They know they have to do something but they do not know what or how.

Your CEO has decided to form a team to develop a "Silicon Valley Strategy." She has selected the people from marketing, sales, R&D, product development, and manufacturing. She wants a couple of people from overseas to participate.

What happens next might go something like this. The team gets in the same room at the same time (which is a nontrivial exercise). They get a pep talk from the CEO. She appoints the VP of Marketing to be the team leader. The CEO promises she will implement the team's recommendations. The CEO says she wants the recommendation to be based on valid information and it must have the personal commitment of the team members. Then she leaves. What happens next? How does the team get from the kick-off meeting to a recommendation?

Figure 1. A McKinsey survey of over 2,000 executives from the full range of industries, regions and functions revealed the following goals of strategic decision making. (In percentage of total decisions.)

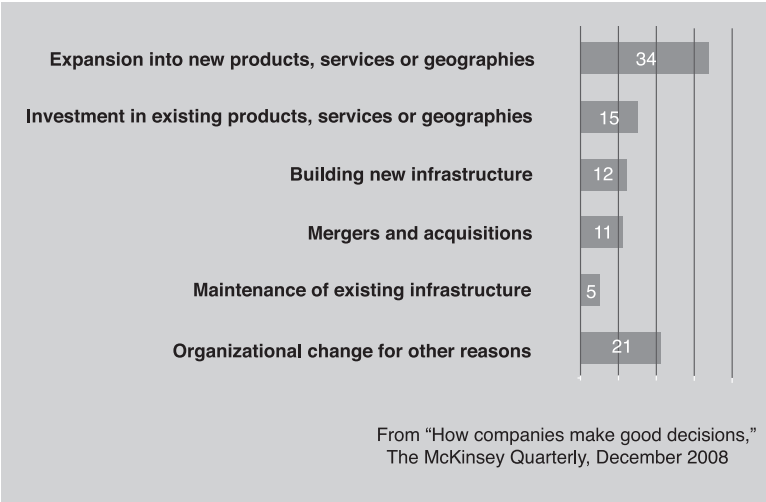


Figure 2. The strategy table for Silicon Valley Strategy.

Strategy Theme	Key Decisions			
	Innovation Boot Camps	Partner with big company	Partner with startups	Technical Center in Valley
	Top exec's only	No big company partners	No startup partners	No Technical Center
	Top Managers from all functions	Google	A handful of startup partners	Software Center
	All of the above plus Product Teams	Apple	Many startup partners	Relocate e-commerce business to Silicon Valley
		Google and Apple		

B. Teams Need Coaches An experienced decision coach knows exactly what to do in situations like this. The first step is to frame the project and then frame the problem. Inappropriate framing is the root cause of most bad decisions. The framing should begin by creating a one-page project vision. The vision answers three questions: What are we going to do? Why are we doing it? And, how will we know if we are successful?

After the project is framed, the coach will help the team focus on framing the decisions. The coach knows which framing tools are appropriate for the situation. The choices include issue raising, brainstorming, frame storming, SWOTS, competitive analysis, stakeholder analysis, capabilities analysis, five-forces analysis, scenarios, and then some. As early as possible the team will want to develop a strategy table. This table shows the key decisions and the choices that will define the strategy. It might look like Figure 2.

Using the strategy table as a framework the coach will help the team define alternative strategies. For illustration, McKinsey Consulting says there are fundamentally three strategies for tapping into Silicon Valley: innovation boot camps, strategic partnerships, and big bets. [2] Illustrative definitions of these strategies are shown in the strategy table, Figure 3.

This is the beginning of the process. From framing and alternative generation the project moves on through analysis and synthesis phases. In the analysis phase the team learns what is important and

what is compelling about each strategy. In the synthesis phase good ideas are combined into a hybrid strategy that the team understands and believes in.

Teams can muddle through and come up with good recommendations using whatever process they are familiar with. They do it all the time. They will do it better and have more fun if they are well coached.

In the rest of this article I will define the role of the decision coach. I define what I mean by decision engineer and I will share my career path from engineer to coach. I believe that decision engineering is a natural path to decision coaching.

II. Role of the Decision Coach

As shown in Figure 4 decision a coach brings four things to a project: process, tools, facilitation, and project management [3]. I will expand on each of these.

A. Process Process is the answer to the question, "How do we do things around here?" All organizations should have a widely accepted process for making strategic decisions. Edwards Deming, the father of the quality movement said, "If you can't explain what you are doing as a process then you don't know what you are doing."

The appropriate process depends on the complexity of the decisions we are making and who needs to be involved. The decision space is defined in Figure 5. The decisions listed in Figure 1 are complex technically and organizationally. They require a process that can deal with technical issues and people issues. I have found the Collaborative Design Process to work best across the spectrum of product planning, corporate strategy, and even public policy decisions. Your organization may have a different process for strategic decisions.

The Collaborative Design Process has four clearly defined phases: framing, alternative generation, analysis, and synthesis. See Figure 6 [4]. This process is simple, common sense engineering practive. It has been applied extensively to business decisions by my former colleagues at Stanford University and at Strategic Decisions Group (SDG) in Palo Alto, California.

We need a process that balances advocacy and inquiry for decisions that are complicated technically and organizationally. Advocacy is about standing up for our interests and beliefs. Advocacy is important. However, in solving tough problems we want to balance strong advocacy with strong inquiry. We want to have a process that allows people to present balanced arguments, remain open to

Figure 3. What is your Silicon Valley Strategy?

Strategy Theme	Key Decisions: Innovation Boot Camps	Partner with big company	Partner with startups	Technical Center in Valley
Innovation Boot Camps	Top exec's only	No big company partners	No startup partners	No Technical Center
Targeted Strategic Partnerships	Top Managers from all functions	Google Apple	A handful of startup partners	Software Center
Big Bets	All of the above plus Product Teams	Google and Apple	Many startup partners	Relocate e-commerce business to Silicon Valley

Figure 4. A decision coach brings four things to a strategic decision project.

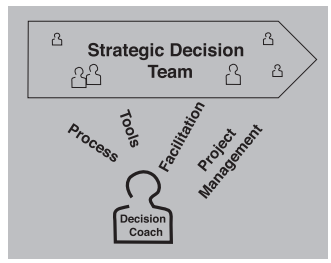


Figure 5. Our choice of a decision making process depends on the level of technical and organizational complexity.

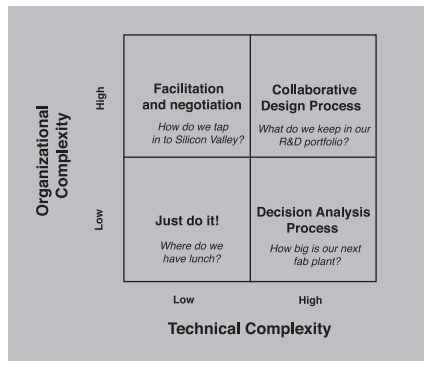
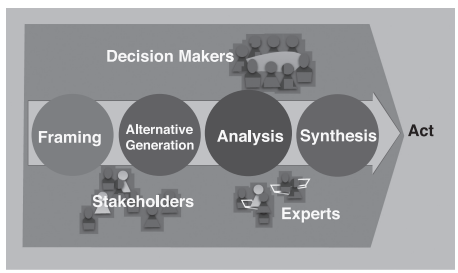


Figure 6. We use the Collaborative Design Process when decisions are complex technically and organizationally.



alternatives, and accept constructive criticism.

Design has become an important competitive advantage. Design is about blending good analysis with synthesis. Steve Jobs called synthesis, "Connecting the dots." In practice we can usually develop powerful hybrid strategies from sets of strategies that are very different analytically. This requires a conscience effort to synthesize. In other words, if we know what is good about each proposed strategy then we can usually combine the "good" and limit the "bad." Many truly innovative approaches are hybrid strategies that combine the strengths of several very different approaches. Apple Computer, for example, is a hybrid. The company combines the strengths of a hardware company and the strengths of a software company. In short, we need a decision making process that blends analysis and synthesis.

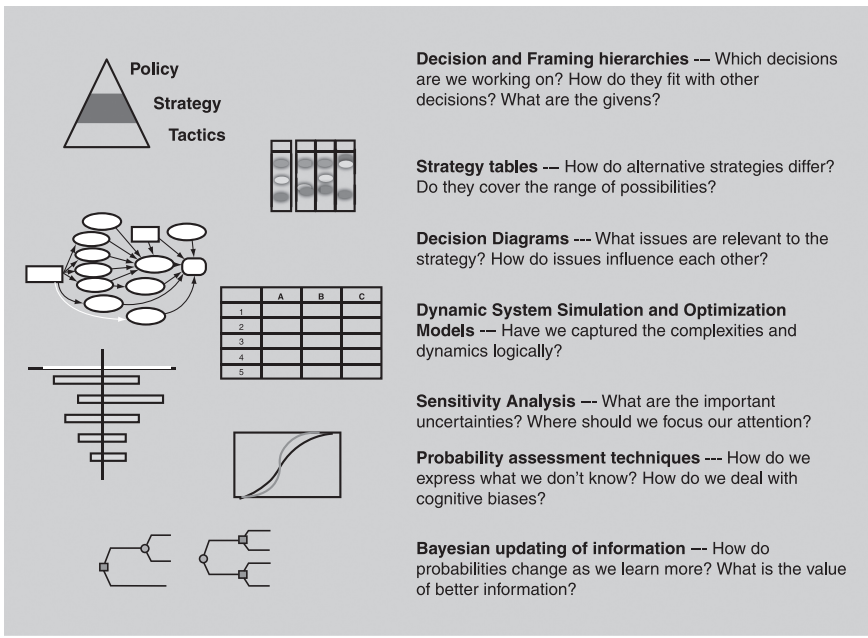
A decision coach can help executives choose the process that is appropriate for the situation. In some cases a well-facilitated meeting with the right people is all that it takes to reach clarity of action. In other situations it can take months and hundreds of hours of meetings, information collection, and computer modeling.

TOOLS

The better known strategic decision making tools are computer-based models, sensitivity analysis, scenarios, and decision trees. There are other tools that professional decision engineers use frequently. They include framing hierarchies, decision diagrams, strategy tables, and expert assessment. The tools most commonly used by professional analysts are listed in Figure 7.

Selecting the right tools is not always easy. Choosing the wrong tools can waste a team's valuable time. I have watched teams struggle with detailed accounting models that did not address the real issues; issues like technical success, market share, or price. Frequently the biggest uncertainty is whether the organization is capable of executing the chosen strategy. An experienced coach can help overcome a team's tendency to use the tools they are familiar with rather than the tools they need.

Figure 7. A decision coach brings a bag full of tools.



FACILITATION

Perhaps the biggest coaching challenge is moving teams toward mutual learning and away from pure advocacy and negotiation. People tend to view decision making as a contest. The objective is to win.

In the 1970's Chris Argyris and David Schöne [5], interviewed many people and they observed many groups in decision making situations. They discovered that there is a large disparity between how people say we should act and how we actually do act. There seems to be a universal norm, "do what I say, not what I do" when it comes to how we think and act in teams.

People say we should think and act according to a Mutual Learning model. They say the goal is to make informed choices based on valid information with internal commitment. They say that the way to do this is to present balanced arguments, remain open to alternatives, and accept constructive criticism. See Figure 8.

What Argyris and Schöne observed is quite different. Our goal is not mutual learning. Our goal is to win. We strive to persuade others. We defend our positions. We tend to downplay our weaknesses rather than accept criticism. Rather than constructive inquiry we seem to prefer persuasion and lobbying. Despite our best intentions, we end up with limited understanding, poor decisions, and low commitment simply because we do not learn from each other. Argyris and Schöne called this the Unilateral Control model [4]. See Figure 9.

I have asked many classes of graduate students if they agree that we should think and act according to the Mutual Learning model. They

universally say yes. When the students are asked how they actually think and act they point to the Unilateral Control Model. It is a bit unsettling. You can run the experiment yourself.

A well-trained, experienced decision coach can help groups move from the Unilateral Control to Mutual Learning. It takes reflection, intervention, and skilled facilitation. I personally had the pleasure of working with Chris Argyris and his colleagues in the 1990's. I have used what I learned from them in my coaching work for the last 20 years. It has never failed me.

PROJECT MANAGEMENT

People forget that even a high-level strategy effort needs to be managed like any other complex project. How many times have you heard project evaluations like these? "The project cost too much." "It took too long," "The wrong people were involved." These are project management issues. They have little to do with the technical content of the project. There is an old adage that I use often, "No one cares how much a project costs if it is a success. No one cares how little a project costs if it is a failure." The goal is to get a successful project at the right price. Price includes time and money, and I might add, personal stress.

A decision coach will understand the tradeoffs that need to be made among time, cost, and quality. It is not possible to get a high-quality project, for low cost, in a hurry. Tradeoffs have to be made.

Figure 8. The Mutual Learning Model. This is how we say we should think and behave in decision making situations.

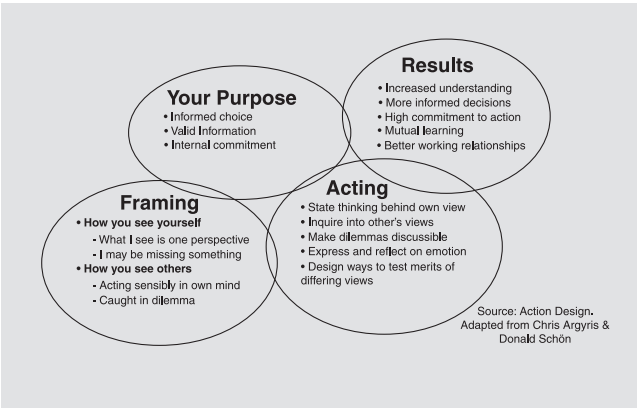
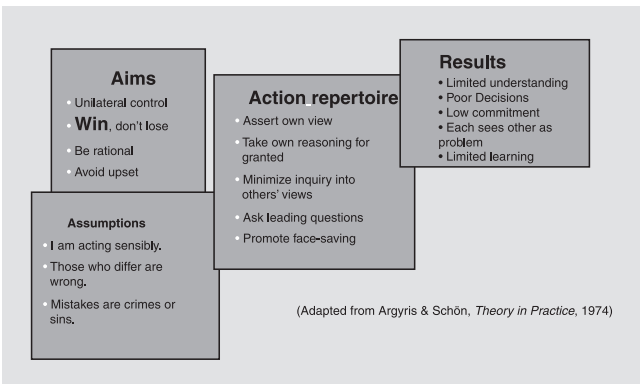


Figure 9. We think and act much differently than we say we should. We practice a Unilateral Control model.



III. DECISION ENGINEERING IS THE PATH TO DECISION COACHING

The term decision engineer has been with us for a long time. Decision engineering books have been written and decision engineering is taught in many universities, usually under the mantel of industrial engineering, systems engineering, management science and engineering, or decision analysis.

I believe that most future decision coaches will begin as decision engineers. Why engineers? It takes a combination of technical and organizational skills to work with teams on decisions like those in Figure 1. Engineers are comfortable with the technical aspects of complex decisions. It comes naturally. With the right training and experience most engineers can acquire the organizational skills.

There is an important asymmetry in the talents that people bring to decision making. I have never met an engineer that thought business school was difficult. I have never met a non-engineer that thought engineering was easy. It really is time for "revenge of the nerds" in strategic decision making.

A. What Is a Decision Engineer?

A decision engineer should have a degree in engineering or another technical field like physics. Decision engineers need to have a profound understanding of systems analysis, applied probability, and decision theory. This enables them to work with systems that are complex, dynamic, and uncertain. Structural models are a powerful tool for bringing groups of people together to talk about tough decisions. Training in system engineering disciplines is needed to design, build, and manipulate computer-based mathematical models.

A decision engineer is able to frame complex problems, design innovative alternatives, do analysis, and present the results. This knowledge comes from training and experience.

An experienced decision engineer, like an experienced lawyer or doctor, has the skills needed to go into new situations and work with diverse groups of people. He is an agile, fast learner. Big decisions require an understanding of a broad range of domains: technology, markets, supply-chains, economics, finance, and project management. They also involve working with people from a broad range of professions.

A decision engineer knows that a good outcome is not the same as a good decision. The distinction between a good decision and a good outcome is the essence of decision theory. It is easy to recognize a bad outcome. It is hard to determine whether a complex decision is good or bad. A decision engineer can stay focused on making a good decision.

A decision engineer is guided by norms of logic and behavior. His critical thinking skills enable him to understand the distinction between what is normative and what is descriptive. Engineering is guided by professional norms of good design: efficiency, ease of use, safety, and durability.

A decision engineer is a Bayesian. If you have to look up the term "Bayesian," then you are probably not a decision engineer—yet. Bayes' Rule provides a logical, theoretically sound framework for updating probabilities as new information is acquired. Bayes' Rule is a central underpinning of normative decision making.

Good engineers know how to exercise judgment when data is not available. Early in my engineering career I was told that, "Engineering is the art of approximation." Decision engineers know how to help other people assign probabilities to uncertain events and overcome cognitive biases. In the terms of Daniel Kahneman, engineers know how to "slow think" when it is appropriate [6].

A decision engineer is forward looking. Decision making is about the future. Decision engineers are comfortable using future-oriented tools like expert assessments, scenarios, and computer-based structural models.

A decision engineer is process oriented. There are two fundamental processes associated with decision making: the Decision Analysis Process [10] and the Collaborative Design Process. The Decision Analysis process is for problems that are technically complicated but straightforward organizationally. The Decision Analysis process is appropriate when there are only a few stakeholders involved and they are well aligned. The Collaborative Design process is appropriate when the stakes are high and many people with diverse backgrounds and diverse objectives are involved.

A decision engineer is comfortable using a broad range of tools: decision hierarchies, strategy tables, decision diagrams, structural modeling, sensitivity analysis, probability assessment, and decision trees. See Figure 7.

There may be other defining characteristics of a decision engineer. These are the important ones based on my experience. I will now share some history and my own career path. This might help you think about becoming a decision coach.

B. My Personal Odyssey As an undergraduate I studied mechanical

Figure 10. People say they want to move toward the Mutual Learning Model. A coach can help them get there.

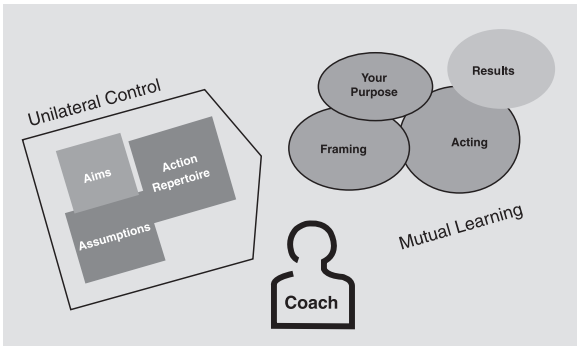
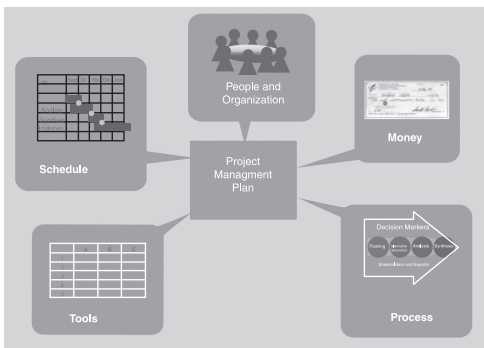


Figure 11. A good coach knows how to manage strategic decision projects.



and electrical engineering at Northwestern University. My first job was with Honeywell Aeronautical Division in Minneapolis, Minnesota. I worked on the Apollo Project. From Honeywell I went to IBM in Boulder, Colorado, to work on the IBM360 computer. In 1970 I decided to study in the newly formed Engineering-Economic Systems Department at Stanford University.

I finished a Ph.D. degree in 1975 and joined the Decision Analysis Group at SRI International. This was the era of the first energy crisis. After about three years at SRI some friends and I started a company to develop decision support systems for electric power companies and government policy makers. We developed and sold complex models for analyzing energy markets and electric power systems.

In 1989, I became a director at Strategic Decisions Group (SDG) a management consulting company in Palo Alto, California. I was the SDG account manager for General Motors (GM). It was a turbulent time in the auto industry. Many important strategic decisions had to be made. The decisions were complex, they involved many people, and too often there was a gap between what was decided and what was actually done.

SDG and GM developed a decision making process that worked wonders for breaking down organizational silos and bringing the voices of marketing and engineering into the decisions. We consulted with teams that worked on the fifth-generation Corvette, the new Cadillac line, the full-sized pickup truck, and several other vehicle lines. All of these products involved big, risky decisions.

Over time I moved from a consulting role to a coaching role. In the coaching role I helped form teams of GM professionals. I helped select the right process; frame the decisions; develop alternatives; oversee modeling efforts; facilitate difficult meetings; resolve conflicts; help develop presentations; and supervise project management. Some of the teams were drawn from around the world. The Director of Corporate Strategy and Knowledge Development at GM, Vince Barabba, has written three books about the lessons learned [7]–[9].

GM developed its own cadre of decision engineers and coaches. These coaches are now embedded throughout the company. Many former decision coaches are now top-level executives. I retired from consulting in 2000 to write and pursue public policy work in natural resources and energy.

IV. Conclusion

Decision coaching has been a rewarding career for me. It has allowed me to enjoy my passion for design, technology, and engineering. I've had the pleasure of working with many smart, dedicated people on important projects. I've seen the world and I have helped create billions of dollars of value. My path is typical of the path I believe many engineers can follow.

If you want to become a decision coach then my advice is to first become a decision engineer. Find a place where you can learn systems analysis, computer modeling, and decision analysis. Learn about business. Look for mentors. Get involved in tough projects that require collaboration. Read the writings of the pioneers of modern management: Drucker [11], Deming [12], Kahneman [6], Howard [10], Argyris [5], Porter [13], Christiansen [14], and Martin [15]. Learn how to keep teams focused on decisions. Learn how to present results.

Decision engineering and decision coaching are excellent preparation for taking up executive roles. As Peter Drucker so wisely said, "Decision making is only one of the tasks of an executive. It usually takes but a small fraction of his time. But to make decisions is the specific executive task." [11].

References

[1] Massimo Garbulo and Dan Lovallo, *How companies make good decisions: McKinsey Global Survey Results,* January 2009, http://www.mckinsey.com/insights/_strategy/how_companies_make_good_decisions_mckinsey_global_survey_results

[2] Alex Kazaks and Michael Uhl, *How should you tap into Silicon Valley?*, McKinsey Quarterly, September 2015, http://www.mckinsey.com/insights/business_technology/how_should_you_tap_into_silicon_valley

[3] S.M. Barrager, A New Profession is Emerging: Decision Coach, *INFORMS Analytics Conference*, Huntington Beach, California, April 2012, Available http://www.slideshare.net/barrager/a-new-profession-is-emerging-16516243

[4] S.M. Barrager, The Collaborative Design Process and Decision Engineering, Presented at *INFORMS Meeting, San Francisco*, November 2014, Available http://www.slideshare.net/barrager/informs-collaborative-design
[5] Chris Argyris and D.A. Schön, *Theory in Practice: Increasing Professional Effectiveness*. San Francisco: Jossey-Bass,1974, pp. 63–136.
[6] Daniel Kahneman, *Thinking Fast and Slow*, New York: Farrar, Straus, and Giroux, 2011, p. 13
[7] Vincent P. Barabba, *Meeting of the Minds: Creating the Market-based Enterprise*, Boston: Harvard Business School Press, 1995
[8] Vincent P. Barabba, *Surviving Transformation: Lessons from GM's Surprising Turnaround*, New York: Oxford University Press, 2004
[9] Vincent P. Barabba, *The Decision Loom: a Design for Interactive Decision-making in Organizations*, United Kingdom: Triarchy Press, 2011
[10] Ronald A. Howard and Ali E. Abbas, *Foundations of Decision Analysis*, New York, Pearson, 2015
[11] Peter F. Drucker, *The Effective Executive*. New York: Harper & Row, 1967
[12] W. Edwards Deming, *Out of the Crisis*, Cambridge: Massachusetts Institute of Technology, 1986
[13] Michael E. Porter, *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, New York: The Free Press, 1980
[14] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*, Boston, Harvard Business School Press, Christensen, Clayton M. 1997
[15] Roger Martin, *The Design of Business*, Boston: Harvard Business School Press, 2009

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