### Design Thinking and Management Education:

### **Benefits for Problem Framing and Problem Solving**

Dr Judy Matthews

School of Management, QUT Business School, Queensland University of Technology Brisbane, Australia Email: jh.matthews@gut.edu.au

### ABSTRACT

Design and design thinking are identified as making valuable contributions to business and management. The numbers of higher education programs that teach design thinking to business students and executives are growing, however to date little information about the outcomes of these initiatives has emerged. This paper presents the findings from the incorporation of design thinking and methods in one unit of an MBA program. All 90 participants from three MBA classes wholeheartedly expressed their support for this initiative. An evaluation of this experiment found positive reactions, learning, changes in behaviour and positive results for their companies. The challenges and future directions for the inclusion of design thinking and design methods in management education programs are proposed.

Keywords: design thinking, problem framing, problem solving, management education and development

Management Education and Development

### **INTRODUCTION**

The potential benefits of design thinking for managers and management education have been argued in the last decade (Boland & Collopy 2004; Brown 2008, 2009; Dunne & Martin 2006; Martin 2009; Starkey & Tempest 2009). Design thinking was described as way of approaching management problems with an open mind, similar to the way a designer approaches design problems (Dunne & Martin 2006). Using examples where design firms such as IDEO apply their expertise in design to high technology issues, issues in healthcare organizations and everyday challenges, these authors contend that business people today, particularly managers, need to become designers.

The growing recognition of the potential impact of design and its contribution to successful business practice and the popularity of the notion of design thinking at the business level have largely stimulated interest in design and design thinking at the company level. Recent research indicates that companies who use design in their business, perform better economically in the marketplace (Cox 2005; Borja de Mozota 2006; Dell'Era Marchesi & Verganti 2010: Moultrie & Livesey 2009; Nussbaum 2006). Research by the UK Design Council on the performance of firms and the impact of design on firms' performance found that over a ten-year period of analysis, the benefits of effective use of design include an improved share price performance and therefore greater shareholder returns (UK Design Council 2004). Many large successful international firms such as GE, P&G, Sony and Philips, use a design perspective as a problem-solving apparatus across the company.

The research question we are addressing is: what are the benefits and challenges of adding design thinking and design methods to courses in MBA programs? This research responds to suggestions (Boland & Collopy, 2004; Starkey & Tempest 2009) regarding the importance of design and its potential contributions to management education and to an earlier call for design literacy in managers in MBA programs. A survey of 19 of the top US MBA programs found not a single one addressed or incorporated design into its curricula in any significant way and even in programs that focused on marketing and branding, curricular attention to the principles or theories of design was at best cursory (Formosa & Kroeter 2002). This study investigates the inclusion of design thinking methods and tools in a new MBA unit concerning problem framing and problem solving. Problem solving is widely accepted as one of the essential skills of an effective manager (Brightman, 1980) and an essential element in a manager's toolkit of abilities (Carlopio & Armstrong 2012).

This paper reports early findings from an experiment where design thinking tools and techniques were included more explicitly in graduate and executive education. This research extends the existing literature on design thinking and management education in a number of ways. First, we discuss notions of design and design thinking identifying common principles. Second, we investigate the application of design thinking and design methods to one MBA unit concerned with problem framing and problem solving, and present details and results of an empirical study of the inclusion of such

2

methods in a problem framing unit. Third, we discuss the processes and outcomes of this study using Kirkpatrick & Kirkpatrick's (2006) evaluation framework. Finally we discuss the challenges and limitations of this study and suggest potential new directions for management education and development. This paper reports key findings from including design thinking and design methods in the teaching of 90 students in MBA and executive MBA programs in a unit focused on problem framing and problem solving. To our knowledge, little empirical work on the inclusion of design thinking and its effects has been presented and hence this study contributes to new knowledge and better understanding in management education.

### BACKGROUND

Management Education in Australia and the need for change as companies strive to compete on global markets is an area of intense scrutiny (Hall Agarwal & Green 2013) and the contribution of management to productivity is a source of recent concern (Green & Agarwal 2009). This focus on management education falls within the context of recent reviews of management education in MBA programs (Datar Garvin & Cullen 2010). The changing needs of managers in complex environments have strong implications for consequent changes in management education.

Like many professionals, managers are influenced by their fields of endeavour. Managers are tasked not just with solving existing problems and responding in new ways to unexpected changes in existing situations, but also with finding new opportunities and creating new responses to opportunities. The importance of managers being reflective practitioners, reflecting on the problem at hand as well as reflecting on the problem choice of approach is well known (Schön, 1983). Diagnostic ability and problem framing are important in many areas of professional activity and how problems are framed in terms of perspectives tends to shape understanding actions and sensemaking of processes.

Similarly how designers think has been the subject of scrutiny where the design process includes formulating, moving, representing, evaluating, and reflecting (Lawson 1980, 2006). This discussion was extended with reflections around "designerly ways of knowing." (Cross 2001), noting that design practice does indeed have its own strong and appropriate intellectual culture, and design research with

notions imported from either the sciences or the arts is to be avoided. Herbert Simon contends that everyone who devises courses of action aimed at changing existing situations into preferred ones is a designer (Simon 1996)". Lawson (1997: vii) adds "We all can and do design; we can learn to design better".

Design thinking is generally referred to as "applying a designer's sensibility and methods to problem solving, no matter what the problem is ... a methodology for problem solving and enablement" (Lockwood 2010: p xi). Design thinking can be described as "a discipline that uses the designer's sensibility and methods to match people's needs with what is technically feasible and what a viable business strategy can convert into customer value and market opportunity" (Brown 2009).

Design thinking is widely understood a human centered approach to innovation that includes deep understanding of people as inspiration, using prototyping and building to think, using stories, and having an inspired and inspiring culture (Brown 2008). To a large extent, the notion of design and design thinking in the business literature has been largely popularized by stories and case studies of work carried by design firms such as IDEO (Brown 2008, 2009; Hargardon & Sutton 1997; Kelley 2001), Design Continuum and frog design (Schilling 2010), in new product development.

### Using Design Thinking for Problem Solving

Designers seek outcomes that are desirable for users, viable for the client, and feasible within technical and design constraints. Design thinking is applied to problem solving situations, around the concept of *wicked problems*, drawing on Rittel's initial description of social planning problems as indeterminate (Churchman 1967; Rittel & Webber 1973) and subsequently developed by Buchanan (1992). Buchanan argued that designers deal with problems that are ill defined, so that the creative redefinition of the problem is part of the professional skill. Some strategy problems have been labelled as wicked problems, for example, if the problem involves many stakeholders with conflicting priorities, if it changes even as solutions are attempted, and if there's no way to evaluate if the remedies will work (Camillus 2008). The generative nature of design thinking in developing new

solutions is not limited to business settings and there is a wealth of literature regarding the application of design thinking to social innovation for real world solutions that create better outcomes for organizations and the people they serve (Brown & Wyatt 2007).

Design thinking comes in several varieties, stages and definitions (Johansson-Sköldberg Woodilla & Cetinkaya 2013). These authors describe design and designerly thinking in five separate ways: as the creation of artefacts; as a reflexive practice; as a problem solving activity; as a way of reasoning/making sense of things, and as the creation of meaning. The notion of design thinking used here is closely based on human centred interaction and closely parallels the methods commonly used by designers and others to develop creative and innovative solutions. A summary of approaches to design thinking is presented in Table 1.

### [Insert Table 1 here]

We now turn to the research question: what are the benefits and challenges of adding design thinking and design methods to problem framing and problem solving courses in MBA programs.

### **RESEARCH DESIGN AND METHODS**

A new unit was developed for the MBA and Executive MBA programs that provided a stronger basis for problem framing and problem solving that would be useful for situations of ambiguity and uncertainty. The unit, Problem Framing for Creative Action features 21 hours of class time duration, with workshops, individual and team exercises and instructional activities supported by a wellestablished Blackboard site. Multiple problem solving models are introduced and applied in the first three modules of this unit (De Bono 1993; Proctor 2010; Van Gundy 1988; and Wood Cogin & Beckmann 2010) with a strong focus on problem framing, idea generation, idea selection and evaluation with a series of iterative steps with questions, creative problem solving tools, techniques and instructional cases. Proctor's creative solving process was the dominant model as shown in Figure 1.

[Insert Figure 1 here]

Design thinking and design tools and methods were introduced after the first formative assessment in the later nine hours of the unit. Relevant design thinking tools and materials were accessed and obtained from a wide range of library and web-based sites including human centred design (Brown, 2008, 2009; IDEO 1999; Kelley 2001; Liedtke & Ogilvie 2011; Stanford d School frameworks). Additional resources were developed through collaboration with an experienced industrial designer and these design thinking tools were co-delivered with the designer.

### [Insert Figure 2 here]

### [Insert Figure 3 here]

Action Research is a method of establishing a clear vision for the program and encouraging participants to explore ways of achieving their goals through action and reflection (Susman & Evered, 2002; Zuber-Skerritt, 2002). The development and delivery of this unit was based on an action research approach of engaging with practitioners (experienced middle and senior managers enrolled in MBA and Executive MBA programs) around problems in their workplaces as issues of concern, facilitating increased awareness of tools and processes, nurturing and challenging their understanding. The creative problem solving and design thinking principles and tools were applied to problems in the classroom context throughout the unit, as well as in a final team-based problem-solving workshop.

In this *Problem Framing for Creative Action* unit, participants were introduced to tools and processes to assist their exploration with distinct design methods. Encouraging participants to set their own goals and select meaningful projects from their own business around issues of concern, or the development of new possibilities for the individual assessment tasks ensured that individuals were focused on achieving their desired ends. Reflections and learning from these classes will be incorporated into future development and delivery of this unit.

### Analysis

Data from the teaching and unit evaluations, unsolicited correspondence, and final assessments provided richer understanding of processes and benefits gained by the participants were analysed using thematic analysis (Miles & Huberman 1994) to identify themes relevant to evaluation.

The results of this initiative are presented through the participants' views of the processes and outcomes that design thinking methods and tools generated. All participants reported gaining new insights from their customers and expressed an on-going commitment to use design thinking tools in future investigations of their customers and in capturing such insights to apply in their business. Participants specifically nominated tools such as empathy maps, journey mapping, narratives, co-design, an experimental approach, and prototyping as contributing to new ways of gaining customer insights leading to valuing customers.

### FINDINGS AND DISCUSSION

Responses to incorporating design thinking and methods into problem solving course are presented under (i) Reactions to framework and material, (ii) learning, (iii) changes in behaviour and (iv) results (Kirkpatrick & Kirkpatrick 2006). Comments regarding the benefits of context as a basis for learning, the benefits for own personal perspective, for problem framing and solving at team level and for the broader organization, through better morale of employees and better engagement with stakeholders a way of changing dynamics on workplace were included.

(i) Reactions to framework and material have been measured by student evaluation of the unit
 4.6 [out of possible 5] plus spontaneous letters thanking me for the development and delivery of the
 course. Three examples of the letters are presented.

- Thank you for taking us on the journey of creative problem solving. I have thoroughly enjoyed the course and in particular design thinking.
- I enjoyed this subject, I am in the process of leading a number of groups embracing Design Thinking at work. I have seen some fantastic changes already in the participants' attitudes. Thanks for introducing me to the concept. Kind regards,
- You will be pleased to know that my proposals and contributions to helping fix my reporting department's issues have worked (take a peek at my new email signature). Thanks to Problem Framing for Creative Action, I have a new job internally in Y company. What a

7

great chance to practice my new design techniques.

### (ii) Learning

### Design thinking tools were useful to communicate information and build solutions

• "The visualisation for these types of activities worked extremely well. The sample group used to review the information were able to clearly see the information in this method much more clearly than with words or an explanation. I also found it a simpler process to follow and take people on the journey to creative problem solving."

# Design thinking improved communication, problem framing and problem solving around a complex problem.

- "Design thinking process has facilitated my ability to explain the situation and solutions across a wide range of education levels within the organisation, from drivers to senior managers, using the visualisation tools used. It became clear that the perceived initial problem was not necessarily the problem we were trying to solve. The key in the process was to define the problem, and once this was clearly understood, allow ideation to occur. A convergent process was then required to narrow the options and the 3 ideas which met the required criteria were then selected. These were part of the recommendations provided to senior management for further consideration."
- "The second half of this course which formally introduced me to the design process, whilst challenging, brought together a number of processes I had previously undertaken in work situations into a consistent and coherent framework for problem solving. Many of the ten tools outlined by Liedtka & Ogilvie (2011) have been used in isolation by me and my team but the light bulb moment occurred for me when the framework above was presented and provided a holistic approach to the process."

### (iii) Change in behaviour

### Design thinking has changed my approach to problem solving as a manager.

- Design thinking as a concept has removed the perception that solutions need to be perfect and 100% right all the time. The idea that there is no room for error in business is flawed (Liedtka & Ogilvie, 2011). After completing this course, I agree with this statement. As a leader and a manager in a real world business, it would be difficult to sell the idea to customers and shareholders that failure is acceptable because we can learn from it. But this is the risk or the challenge if design thinking is only implemented to approach isolated problems. Implementing design thinking throughout everyday activities in the business is an approach to achieving Kaizen in an innovative and creative manner.
- For my business, my base level product is legislated. Differentiation from competitors is critical to success and the only way to achieve differentiation is through creativity and innovation in value add products, processes and services. To ensure creativity in problem solving is achieved, I have concluded that the design thinking framework is better suited to my problem solving style compared with Proctor's Six Steps process and it is also most applicable for my current business needs.

### Design thinking tools have led to new team processes.

- "I have focused on "The 10 Tools for Design Thinking" by Liedtka and Ogilvie to follow a process to creatively approach the issue I face with the X Team's operation. The process has resulted in the development of a new business model that will place the X team's operation in a position to deliver solid growth. Including the X Team in this process has resulted in a new energy in this team. They are now approaching things very differently."
- *"With problem framing through creative action I have applied my learnings to the issues we face in another state. The operation was in a state of continuous mediocrity, there was no direction, and there was no energy in the team. Through the process outlined in assessment*

pieces A and B, and the application of The 10 Tools for Design Thinking we have a business model that will encourage growth and perhaps more importantly creativity."

(iv) Results

### Design thinking contributed to better employee participation and morale.

• "Perhaps one of the most surprising aspects of adopting the design thinking process was the improvement in the mindset and morale of the team. The build team has the poster in their workspace."

### Design thinking has benefits for stakeholders as well as employees

• "The design thinking process has been a very beneficial exercise. I have incorporated close to 60 stakeholders at varying levels, and the data collection has been quite intensive. I feel as though the stakeholders have also benefitted from the exercise. "....

Applying the design thinking tools has lead my company to develop three new projects:

(i) *Reducing Drafting Timelines*: I am leading this group and over the past couple of months we have prototyped and tested a number of 'solutions'. These have lead to a significant decrease in overtime (currently zero hours) and drawing time (80% reduction in time now 24 minutes).

(ii) *Innovation Project:* I have been asked by the R&D Director to teach his engineers to be innovators. The first workshop based on Design Thinking is planned for 15<sup>th</sup> July 2013. Ten engineers will be involved.

(iii) *Knowledge Sharing*: I am leading this global group to prototype and test new ways of knowledge sharing with both internal and external customers.

### CHALLENGES OF INCLUSION OF DESIGN THINKING

The inclusion of design thinking in the *Problem Framing for Creative Action* unit required specialised resources from numerous dispersed sources. Encouraging participants to engage with design thinking tools such as visualisation, journey mapping, empathy maps, personas, prototyping and testing was a

gradual process that worked well. As the topic of design thinking for business is becoming more popular, more suitable resources are being developed to meet this demand, and specialised resources and combinations were developed for teaching this unit.

Resource constraints regarding the availability of teaching staff with requisite knowledge and skills were resolved through collaborative teaching across schools of management and design and in developing new materials and resources. Teaching design thinking skills required a person with training and expertise in design. An academically trained professional industrial designer with experience tutoring in new product development was an invaluable addition for engaged teaching and delivery and working with these managers.

### **CONTRIBUTIONS**

This paper presents the results of an empirical study of introducing design thinking to management education course on problem framing and problem solving for middle and senior managers in MBA programs. The outcome can be expressed as "Design thinking has changed my approach to problem solving as a manager" and led to new and better ways of working with customers.

### LIMITATIONS

The early positive findings from the inclusion of design thinking in problem framing and problem solving unit may be a result of influences outside the delivery of this unit. Follow up of participants in six months time to investigate the impact will be carried out. The limitation that the responses presented are those of the students themselves could be extended by direct evidence of learning from supervisors or other external sources to increase the reliability of results. Further exploration of responses and results will be continued in future units with thorough evaluation.

### **CONCLUSIONS AND IMPLICATIONS FOR MANAGERS**

The potential contributions of design and design thinking for management have been well argued in the last decade from management theorists (Boland & Collopy, 2004; Brown 2008, 2009; Dunne & Martin 2006; Martin 2009; Starkey & Tempest 2009) but to a large extent there appears to be little

research on the output of such programs. Many programs are established to bring together students from a range of disciplines at the undergraduate and graduate levels to learn design methodologies and apply them to workplace projects. The incorporation of design thinking tools and methods into the *Problem Framing for Creative Action* unit has, to a large extent, demonstrated some of the potential benefits of design thinking and doing, by applying the tools and techniques within frameworks for maximum advantage. The early results from this initiative indicate positive results. All students stated they had learned new ways of defining and framing problem situations and many provided examples of implementing these practices through co-design with stakeholders or employees.

### **Implications for theory and practice**

Theoretical implications of the design thinking in problem framing and problem solving will be explored in a future paper on the framing of problems and opportunities in business contexts. Design thinking through its deep customer insights and sensitivity to latent needs acknowledges and validates the emotional aspects of problems. Inclusion of these methods can enhance problem solving and recent research indicates the importance of emotions in everyday problem solving competence (Blanchard-Fields 2013).

Future offerings of this unit will continue to incorporate design thinking and design methods in at least 50% of the unit content and this proportion will increase over time. Continued development, experimentation and development of material relevant to design thinking for incorporating into multiple levels of management education programs will be undertaken, with testing of the material in teaching situations. Future implementation may include closer links with an extension of design thinking to strategy formulation to capture more benefits from design thinking (Leavy 2010). In addition, professional development programs to raise awareness of more academic staff to the possibilities of inclusion of design thinking in other units are being planned to increase the capability of staff to participate and use design thinking skills. Further engagement of managers and management academics with design thinking may also assist managers to achieve the necessary

12

design sensibilities (Fulton Suri, & Hendrix 2010) to increase their contributions to their workplaces and companies.

### REFERENCES

- Boland, R and Collopy, F (2004) Design Matters for Management. In R. Boland & F. Collopy (Eds.), *Managing as designing* (pp. 3-18). Stanford, CA: Stanford University Press.
- Bingham, CB and Kahl, SJ (2013) How to Use Analogies to Introduce New Ideas, MIT *Sloan Management Review*, 54, 2, 9-12.
- Blanchard-Fields, F. (2013) Everyday Problem Solving and Emotion: An Adult Developmental Perspective, *Current Directions in Psychological Science*, 16, 1, 26-31.
- Borja de Mozota, B. (2006). Design Management. New York and Paris. Allworth Press.

Brightman, H. J. 1980 Problem solving: a logical and creative approach. Atlanta, Georgia.

- Brown, T. 2008. Design Thinking. Harvard Business Review, June: 85-92
- Brown, T. (2009) Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. Harper Business.
- Brown, T and Wyatt, J (2010) Design Thinking for Social Innovation, *Stanford Social Innovation Review*, Winter, 31-35.

Buchanan, R (1992) Wicked problems in design thinking. Design Issues, 8(2): Spring, 5–21.

- Buchanan, R (2004) Management and Design: Interaction Pathways in Organizational Life. In R. Boland & F. Collopy (Eds.), *Managing as designing* (pp. 36-53). Stanford, CA: Stanford University Press.
- Camillus, JA (2008) Strategy as a Wicked Problem, Harvard Business Review, May,
- Carlopio, J and Andrewartha, G (2012) Developing management skills: a comprehensive guide for leaders. French's Forest, N.S.W. Pearson Australia,
- Churchman, CW (1967) "Guest editorial: Wicked problems", Management Science, 14, 4,141-142
- Cooper, R, Junginger, S and Lockwood, T (2009) Design Thinking and Design Management: A Research and Practice Perspective. Design Management Review, 20, 2, 45–55.
- Cox, G (2005) The Cox Review of Creativity in Business: Building on the UK's Strategy. SME's in manufacturing. London.
- Datar, S, Garvin, D and Cullen, P (2010) *Rethinking the MBA: Business Education at a Crossroads*, HBS Press, Cambridge, Mass.
- DeBono, E (1996) Serious Creativity: Using the Power of Lateral Thinking to Create New Ideas.
- Dell'Era, C Marchesi, A and Verganti, R (2010). Mastering Technologies in Design-Driven Innovation, *Research Technology Management*, March-April, 12-23.
- Dunne, D & Martin, R (2006) Design Thinking and How it Will Change Management Education, Academy of Management Learning and Education, 5, 4, 514-523.
- Dunne, D (2010) Two Inquiry-Based Approaches To Sustainable Value: Positive Design And Integrative Thinking, In Thatcherkery, T, Cooperrider, D and Avital, M (Eds) *Positive Design*

*and Appreciative Construction: From Sustainable Development to Sustainable Value.* Advances in Appreciative Inquiry, Volume 3. Emerald Press.

- Formosa, K and Kroeter, S (2002) Toward design literacy in American management: A strategy for MBA programs. *Design Management Journal* 13(3). 46-52.
- Fulton Suri, J and Hendrix, RM (2010) Developing Design Sensibilities, *Rotman Magazine*, Spring, 58-63.
- Green, R. Agarwal, R., et al. (2009) *Management Matters in Australia: Just How Productive are We?* Department of Innovation, Industry, Science and Research, Australia.
- Hall, R, Agarwal, R & Green, R. (2013) The Future of Management Education in Australia: Challenge and innovations, *Education* + *Training*, 55, 4/5, 348-369.
- Hargadon, A and Sutton, RI (1997) Technology brokering and innovation in a product development firm, *Administrative Science Quarterly*, 42, 4, 716 749.
- Hargadon, AB (1998) Firms as knowledge brokers: Lessons in pursuing continuous innovation, *California Management Review*, Spring 40, 3; 209 – 227.
- IDEO (1999) The Deep Dive: Shopping cart, http://www.ideo.com/work/shopping-cart-concept/#
- Johansson-Sköldberg, U, Woodilla, J and Cetinkaya, M (2013). Design Thinking: Past, Present and Possible Futures, Creativity and Innovation Management, 22, 2, 121-146.
- Jonassen, DH (2004). *Learning to Solve Problems: An Instructional Design Guide*. Jossey-Bass, San Francisco.
- Kelley, T and Littman, J (2001) The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm, Crown Business.
- Kirkpatrick, DL and Kirkpatrick, JD (2006) *Evaluating training programs: the four levels*, San Francisco, CA: Berrett-Koehler
- Lawson, B (2006) How designers think, 4th edition. Oxford, UK: Elsevier
- Lawson, B (1997) *How designers think: The design process demystified*, 3rd Ed. Reed Elsevier, Oxford: Architectural Press. Ch. 7 Problems, solutions and the design process pp. 113-127.
- Lawson, B and Dorst, K (2009) *Design expertise*, Architectural Press. Oxford University Press. Chapter 2.
- Leavy, B (2010) Design Thinking a new mental model of value innovation, *Strategy & Leadership*, 38, 3, 5-14.
- Liedtka, J and Ogilvie, T (2011) Ten Tools of Design Thinking. Darden Case.
- Liedtka, J and Ogilvie, T (2010) *Designing for Growth: A Design thinking tool for Managers*. Columbia Business School Publishing.
- Liedtka, J (2000). In Defense of Strategy as Design, California Management Review, 42 (3), 8-30.
- Lockwood, T (2010) *Design Thinking: Integrating Innovation, Customer Experience, and Brand Value.* Design Management Institute.
- Martin, R (2007) Design and business: why can't we be friends? *Journal of Business Strategy*, 28 (4), 6-12.
- Martin, R (2009) The Design of Business, Harvard Business Press, Boston.

- Matthews, JH (2009) Creativity, Design and Entrepreneurship: Management Education and Development for Innovation, Fully refereed paper accepted for presentation at US Academy of Management Meeting, Green Management Matters, Chicago, Illinois, USA. 7 - 11 August.
- Meinel, C and Leifer, L (2011) Design Thinking Research. In H. Plattner, C. Meinel, L. Leifer (Eds.), *Design Thinking: Understand—Improve—Apply* (pp. xiii-xxi). Heidelberg: Springer.
- Miles, MB and Huberman, M (1994) *Qualitative Data Analysis: An Expanded Sourcebook*, Second Edition, Sage Publications.
- Moultrie, J and Livesey, F (2009) International Design Scorecard: Initial Indicators of international design capabilities, Institute for Manufacturing, University of Cambridge. http://www.ifm.eng.cam.ac.uk/ctm/idm/projects/scoreboard.html
- Nickerson, JA and Zenger, TR (2004) A knowledge-based theory of the firm: The problem solving perspective. *Organization Science*, 15(6) 617–632.
- Nussbaum on Design 2006, Business Week, May,17, Cover Story <u>http://www.businessweek.com/innovate/NussbaumOnDesign/archives/2006/05/a\_new\_rankin</u> g on global design from helsinki--where they know design.html
- Proctor, T (2010) Creative Problem Solving for Managers: Developing skills for decision making and *innovation*, Second Edition. Routledge
- Rittel, H and Webber, M (1973) Dilemmas in a general theory of planning. *Policy Sciences*, 4: 155-169.
- Schilling, MA (2010) *Strategic Management of Technological Innovation*, Third Edition, McGraw-Hill International.
- Schön, AD (1983) *The Reflective Practitioner: How Professionals Think in Action*. London: Basic Books Inc.
- Simon, HA (1996) The Sciences of the Artificial, Boston, Mass.: MIT Press.
- Starkey, K and Tempest, S (2009) The winter of our discontent the design challenge for business schools, *Academy of Management Learning and Education*.8 (4), pp. 576-586.
- Susman, GI and Evered, RD (1978) An assessment of the scientific merits of action research, Administrative Science Quarterly, 23, 582–603.
- Sutton, RI and Hargadon, AB (1996) Brainstorming Groups in Context: Effectiveness in a Product Design Firm, *Administrative Science Quarterly*, 41, 4, 685-718.
- UK Design Council (2004) The impact of Design on Stock Market Performance. An analysis of UK quoted companies 1994-2003, London.
- Ward, A, Runcie, E and Morris L (2009) Embedding Innovation: design thinking for small enterprises, *Journal of Business Strategy*, Vol 30 No2/3, 78-84.
- Wood, R, Cogin, J and Beckmann, J (2009) *Managerial Problem Solving: Frameworks, Tools, Techniques*, North Ryde, NSW: McGraw-Hill Australia Pty Ltd.
- Van Gundy, AB (1988) *Techniques of structured problem solving*. Second edition. New York: Van Nostrand Reinhold Company.
- Zuber-Skerritt, O (2002). A model for designing action learning and action research programs, *The Learning Organization*, 9 (4), 143-149.

Tabla 1	Annuaghas	to Design	Thinking
Table 1.	Approaches	to Design	1 ninking

Approach	Author	Details	Examples
Design and designerly thinking can be classified in five ways as: the creation of artefacts, a reflexive practice, a problem solving activity, a way of reasoning/making sense of things, and the creation of meaning,	Johansson- Sköldberg, Woodilla, & Cetinkaya, (2013)	<ul> <li><i>Reflexive practice.</i> Reflective</li> <li>Practitioner practice based focus on relation between creation and reflection upon the creation, that allows for constantly improved competence and re-creation.</li> <li><i>Problem solving activity</i> as places of interventions, where problems and solutions could be reconsidered.</li> <li><i>Way of reasoning/making sense of things</i> based on ethnographic research, and creative design processes; using abductive processes to make sense and generalize from observations and find patterns grounded in practical experience described through practical examples.</li> <li><i>Creation of meaning</i></li> </ul>	Design thinking as problem solving or creating new solutions.
Design thinking includes: empathy, integrative thinking, optimism, and collaboration to transform the way a company develops products, processes and strategy	Brown (2008)	Design thinking uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity.	Design thinking can transform the way a company develops products, processes and strategy
Design thinking uses the abductive thinking of designers, and actively to look for new data points, challenges accepted explanations, and infer possible new worlds	Martin (2009)	Evidence showing that creative thinking in a business is required for success. Examples of companies such as Apple, IBM focusing on what occurred before and after design thinking was adopted.	Case studies of popular corporation's process and journey but lacks in clear instructional directions to modify business
Design thinking integrates human, business and technology factors in the problem identification-solving and design process.	Meinal & Leifer (2011)	Design thinking comprises human- centred methodology combining expertise from design, social sciences, engineering and business. It blends an end-user focus with multi-disciplinary collaboration and interactive improvements to produce intuitive products, systems and services.	Exploration of the design thinking process, by describing the development and application of design thinking

Figure 1. Nine Steps Creative Problem Solving Framework (Proctor, 2010)



Figure 2. Design thinking





## Designing for Growth

