5-2003

Evaluating and Organizing Thinking Tools in Relationship to the CPS Framework

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by

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A Project for Studies in Creativity

Submitted in Partial Fulfillment of the Requirements of the Degree of Master of Science

State University of New York- Buffalo State College
International Center for Studies in Creativity

May 2003

Dates of Approval

_____ _____

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ABSTRACT

Evaluating and Organizing Thinking Tools in Relationship to the CPS Framework

This project surveyed, analyzed and organized thinking tools drawn from several areas of theory and practice within the new proposed framework for Creative Problem Solving (CPS). The tools were drawn from a diverse set of literature and organized in accordance with the new skill-based version of CPS. The literature review focused on Total Quality Management (TQM), Strategic Management, Problem Solving, Decision Making, and Creativity Processes and Methods, other than CPS**.** Forty-four thinking tools, other than the 'classic' CPS tools, were collected, analyzed, described and categorized within the seven steps of the new CPS framework, according to the main categories of divergent and convergent thinking. Implications for future studies suggested the opportunity to widen the search for more thinking tools, by achieving a higher balance between divergent and convergent tools within each step of the CPS framework, as well as the need to apply these thinking tools within the facilitation of the CPS process.

DEDICATION

This Master's Project is dedicated to the memory of my beloved father Piergiorgio and of my mentor Mirella. In their own ways, they handed down to me fundamental values of self-respect, perseverance, honesty and coherence and they taught me to always pursue the things I believed in. They both would be very proud of my accomplishments in my new 'American life'. Grazie pap_ e grazie Mirella. So che dall'alto mi guardate e siete orgogliosi di me.

I wish to also dedicate this Project to two fundamental people in my life who strongly supported me during this amazing adventure through the Creative Studies: my mother Maria Grazia and my husband Tim. You both have always believed in me more than I ever did. I have become a stronger person because of your unconditional love and generosity. Grazie, miei tesori.

ACKNOWLEDGMENTS

First and foremost, I must acknowledge my mother and my husband. Not only did my mother support my studies financially (Mom, you could not have done a better investment!), but she has constantly fueled my leadership skills with her great belief in my abilities and potentials. With her strong-willed and resourceful personality, my mother is indeed the primary source of my 'creative juice'. On the other hand, I could not have achieved this goal without my husband Tim by my side. Tim, you are everything to me: my love, my best friend, my mentor, my teammate, my companion of travel and adventures. You have been constantly by my side during this Master's Program, by supporting and encouraging my learning efforts, by tolerating and counterbalancing my anxieties and self-doubts, by offering your precious advises and, most importantly, by passing on to me your amazing creative spirit which has increased my self-confidence and my ability to see opportunities, instead of 'problems'. I cannot thank you enough, my love, for all you have done for me with grand generosity!

A big acknowledgment (and a million of thanks!) goes to my mentor, my teacher, my advisor Dr. Gerard Puccio who has been a great role model for me throughout the Program. Gerard, I truly admire your leadership style and your incredible ability of making people feel worthy. It is such a unique talent. You have given me so much confidence and strength, by making me overcome the language fears and barriers and by offering high appreciation of all my contributions. You indeed 'walk the talk' of what a great 'change leader' is. No wonder the Program that you direct is so successful! You have also ignited and 'revived' my interest for research and constantly stimulated my intellectual quest. I am looking forward to years of collaboration and friendship with you.

Another big acknowledgment goes to Dr. Mary Murdock who taught me, more than anybody else in this Program, about 'attitude'. Mary, you have worked so effectively against all my anxieties, by helping me truly understand and appreciate 'tolerance for ambiguity'. You have

constantly raised the bar of your requests, class after class, thereby inciting me to always ‘go beyond’. You are a ‘beyonder’.

I also must acknowledge and thank Susan Keller-Mathers for her contagious passion for creativity and for her incredible energy. Sue, I think I have passion and energy by nature, yet through your teaching those talents of mine have become ‘dynamite’. I am especially very grateful to you for fueling my interest in tools, which are the subject of this Project and my new area of expertise.

Finally, I want to acknowledge and thanks all my colleagues who made the classes so exciting and stimulating, through intellectual exchange and great moral support, as well as all the other people, faculty and staff, who make of the Center a great place where to study, network and grow.

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SECTION 1
Project Purpose

Introduction

The purpose of this project is to survey and then catalog existing thinking tools drawn from several areas of theory and practice, such as idea generation, problem solving, decision making, quality improvement and strategic management, and to place them within the proposed new framework for Creative Problem Solving (CPS).

This section includes a brief overview of the historical development of CPS, a draft of the new framework for CPS proposed by G. J. Puccio, M. C. Murdock and M. Mance (personal communication, February 7, 2002), as well as the statement of significance and the specific questions that guided this study.

Historical Development of the CPS model

According to Isaksen, Dorval and Treffinger (1994), CPS has an inherent dynamic nature. The way CPS has been conceptualized and described has in fact changed over time through many years of research, development and practice. Along the past fifty years, the CPS model has been continuously developed and revised thanks to the significant contributions of many scholars at the Center for Studies in Creativity "who continued to investigate the CPS model through a variety of research and developments efforts, training programs and structured applications of CPS in varied settings" (Isaksen, Dorval & Treffinger, 1994, p. 55).

The brief overview that follows describes the historical development of the CPS model in relation to the steps that have been added over time and the language modification, from its very beginning to its latest published revision.

In his seminal book Applied Imagination (1953), Alex Osborn, founding partner of the advertising agency BBDO and founder of the Creative Education Foundation, described a seven stage version of CPS, composed of the following steps: Orientation, Preparation, Analysis, Hypothesis, Incubation, Synthesis and Verification. In a second edition of Applied Imagination (1963), Osborn proposed a new version of CPS that condensed the seven steps into three more comprehensive stages: Fact-Finding, Idea-Finding and Solution-Finding. Through the subsequent work of Parnes (1967) and Parnes, Noller and Biondi (1977), the CPS process evolved from three to five steps: Fact-Finding, Problem-Finding Idea- Finding, Solution-Finding and Acceptance- Finding. A sixth step was added to the front end of the CPS model by Parnes (1985), who named it Objective- Finding, and by Isaksen and Treffinger (1985), who named it Mess-Finding. Isaksen and Treffinger (1985) also renamed the Fact-Finding stage as Data-Finding.

Building upon years of experiences with the teaching and application of CPS, Isaksen, Dorval and Treffinger (1994) further revised the CPS framework and proposed "The Componential View of CPS" (p.61), by describing it in three main components and six steps. The three components - Understanding the Problem, Generating Ideas and Planning for Action- "were added to the framework to clarify

that the framework could be used flexibly as components" (Isaksen, Dorval &Treffinger, 1994, p.58). Each component encompassed specific steps: Understanding the Problem included Mess-Finding, Data- Finding and Problem-Finding; Generating Ideas included Idea-Finding; and Planning for Action included Solution-Finding and Acceptance-Finding.

Miller, Vehar and Firestien (1996; 2001) introduced the latest revision of the CPS model, which modified the language used to describe the process in order "to make it easier to understand and to use in plain English" (p.107). In this latest revision, the three components were named Explore the Challenge, Generate Ideas and Prepare for Action and the six steps were named Identify Goal, Wish or Challenge, Gather Data, Clarify the Problem, Generate Ideas, Select and Strengthen Solutions and Plan for Action.

Latest Developments: The Proposed New Framework for CPS

The latest development of CPS (Puccio, G. J., Murdock M. C. & Mance M., personal communication, February 7, 2002) repositions the CPS framework as a model for developing thinking skills. The proposed new framework for CPS – still under development- comprises seven steps, each of which has been linked to a thinking skill. A preliminary draft of the new framework for CPS is displayed in **Table 1.1**: each step is defined by its name and purpose and the related thinking skill is reported in the column to the right.

Table 1.1. The Proposed New Framework for CPS

NAME OF THE STEP	PURPOSE	THINKING SKILL
Assessing the Situation	• To describe and identify relevant data; and • To determine next process step	**Diagnostic Thinking**
Exploring the Vision	To develop a vision of a desired outcome	**Strategic Thinking**
Formulating the Challenges	To identify the gaps that must be closed to achieve the desired outcome	**Problem Analytic Thinking**
Exploring Ideas	To generate novel ideas that address significant gaps/challenges	**Ideational Thinking**
Formulating Solutions	To move from ideas to solutions	**Evaluative Thinking**
Exploring Acceptance	To increase the likelihood of success by testing solutions	**Contextual Thinking**
Formulating a Plan	To develop an implementation plan	**Tactical Thinking**

Adapted from: Puccio, Murdock & Mance: Personal communication, February 7. 2002

Statement of Significance

The 'dynamic nature' of CPS refers not only to its framework (i.e. components and steps), but also the tools that have been developed and added over time to be used within CPS. While developing the CPS model, all the scholars mentioned in the 'Historical Development of the CPS Model' paragraph have significantly contributed to develop the 'CPS toolbox'. From a thinking tool perspective, the contributions of the scholars who have worked over many years on the CPS model have focused on developing a set of basic divergent and convergent tools and on organizing them by the step of the process for which those tools have been considered most appropriate.

Starting from Osborn (1953) who first introduced the Brainstorming technique to the world, the CPS toolbox has been further developed through the work of Parnes (1967) and Parnes, Noller and Biondi (1977), with a main focus on the divergent thinking area. In the early Eighties, Diane Foucar-Szocki, Don Treffinger, Scott Isaksen and Roger Firestien developed "a range of convergent tools to balance the prior focus on divergent tools and techniques" (Miller, Vehar and Firestien 2001, p. 107). Isaksen and Treffinger (1985) and Isaksen, Dorval and Treffinger (1994), continued to build on the effort to achieve a higher balance between diverging and converging thinking tools within the CPS framework. Finally, Miller, Vehar and Firestien (1996; 2001) contributed to refine and widen the CPS

toolbox by revising the language used to describe the thinking tools and by introducing other divergent and convergent tools.

In the latest development proposed by G. J. Puccio, M. C. Murdock and M. Mance (personal communication, February 7, 2002), each step of the CPS framework is associated with a thinking skill. These skills are delineated as "a way to further differentiate the qualitative differences among the stages, as well as to highlight how learning each CPS step makes a unique contribution to the development of a leader's skill base" (Puccio, Murdock & Mance, personal communication, March 14th, 2003). In other words, learning and practicing CPS can help build mental and process skills that enhance an individual's ability to cope with change in a creative and flexible way in everyday personal and professional life. This new approach significantly broadens CPS, by positioning it as an inclusive conceptual framework that can absorb thinking tools already in use in other models and processes, inside the realm of creativity (i.e. idea generation tools) as well as in other areas of theory and practice (i.e. problem solving, quality improvement, decision making tools). The application of these tools can help sharpen the thinking skills related to each step of the process, thereby contributing to the continuous development of such skills. The purpose and significance of this project is to focus on the effort to link CPS to other areas or constructs, by surveying, selecting and analyzing existing tools and by organizing them within the steps and the thinking skills proposed by the new CPS framework. By doing that, this study aims to fill the

need for widening and enriching the existing array of tools that can be used within the CPS model. Besides the 'classic CPS tools' that currently comprise the CPS toolbox, several other tools, drawn from other areas or disciplines, can be effectively used to meet the purpose presented by each step, as well as to contribute to the development of the thinking skill related to that step. In this respect, this study is the first of its kind and its hope is to initiate a new pathway of research and application aimed to strengthen the 'inclusive' nature of the CPS framework which can incorporate many more thinking tools from different disciplines. Ultimately, the principle underlying the meaning of this study is that the strength of CPS resides in its framework, more than in its 'toolbox'. By providing a robust and flexible framework, CPS can position itself as a highly versatile method that can be applied through a wide array of tools and techniques, depending on the specific needs required by the situation at hand.

An additional contribution offered by this project, is the refinement and improvement of the definitions of the thinking skills that have been linked to each stage of the new CPS framework. Part of the preliminary work that has been conducted to establish the parameters for the thinking tools selection and analysis, consisted of a review of the thinking skills literature aimed to find appropriate definitions of the thinking skills that matched each step of the CPS framework. The outcomes of this preliminary work are illustrated in Chapter 2 - Methods and Steps for Conducting the Study

Project Questions

Specific questions that guided this study were:

- What is an accurate description of each of the thinking skills linked to the proposed new framework for CPS?
- What existing thinking tools can be coherently incorporated within the new CPS framework, according to the criteria provided by the thinking skills descriptions?
- What is a description of the purpose and the function of these tools within the different steps?
- How can each tool be categorized within the different steps (and related thinking skills) of the new CPS framework?
- How do these tools align with the existing divergent and convergent categories?

Summary

This section introduced the purpose of this project, aimed to survey and catalog existing thinking tools drawn from several areas of theory and practice and to place them within the proposed new framework for Creative Problem Solving.

The meaning of this project was examined into the context of the historical development of the CPS model and its latest revision proposed by G. J. Puccio, M. C. Murdock and M. Mance (personal communication, February 7, 2002). The significance of this project and the questions that guided it were then expounded.

The next section provides a detailed explanation of the methodology and the steps that were followed for conducting the study.

Section 2

Methods and Steps for Conducting the Study

Introduction

The purpose of this section is to describe the methods and steps by which this study was conducted. The sequence and main content of the steps involved in the methodology adopted for this study are outlined below:

- ***Step 1- Preparation***

  A. Establishing main parameters for thinking tools selection and analysis

  A. Reviewing the literature to identify preliminary thinking skill definitions

- ***Step 2- Validation***: Assessing and refining thinking skill definitions.
- ***Step 3- Data Collection & Selection:*** Surveying thinking tools and establishing criteria for data selection.
- ***Step 4 - Data Analysis and Organization***: Conducting the analysis and organizing the tools within the CPS framework.
- ***Step 5- Data Presentation and Description***: Structuring the tools description and explaining procedures for references and citations.

Each of the above-mentioned steps is described in detail in the following pages.

Step 1- Preparation

A. Establishing main parameters for thinking tools selection and analysis

In order to respond to the fundamental question "What existing thinking tools can be coherently incorporated within the new CPS framework", three important areas were identified as the main parameters that would guide the selection and analysis of the thinking tools:

- The **purpose** statement that describes each step of the new framework for CPS: the descriptions of the purpose of each step were provided by Puccio, G. J., Murdock, M. C. and Mance, M. (personal communication, February 7, 2002) and are displayed in **Table 2.1**
- A definition of the **divergent** and **convergent categories** within which the tools would be classified: these definitions were provided by Puccio, G. J. (personal communication, February 7, 2002) and are displayed in **Table 2.2**
- A definition of the **thinking skills** associated with each step of the new CPS framework: the identification of the thinking skill definitions began with a literature review (see Step 1- B) and went through a subsequent validation phase aimed to assess and refine those definitions (see Step 2).

Table 2.1 Purpose Statement for Each Step of the New CPS Framework

NAME OF THE STEP	PURPOSE
Assessing the Situation	To describe and identify relevant data ; and To determine next process step
Exploring the Vision	To develop a vision of a desired outcome
Formulating the Challenges	To identify the gaps that must be closed to achieve the desired outcome
Exploring Ideas	To generate novel ideas that address significant gaps/challenges
Formulating Solutions	To move from ideas to solutions
Exploring Acceptance	To increase the likelihood of success by testing solutions
Formulating a Plan	To develop an implementation plan

Puccio, Murdock & Mance, personal communication, February 7, 2002.

Table 2.2 Definitions of Divergent and Convergent Categories

Divergent	A broad search for many diverse and novel possibilities.
Convergent	A focused and affirmative evaluation of possibilities

Puccio, Murdock & Mance, personal communication, February 7, 2002.

In addition, a working definition of '**thinking tool**' needed to be agreed upon, in order to establish what was meant by that name. The definition of thinking tool was constructed by elaborating on a definition of 'tool' provided by Webster's Dictionary (Webster's New Universal Unabridged Dictionary, 1996, Barnes & Nobles Books), stated as follows: "anything used as a means of accomplishing a task or a purpose". This basic definition was built upon and the resulting definition was: "*A thinking tool is a structured or systematic means of focusing a thought process in*

order to accomplish a purpose". Thus, for purposes of this study, for thinking tools to be included, they must be aimed at carrying out the purposes of the respective CPS steps. It was consequently established that the selection and analysis of the tools would be based on the comparison between the language used for describing the purpose of the thinking tool and the language used to define the purpose of the step, as well as the related thinking skill and the divergent or convergent category.

B. Reviewing the literature to identify preliminary thinking skill definitions

A literature review was conducted in order to identify an appropriate definition of the thinking skill that matched each step of the new CPS framework. Where established definitions for some thinking skills did not exist, it was decided that working definitions would be created. Most of the definitions were the result of a mixed approach: partially derived from the literature and subsequently elaborated into a working definition able to coherently reflect the purpose stated for the step.

Several sources were consulted and few were selected to create the definitions. The main sources utilized to construct a definition for each thinking skill and the resulting preliminary definitions that were elaborated are listed in **Table 2.3.**

Table 2.3 Preliminary Thinking Skill Definitions and Sources Utilized

THINKING SKILL	SOURCES	PRELIMINARY DEFINITIONS
Diagnostic Thinking (Assessing the Situation)	- Webster's Dictionary - The American Heritage Dictionary	The ability to identify and determine the nature of a problem or a situation and render an opinion as to the appropriate process steps to be taken.
Strategic thinking (Exploring the Vision)	Marzano, R. J. (1988). Dimensions of thinking: A framework for curriculum and instruction. Alexandria, VA: Association for Supervision and Curriculum Development	The ability to establish a future direction and to state the outcome(s) one expects to attain.
Problem Analytic Thinking (Formulating the Challenges)	Sternberg, R. J. (1985). Beyond IQ: A triarchic theory of human intelligence. New York: Cambridge University Press.	The ability to structure a problem into a springboard for solution generation
Ideational Thinking (Exploring Ideas)	- Webster's Dictionary - Gonz_lez, D. (2002). When we peek behind the curtain: Highlighting the essence of creativity methodologies. Evanston, IL: THinc Communications	The ability to form and entertain original mental images and thoughts that respond to open-ended questions, challenges and opportunities
Evaluative Thinking (Formulating Solutions)	- Marzano, R. J. (1988). Dimensions of thinking: A framework for curriculum and instruction. Alexandria, VA: Association for Supervision and Curriculum Development - Isaksen, S. G., Dorval, B. K. & Treffinger, D. J. (1994). Creative approaches to problem solving. Dubuque, IA: Kendall/Hunt.	The ability to assess the reasonabless and quality of ideas in order to formulate workable solutions.
Contextual Thinking (Exploring Acceptance)	Webster's Dictionary (definition of 'context')	The ability to understand the interrelated environmental conditions that will support or hinder success.
Tactical Thinking (Formulating a Plan)	- Webster's Dictionary - Morrisey, G. L. (1996). Morrisey on planning. A guide to strategic thinking. San Francisco: Jossey Bass.	The ability to devise a plan or procedure for attaining a desired end and to carry out specific and measurable steps.

Step 2 - Validation

In order to validate and refine the preliminary definitions of the thinking skills, it was decided to consult an 'expert group', composed of individuals familiar with CPS who could objectively assess the consistency between the proposed thinking skill definitions and the core purpose of each step of the process. Thus, a focus group with five Creative Studies alumni and majors was conducted. The group discussion focused on the assessment of the parallel and distinct aspects of the thinking skill definitions from the preliminary stage, as well as on the collection of suggestions for their improvement.

The five respondents involved in the focus group provided several critical inputs and recommendations, which guided the revision and refinement of the thinking skill definitions. As a whole, the thinking skills definitions appeared to be parallel and distinct from each other, yet it was suggested to further differentiate the language utilized to describe the thinking skills, by identifying for each thinking skill a different verb that could pinpoint the key operation required in the related stage. Furthermore, it was recommended to use a verb in the gerund form at the beginning of each description (i.e., establishing, assessing, and the like), instead of the "ability to…", based on the argument that the term 'skill' entails a behavioral expression that refers to the application of an ability. Each thinking skill definition was analyzed in detail and specific suggestions for its refinement were made.

Table 2.4 displays the new framework for CPS, which includes, along with name and purpose of each step, the final version of the thinking skill definitions utilized for conducting this study. Again, these definitions guided the selection and categorization of the thinking tools gathered for this project.

Table 2.4 The New Framework for CPS, including Thinking Skill Definitions

NAME OF THE STEP	PURPOSE	THINKING SKILL
Assessing the Situation	• To describe and identify relevant data; and • To determine next process step	**Diagnostic Thinking** Examining a situation closely and using this analysis to decide on what process step to take next
Exploring the Vision	To develop a vision of a desired outcome	**Strategic Thinking** Establishing a future direction and the outcome(s) one desires to attain.
Formulating the Challenges	To identify the gaps that must be closed to achieve the desired outcome	**Problem Analytic Thinking** Framing a problem into a springboard for idea generation.
Exploring Ideas	To generate novel ideas that address significant gaps/challenges	**Ideational Thinking** Producing original mental images and thoughts that respond to challenges or opportunities
Formulating Solutions	To move from ideas to solutions	**Evaluative Thinking** Assessing the reasonableness and quality of ideas in order to develop workable solutions
Exploring Acceptance	To increase the likelihood of success by testing solutions	**Contextual Thinking** Understanding the interrelated conditions and circumstances that will support or hinder success
Formulating a Plan	To develop an implementation plan	**Tactical Thinking** Devising a plan in specific and measurable steps for attaining a desired end and monitoring its effectiveness

Step 3- Data Collection and Selection

The preparation and validation phases provided the framework for selecting and analyzing the thinking tools. Given the extent of the literature where thinking tools could be surveyed and selected, some specific areas were identified so that the scope of the project could be more narrowly defined. The literature review focused on Total Quality Management (TQM), Strategic Management, Problem Solving, Decision Making, and Creativity Processes and Methods, other than CPS. Still, the breadth of resources offered by the above-mentioned areas of literature appeared immense for a study whose purpose was to initiate a new pathway of research within the CPS framework without any pretence of being exhaustive. Hence, two guidelines were established to set some boundaries for this study:

1. A goal of six tools per each step was set. This goal helped circumscribe the scope of this project, by setting a number of tools that was considered reasonable for a first study of this kind and that, at the same time, could significantly enrich the CPS 'toolbox'.
1. A set of criteria for the tools selection needed to be developed, in order to guide the selection process.

The **criteria** developed to guide the thinking tools selection are listed below:

- Diversity across the stages. The goal of six tools per step was partially derived from this criterion, aimed to encourage not only the expansion but also the

diversity of the thinking tools that could be applied within the CPS framework. Since the purpose of each step is different, a search of a limited number of tools per each step would generate diversity of the thinking tools selected across the steps. Consequently, there was also an expectation to achieve a 'natural' balance between tools classified as divergent and tools categorized as convergent.

- Distinctiveness within each stage. There was a deliberate effort to try to find and select thinking tools that were clearly distinct from one another within each step of the CPS framework. The tools to be selected had to serve the same general purpose (defined by the purpose of the step and the thinking skill) but they had to function in a different way, in order to avoid repetition or mere variations of the same tool within a given step.
- Diversity within each stage. There was an intention to survey and select tools, within each step, that could be suitable to diverse contexts (i.e., individual use versus group use), as well as appealing to different facilitation styles (i.e., analytical-linear approach versus intuitive-holistic approach).
- Confinement of the tool within a step. The purpose underlying this criterion was to distinguish between tools and 'methods' or processes. According to the definition of 'thinking tool' that was established for this project – "*a structured or systematic means of focusing a thought process in order to accomplish a purpose*" - , the tools to be selected had to be confinable, as much as possible, to a given step and the accomplishment of its purpose (whereas a 'method' or

'process' would often cross over different steps). As it will be seen in Chapter 3, the tools selected for the step "Exploring the Vision", often challenged this criterion.

- Attractiveness to the project's author. This criterion reflects the necessary subjectivity entailed in the process of surveying and selecting tools. A solid framework was established in order to conduct the study in a 'rigorous' way, by identifying parameters and criteria for the tools selection and analysis. Nevertheless, the influence of personal preference and style in the tool selection was inevitable and, in a way, it represents a 'personal touch' that characterizes and enriches this project. The term 'attractiveness' is used in its broad sense, meaning by it the power of a tool to catch this project author's attention, for different reasons: a trait of uniqueness or innovativeness, a character of high adaptability to a given CPS step, or a quality of familiarity and personal affinity.

With a set of clear parameters and criteria for collecting and selecting the thinking tools, the literature review began, by ranging over several sources within the areas of theory and practice mentioned above. Two main categories of sources were utilized: books and websites. Numerous thinking tools were then selected for the analysis.

Step 4 - Data Analysis and Organization

Using the literature, the purpose and function of each selected thinking tool were accurately identified and defined. Next, each tool was analyzed to assess how it aligned with the new framework for CPS as a model for developing thinking skills and, specifically, to locate the step of the CPS framework where that tool could be coherently integrated. The comparison between the language used for the description of the purpose of the tool and the language used to define purpose of the step and respective thinking skill guided this analysis.

The tools analysis led to a final screening of the thinking tools that were selected and categorized within each step of the CPS framework, according to the goal of six tools per step. When six thinking tools were identified and matched the requirements established for the analysis, the goal set by the study was met for that particular step and other tools that could be included in other steps were then considered for analysis. The number of six tools per step was exceeded in two steps (Assessing the Situation and Exploring Ideas), essentially because, in both these steps, two of the selected tools appeared very similar, yet they offered a different application which was deemed worthy to mention. On the other hand, few tools were cataloged in more than one step, when they were thought to fit coherently different phases of the process, for different purposes.

Finally, each tool was categorized as divergent or convergent, according to the definition displayed in Table 2.2. The tools were classified as divergent or

convergent, based on the purpose that they were designed to accomplish within a given step. While describing the function of each tool, it was clear that many tools entailed both divergent and convergent operations in their function. However, the classification of the tool within a divergent or convergent category was based on its ultimate purpose within that step, by pointing out the key-operation that was designed to match that purpose: for example, 'responding to open-ended questions' was categorized as divergent, whereas 'selecting and organizing information' was categorized as convergent.

Step 5- Data Presentation and Description

Each thinking tool was then presented and described in a Table, by providing the following information: name, purpose, function, category (divergent/ convergent), sources and remarks. Each of these items is articulated below, in relation to the content pertaining to it and to the procedures employed for references and citations.

- **Tool Name.** Some of the tools were presented with more than one name. These were popular tools that were described and labeled differently by their respective authors, yet they shared a common purpose and methodology of application (with few variations).
- **Tool Purpose.** More than one definition of the tool purpose was reported when it was offered and when definitions taken from different sources described the

purpose of the tool in a distinct way. When available, the purpose of the tool was cited directly from the source, basically because the purpose represented the key element utilized for the tool analysis (comparison between the language used to define purpose of the step and thinking skills and language used to define the purpose of the tool). From the reference standpoint, a direct citation was reported by displaying the page number, next to the name of the author and the year of publication. When a direct citation was not available, the description of the purpose was adapted and name of the author and date of publication were shown in brackets.

- **Tool Function**. The tool function was often adapted and modified from the literature source. Sometimes this involved blending different explanations of the function retrieved in different sources to provide a description of the function that was clear, concise and user-friendly. To facilitate the reading, some key-words in the function description were underscored or highlighted in bold. As for the reference system, the same procedures described in the Tool Purpose were adopted for the Tool Function.
- **Category** (Divergent / Convergent). The tools were classified as Divergent or Convergent, by highlighting the key-operation employed to accomplish the purpose stated for the tool, which paralleled the purpose of the step (i.e., Divergent: responding repeatedly to open-ended questions; Convergent: selecting and organizing key-information).

- **Sources.** The sources utilized for the selection and analysis of the tools were listed, according to the APA style Reference List guidelines. When available, the original source where the tool came from (i.e., original author and reference) was also mentioned.
- **Remarks.** The remarks consisted of additional information retrieved from the sources and/or this project author's personal comments in relation to the application of the tool.

Often the use of a Figure was employed, following the Table, either to give a graphic illustration of the tool or to display additional material (i.e., checklist of questions) that complemented the basic description of the tool.

Summary

This section reviewed the methods and steps by which the study was conducted. The steps involved in the methodology were organized into five steps: Preparation, Validation, Data Collection and Selection, Data Analysis and Organization, Data presentation and Description. A detailed description of each of the steps was provided.

The next section documents the findings gathered by this study.

SECTION 3

Documenting Project Findings

Introduction

The purpose of this section is to present the findings of the work aimed at analyzing and organizing tools within the new CPS framework. Again, these tools were drawn from a diverse set of literature and were organized in accordance to the new skill-based version of CPS.

The thinking tools are presented, described and categorized within each step of the new CPS framework, according to the following sequence: Assessing the Situation, Exploring the Vision, Formulating the Challenges, Exploring Ideas, Formulating Solutions, Exploring Acceptance and Formulating a Plan. At the beginning of each step, an Overview Table displays the Purpose of the step, the Thinking Skill related to that step and its respective definition, the 'classic' CPS Tools normally used in that step and the Other Tools which have been identified, selected and classified within that step. Each tool is marked as Divergent or Convergent, depending on the results of the analysis which has assigned the tool to one of these two main categories, based on the analysis guidelines described in Section 2. The number of the page where each of the Other Tools can be found is displayed next. Following the Overview Table, a series of tables display and describe each of the Other Tools, by providing the following information: name of the tool, purpose, function, category to which it has been assigned (Divergent or

Convergent), sources utilized to identify and describe the tool and remarks about the tool that were deemed worthy to mention with reference to its application. A graphic representation of the tool is displayed in a figure, when a visual illustration was considered necessary for a clear description of the tool.

This section presents seven sub-sections, one for each of the steps of the new CPS framework. It starts with Assessing the Situation.

Presentation and Analysis of Data

SUB-SECTION 1- ASSESSING THE SITUATION

In the new skill-based version of CPS, Assessing the Situation represents the "heart of the process and the step that initiates the process" (Puccio, Murdock & Mance, personal communication, March 14, 2003). The thinking skill associated with this step is "Diagnostic Thinking", which refers to the ability to examine a situation closely and use this analysis to decide what process step to take next. Assessing the Situation is a crucial step because it requires the problem solver to stand above the situation and to make an accurate diagnosis which in turn leads to the determination of the next process step.

Two tools are provided by the 'classic' CPS toolbox for this critical step:

- '5 Ws and an H' (Isaksen, Dorval & Traffinger, 1994) or 'Brainstorm on data gathering questions' (Miller, Vehar & Firestien, 2001) for the divergent phase; and
- 'Hits & Highlighting' (Isaksen, Dorval & Traffinger, 1994; Miller, Vehar & Firestien, 2001) for the convergent phase.

Seven 'Other Tools' were identified, selected and categorized within this step, two of which were classified as divergent and five as convergent. The divergent tools were drawn from sources belonging to the 'creativity tools' literature (Higgins, 1994; Majaro, 1991; Michalko 1991), which refers to the field of 'Creativity Processes and Methods', other than CPS. The convergent tools were drawn from the 'Total Quality Management' (TQM) literature (Goetsch & Davis, 1994; Kanji & Asher, 1996) as well as from the Problem Solving and Decision Making literature (Kepner &Tregoe, 1981). Finally, one convergent tool - FBC grid (Table 3.8) – was taken from the 'creativity tools' literature (Michalko, 1991), although it originally derived from the advertising and marketing field.

An Overview Table for this step is displayed in **Table 3.1**. Each of the 'Other Tools' is then illustrated in the tables that follow (**Table 3.2 – 3.8**).

Table 3.1 Assessing the Situation- Overview Table

PURPOSE OF STEP & THINKING SKILL	'CLASSIC' CPS TOOLS	OTHER TOOLS	CATEGORY	PAGE
Purpose To describe and identify relevant data and to determine next process step	5 W's and an H [or brainstorm on data gathering questions]	• WHY-WHY diagram • Phoenix Checklist	**Divergent** **Divergent**	28 30
Diagnostic Thinking Examining a situation closely and using this analysis to decide on what process steps to take next.	Hits/ Highlighting	• Fishbone Diagram • Stratification • Affinity Diagram • Is/Is not Matrix • FCB grid	**Convergent** **Convergent** **Convergent** **Convergent** **Convergent**	32 35 36 38 40

Table 3.2 Why- Why Diagram

TOOL	**WHY-WHY DIAGRAM**
PURPOSE	• To penetrate to the roots of a problem in a systematic way (Majaro, 1991, p. 85) • To explore many possible causes and relate them to the overall problem (Higgins, 1994, p. 53)
FUNCTION	1. State the problem/ situation on the left side of flipchart or paper. 1. Create a decision tree of causes to the right of the problem (**Figure 3.1**) by asking: - a succession of 'Whys' (Why is this happening? Why is it a problem?) regarding the problem; and - a succession of 'Whys' for each of the possible causes. 1. Continue the process until each strand of the problem is teased out as far as possible. 1. Analyze the Why-Why Diagram to identify main issues and to restate the problems in term of its root cause. (Majaro, 1991; Higgins, 1994)
CATEGORY	**DIVERGENT:** Responding, repeatedly, to open-ended questions (Why?)
SOURCES	• Majaro, S. (1991).The creative marketer. Oxford: Butterworth-Heinemann • Higgins, J (1994). 101 Creative Problem Solving techniques. Winter Park, FL: New Management Publishing Company
REMARKS	Why- Why diagram encourages participants to think about the situation in an expansive, divergent way, by repeatedly responding to the 'Why' question. It is partly based on a Japanese quality technique called the 'Five Whys'. It differs from the 'classic' CPS tool Ladder of Abstraction in that it focuses on the known or hypothetic causes/facts related to the situation (diagnostic level) as opposed to the restatement of the problem. It is however a natural springboard for the restatement of the problem (therefore, it can be applied also in The Formulating the Challenges stage).

Figure 3.1 Why- Why Diagram

Adapted from Majaro , 1991.

Table 3.3 Phoenix Checklist

TOOL	**PHOENIX CHECKLIST**
PURPOSE	To encourage an individual to look at a challenge from many different angles and ensure that no aspect of a challenge or situation is overlooked (Michalko, 1991).
FUNCTION	1. Write your challenge/problem/situation. 1. Ask questions, using the Phoenix checklist to dissect the challenge into as many different ways as you can (see the checklist of questions in **Figure 3.2**) 1. Record your answers and information requests for evaluation and analysis. (Michalko, 1991)
CATEGORY	**DIVERGENT:** Generating responses to open-ended questions.
SOURCES	Michalko, M. (1991). Thinkertoys. Berkeley, CA: Ten Speed Press
REMARKS	The Phoenix checklist is a list of questions developed by the Central Intelligence Agency. It contains a series of interesting and provoking questions that might be helpful to look at the situation from many different perspectives and to pinpoint where you need to collect more information. Michalko (1991) suggests using it as a base on which to build your own personal checklist of questions.

Figure 3.2 Phoenix checklist of questions

[Taken from: Michalko, 1991, p.140.]

Table 3.4 Fishbone Diagram

TOOL	**FISHBONE DIAGRAM** (aka Cause & Effect Analysis or Ishikawa Diagram)
PURPOSE	• To examine effects or problems to find out the possible causes and to point out possible areas where data can be collected (Kanji & Asher, 1996, p. 79). • To facilitate the analysis of a problem cause and effect, so that the real root of the problem –rather that merely its symptoms- may be identified and addressed (Majaro, 1991, p.81).
FUNCTION	1. Draw a straight line across a piece of paper or flipchart with a box or circle at one end. Inside the circle or box, write down the problem or situation under discussion. This is the head and spine of the fish (**Figure 3.3**) 1. List all possible causes of the problem selected for analysis. Draw stems at about 45° along the spine. These stems represent every likely causes of the problem, which are written inside boxes at the ends of the stems, and constitute the bones of the fish. 1. Each stem is examined in turn and further branches are added to represent sub-causes that might be related to that factor. If a particular issue appears more than once, it might be considered as a significant issue and can be identified with a colored mark. 1. When the diagram is considered to be fully developed, analyze and discuss the diagram and identify the main issues that will have to be resolved in order to make an impact on the original problem. Rank these issues in order of priority. (Majaro, 1991)

CATEGORY	**CONVERGENT :** Categorizing main factors, classifying cause and analyzing the diagram. This tool is used in conjunction with a divergent tool such as Brainstorming (or Brainstorming with Post-its) in order to generate lists of causes. Other convergent tools can be used in combination with it to select and prioritize the causes.
SOURCES	Original source: Ishikawa K. (1985). Guide to quality control. Tokyo: Asian Productivity Press Other sources: • Majaro, S. (1991).The creative marketer. Oxford: Butterworth-Heinemann • Goetsch, D.L & Davis, S. (1994).Introduction to total quality: Quality, productivity, competitiveness. New York: Merrill. • Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage. • Wycoff, J. (1995). Transformation thinking: Tools and techniques that open the door to powerful thinking for every member of your organization. New York: Berkley Books.
REMARKS	Within the CPS framework, Fishbone Diagram can provide a useful graphic representation of the situation that can be used to: • Identify the key issues/causes and the areas where you need to gather more data • Start generating problem statements about the challenge (therefore, it can be applied also in The Formulating the Challenges step) Alternative directions for use: ✓ Identify the main factors or categories first (i.e., manpower, machines, methods, and materials; policies, procedures, people and equipment). ✓ Brainstorm causes and sub-causes after the main factors have been identified. Wycoff (1995) also mentions a useful variation of the tool, by using post-its, for moving the information around the diagram.

Figure 3.3 Fishbone Diagram

[Graphic from Majaro, 1991.]

Adapted from Majaro, 1991

Table 3.5 Stratification

TOOL	**STRATIFICATION**
PURPOSE	To group or split data by common elements or characteristics in order to • make it easier to understand the data • expose patterns in the data • pull insights from it (Goetsch & Davis, 1994)
FUNCTION	1. Make a list of criteria or characteristics (i.e. variables, such as people, machine, environment, materials) that could cause systematic differences in the data. 1. Select the key-ones. 1. When used Before data collection: - Design data collection forms to include all these categories - Collect the data and examine them for any pattern or trend 1. When used After data collection (or for data already available): Group the data in these categories and focus the analysis on any pattern or trend. (Kanji & Asher, 1996)
CATEGORY	**CONVERGENT:** Selecting the key variables, organizing and analyzing the data. The variables can be generated through Brainstorming.
SOURCES	• Goetsch, D.L & Davis, S. (1994).Introduction to total quality: Quality, productivity, competitiveness. New York: Merrill. • Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage.
REMARKS	Stratification is a tool for organizing data that helps look for emerging patterns, thereby leading to identify the root cause of a problem. Within the CPS framework, it could be used as a way to display or organize data alternative to "5W's and H", by grouping data according to key-categories that have been predefined.

Table 3.6 Affinity Diagram

TOOL	**AFFINITY DIAGRAM**
PURPOSE	To organize large amounts of data in groups according to some form of natural affinity (Kanji, & Asher 1996).
FUNCTION	1. Define the subject that is to be considered 1. Each team member starts by writing data about the situation on separate cards (i.e. index cards/post-it notes) 1. Team members lay the cards on the table without conversation to influence them and start arranging them into the natural groups they can identify: - Working collectively and in silence, arrange two cards which are related in some way. Repeat this step. - Different opinions about the relationship between different data will be discovered. - Complete the work when all the data have been organized according to a limited number of groups and different opinions have been resolved. 1. Find a heading for each data group and display them in an organizational chart showing subordinate connections (**Figure 3.4**) (Kanji, & Asher 1996)
CATEGORY	**CONVERGENT:** Arranging data in group by affinity and labeling the groups. Data can be generated through Brainwriting techniques.
SOURCES	Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage.
REMARKS	Affinity diagram is a TQM tool which combines Brainwriting with Highlighting (clustering and labeling the group). The uniqueness of the method lies in the alternation between silence (during the grouping activity) and discussion (to resolve different opinions).

Figure 3.4 Affinity Diagram

Adapted from Kanji & Asher 1996

Table 3.7 Is/Is Not matrix

TOOL	**IS/IS NOT MATRIX**
PURPOSE	To identify patterns in observed characteristics by a structured form of stratification (Kanji & Asher, 1996, p. 184)
FUNCTION	1. Identify the problem or situation to be analyzed 1. Ask a series of questions following a scheme of categories such as - Where (location where the problem occurs) - When (time/relation to other events) - What kind or how much (type, category, size of the problem) - Who (group or individuals present or near the event) 1. For each category ask **Is and Is not**: where, when, to what extent or to whom does it occur/ where, when, etc. does it not occur 1. Draw inferences or possible explanations (from the comparison between the is/is not answers): Is there a pattern? What might explain it? (**Figure 3.5**) (Kanji & Asher 1996)
CATEGORY	**CONVERGENT:** Categorizing and organizing knowledge of information in a structured format. This tool can be used in combination with the divergent technique of Brainstorming, which is applied for generating questions and responses to them.
SOURCES	Original source: Kepner, C. H. & Tregoe, B. B. (1981). The new rational manager. Princeton, NJ: J.M. Publishing. Other source: Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage.
REMARKS	Is/Is not matrix can provide a useful guide to diagnosis of problems/situation, by organizing available knowledge and ideas about the problem. It offers a structured way of asking a series of questions that aim to pinpoint the problem, thereby guiding data collection and analysis.

Figure 3.5 Is/Is Not matrix

[Figure from Kanji & Asher, 1996, p. 184.]

Taken from Kanji & Asher, 1996, p. 184

Table 3.8 FCB Grid

TOOL	**FCB GRID**
PURPOSE	To compress large amount of complex information in a grid and to identify holes in the market. (Michalko, 1991)
FUNCTION	1. Draw a four-cell matrix: the two axes indicate positions of High and Low involvement/ degrees of Thinking and Feeling in relation to products and services (**Figure 3.6**) ✓ **High Involvement (High Quadrant)**: represents expensive products or services (i.e.: cars, boats, jewelry) ✓ **Low Involvement (Low Quadrant)** : represents less costly /inexpensive product (i.e. dishwashing soap) ✓ **Think (Left Quadrant)**: represents products or services that are evaluated according to verbal, numerical, analytical and cognitive criteria, for which the consumer desires information and data (i.e.: computers, cameras, fitness programs) ✓ **Feel (Right Quadrant)**: represents products /services that appeal to a consumer's emotional needs and desire (i.e. stylish clothes, cosmetics,…) The axes are continuums with High and Low Involvement, and Think and Feel, at the extremes of the axes and different degrees of these variables in between. **2.** Place existing products/services (within a certain segment) into the grid according to their characteristics (i.e., life insurance would fall in the High/Left quadrant, insecticide in the Low/Left and costume jewelry in the Low/Right quadrant) **3.** Identify the holes in the market to place your product/service, by researching the product and its potential market. (Michalko, 1991)
CATEGORY	**CONVERGENT:** Placing products/services (i.e. data) in a grid (four-cell matrix).

	matrix).
SOURCES	• Michalko, M. (1991). Thinkertoys. Berkeley, CA: Ten Speed Press • Higgins, J (1994). 101 Creative Problem Solving techniques. Winter Park, FL: New Management Publishing Company
REMARKS	The FCB Grid was first developed in 1978 by Richard Vaughn, a research director of the worldwide advertising corporation Foote, Cone & Belding. It is a tool used in marketing and advertising to identify the holes in the market and the emerging opportunity for new products or services. It could be used in the "Assessing the situation" step of the CPS framework to draw a picture of the existing offer in the market, in order to better understand where the opportunities for new product or services might lie. <u>Variations:</u> The axes can be named in different ways according to the variables you want to take into account to compare the position of your product/service to the competition.

Figure 3.6 FCB Grid

[Graphic from Michalko, 1991.]

Adapted from Michalko, 1991

The next sub-section presents and describes the thinking tools that were selected and categorized in the 'Exploring the Vision' stage.

SUB-SECTION 2- EXPLORING THE VISION

The purpose of Exploring the Vision is to create a clear image of a desired outcome. The thinking skill associated with this step is 'Strategic Thinking' which is concerned with establishing a future direction and the outcome(s) one desires to attain.

The 'classic' CPS tools normally used in this step of the process are:

- Generating Wish/ Goals/ Challenges statements (Miller, Vehar & Firestien, 2001) for the divergent phase; and
- Screening Options Using the 3 Is Rule (interest, influence, imagination) and Searching for Success Zone (Isaksen, Dorval & Traffinger, 1994) for the convergent phase.

Seven 'Other Tools' were identified, selected and categorized within this step: six divergent tools and one convergent tool. The divergent tools were drawn from the Strategic Management literature (Senge, Kleiner, Roberts, Ross, & Smith, 1994; Whiteley, 1991) as well as from the 'creativity tools' sources, accessing information from both books and websites (Wycoff, 1995; http://www5. open.ac.uk/b822/). The convergent tools were drawn from the TQM literature (Kanji & Asher, 1996).

An Overview Table for this step is displayed in **Table 3.9.** Each of the 'Other Tools' is then described in the tables that follow (**Table 3.10 – 3.16**).

Table 3.9 Exploring the Vision- Overview Table

PURPOSE OF STEP & THINKING SKILL	'CLASSIC' CPS TOOLS	OTHER TOOLS	CATEGORY	PAGE
Purpose To develop a vision of a desired outcome **Strategic Thinking** Establishing a future direction and the outcome(s) one desires to attain.	• Generating Wish/Goals/ Challenges statements (WIBNI…) • Screening options using the 3 Is rules • Searching for Success Zone	• Drawing Forth Personal Vision • Creating a Vision for the Organization • Imagineering • Cartoon Story Board • Mindscapes • Imaginary journalism • Opportunity Analysis	**Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Convergent**	44 46 49 50 52 55 56

Table 3.10 Drawing forth personal vision

TOOL	DRAWING FORTH PERSONAL VISION (INDIVIDUAL LEVEL)
PURPOSE	To help you define your personal vision: what you want to create of yourself and the world around you. (Senge, Kleiner, Roberts, Ross, & Smith, 1994, p.201)
FUNCTION	1. **Describe your personal vision:** ✓ Imagine achieving a result in your life that you deeply desire. Ignore how "possible" or "impossible" this vision seems. ✓ Answer, using the present tense (as if it happening now) the following questions: <u>What does it look like? What does it feel like? What word would you use to describe it?</u> ✓ Select the categories that fit your needs from the attached checklist of questions (**Figure 3.7**) 2. **Expand and clarify your vision:** Ask yourself the following question about each element of your vision: ✓ <u>If I could have it now, would I take it?</u> (if 'no', discard or modify the element to fit your deepest desires). This question helps you clarify your true desires. ✓ Assume I have it now. <u>What does that bring me?</u> (Why do I want it? What does allow me to create?)This question helps you expand your vision and see its underlying implications more clearly. (Senge et al, 1994).
CATEGORY	**DIVERGENT**: Generating many options in response to open-ended questions
SOURCES	Senge, P. M., Kleiner, A., Roberts, C., Ross, R. B., & Smith, B. J., (1994). The fifth discipline fieldbook: Strategies and tools for building a learning organization. New York: Doubleday.
REMARKS	This technique is essentially based on Robert Fritz's (1989) model of change. In Exploring the Vision it might help the individual explore, expand and clarify his/her true desires and objectives.

Figure 3.7 – Checklist of Questions for Drawing Forth Personal Vision

[Graphic from Senge et al. , 1994, p. 204.]

Taken from Senge et al. , 1994, p. 204

Table 3.11 Creating a Vision for the Organization

TOOL	CREATING A VISION FOR THE ORGANIZATION (TEAM LEVEL)
PURPOSE	To define common vision and purpose. (Senge, Kleiner, Roberts, Ross, & Smith, 1994, p.337)
FUNCTION	**1. The vision of the future** It is five years from today's date and you have, marvelously enough, created the organization you most want to create. Describe it as you were able to see it, realistically, around you. Consider the attached checklist of questions (**Figure 3.8**, select the ones that best fit your organization) and note the main points on a flipchart **2. Current reality** Now come back to the current year, and look at the organization as it is today. Respond to the questions (**Figure 3.8**) **3. Critical Gaps & Strategic Priorities** Develop within the team an understanding of the vision you want to achieve and of the major gaps between your vision and the current reality. Identify the <u>critical gaps</u> you want to address first and the milestones which will show if you are drawing close. These milestones will be the strategic priorities on which you will start working on. <u>Criteria for selecting Strategic Priorities</u> A good strategic priority is: 1. Clearly linked to the vision 1. Capable of galvanizing commitment from people in the team 1. Demanding someone accountable for it 1. Not too narrow (must be related to the rest of the vision) 1. Not too broad: it must be distinct enough that a single person or task force can 'put their arms around' what need to be done. (Senge et al, 1994).

CATEGORY	**DIVERGENT**: Responding to Vision of the Future/Current Reality open-ended questions This tool is used in combination with a convergent technique focused on selecting strategic priorities through a set of criteria
SOURCES	Senge, P. M., Kleiner, A., Roberts, C., Ross, R. B., & Smith, B. J., (1994). The fifth discipline fieldbook: Strategies and tools for building a learning organization. New York: Doubleday.
REMARKS	This technique is largely based on Robert Fritz' s (1989) principle that the discrepancy between future desired state and current reality creates the 'structural tension' which motivates people to move into action and to pursue what they want to achieve. The motivation towards the achievement of the vision seem to be strengthened when people think about the future they really want "as if it is already happened". It has to be noted that the identification of Critical Gaps seems to cross the boundaries of the "Exploring the Vision" step and to lead into the "Formulating the Challenges" step. Similarly, the open-ended questions about Current Reality might be seen as most appropriately included into the "Assessing the Situation" step. The 'natural flow' existing between these three steps of the CPS framework (Assessing the Situation, Exploring the Vision and Formulating the Challenges) makes very difficult to single out specific tools for each of these steps. Particularly, it feels 'unnatural' to do so within the Exploring the Vision step, which, by definition, invites to 'cross the boundaries' of thinking.

Figure 3.8 Checklist of Questions for Creating a Vision for the Organization

[Graphic from Senge et al. 1994, pp. 337-338.]

Taken from Senge et al. 1994, pp. 337-338.

Table 3.12 Imagineering

TOOL	**IMAGINEERING**
PURPOSE	To identify areas of opportunity by concentrating on the ideal outcome then working back from it. (Kanji & Asher, 1996, p. 132)
FUNCTION	1. Brainstorm a list of features that characterize the ideal situation (this list can be developed working in a team). 1. For each of the preferred characteristics identified, state the actual current situation in relation to it. 1. For each of the characteristics, identify the gap to be bridged to bring about the ideal situation 1. Use cause and effect analysis (Fishbone Diagram) to break down the gap into small areas that can be addressed (Kanji & Asher, 1996)
CATEGORY	**DIVERGENT**: Brainstorming features of the ideal situation and identifying gaps between ideal situation and current situation.
SOURCES	Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage.
REMARKS	Similarly to the technique described previously, this TQM tool seems to cut across two stages: Exploring the Vision (brainstorming feature of ideal situation) and Formulating the Challenges (Identifying Critical Gaps).

Table 3.13 Cartoon Story Board

TOOL	**CARTOON STORY BOARD**
PURPOSE	To use drawings to clarify a goal and a route to achieve it, and to identify key blockages in attaining the goal. (The Open University website: http://www5. open.ac.uk/b822/)
FUNCTION	1. **Preparation:** Place the paper in landscape position. Draw six square boxes on it (**Figure 3.9**), and label them 1 to 6, leaving enough space under each to write a short sentence. 1. **Where you are going?** Relax, and get an image in your mind of a goal you are trying to achieve. In your imagination, transport yourself forward in time to the point where you have achieved your goal successfully. What does it feel like? What is happening? How are you and others reacting to it? Draw in Box 6 a picture that conveys *to you* this situation. Don't label it yet. 1. **Where you are now?** Bring your imagination back to the present. Form an image of the major elements of the present situation, and draw that in Box 1, much as you did for Box 6. Don't label it yet. 1. **Intermediate turning-points**. Do the same for Boxes 2–5, using them to depict a sequence of four key intermediate steps in successfully moving from the present situation to the desired situation –four key 'scenes in the drama'. Don't label them yet. 1. **Potential blocks**. When you have finished all six boxes, and are happy that they convey (to you) a successful progression from 'here' to 'there', spend some time contemplating your picture, and …begin to think of what must be overcome if you are to make this progression. Write a word or brief phrase under each picture to show what might *block* the progression at that point; these are the key challenges you must overcome. (The Open University website: http://www5. open.ac.uk/b822/)

\CATEGORY	**DIVERGENT**: Imagining goals (and steps to get there) and drawing the pictures.
SOURCES	The Open University website (author: Jane Henry): http://www5.open.ac.uk/b822/frameset.cfm?file=techniques%2FCARTOON%5FSTORY%5FBOARD%2EHTML&caller=alpha).
REMARKS	Similarly to the techniques previously described within this stage, the outcome of Cartoon Story Board seems to lead naturally to the "Formulating the Challenges" step. Likely, the key-challenges (potential blocks) identified through the story board need to be further elaborated and 'reframed' in Formulating the Challenges. The author suggests that the cartoon story board is the product of both conscious and unconscious mind. It could be posted on a wall for some time for contemplation and further incubation. The activity is presented as an 'individual' one, yet a group activity might be built on it.

Figure 3.9 Cartoon Story Board

[Graphic from the Open University website.]

Adapted from the Open University website.

Table 3.14 Mindscapes

TOOL	**MINDSCAPES**
PURPOSE	• To provide a visual image of the journey toward a goal; and • To stimulate the generation of visual metaphors for a given situation (desired goal or vision/ blocks that need to be overcome) (Wycoff, 1995)
FUNCTION	1. Prepare the Trek Mindscape (copies of pre-printed treks can be ordered) on a large sheet of paper (**Figure 3.10**) 1.Use the space in the 'cloud' (at the end of the road) to record your goal/goals. Use the symbols of roadblock, dead ends, bridges, side tracks to represent various challenges of journeying toward your goal(s). Post-it notes can be used for adding new options and moving them around the Mindscape to reflect new possibilities or condition 1.Use the following provocative questions (individually or as a group) to design and enrich the map: ✓ How can we visually describe our goals? ✓ What metaphors might describe how we work together? ✓ How would we like to see ourselves? ✓ What is the environment we are trying to create? ✓ What are some possible scenes from our future? ✓ What are the limits or barriers to overcome in order to take the trek? ✓ Where am I (or where are we) on the path right now? ✓ How will we measure and celebrate success? (Wycoff, 1995)
CATEGORY	**DIVERGENT**: Generating goals, blocks/challenges and writing them on a map.

SOURCES	Wycoff,J. (1995). Transformation thinking: Tools and techniques that open the door to powerful thinking for every member of your organization. New York: Berkley Books.
REMARKS	Mindscape is a variation of Mindmap designed to represent the journey toward a vision. Similarly to the tools previously described, the process suggested by this tool comprises several steps. Therefore it cuts across different stages. Mindscape is conceived as a visual tool that should be posted on a wall (i.e. mural-size poster), in order to inspire the members of an organization (or of a team) and to elicit new contributions/refinements over time. It is meant to be as a 'work in progress'.

Figure 3.10 Mindscapes Trek

[Graphic from Wycoff, 1995.]

Wycoff, 1995. Used by permission.

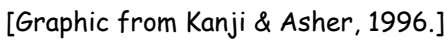
Table 3.15 Imaginary Journalism

TOOL	**IMAGINARY JOURNALISM**
PURPOSE	To help shaping a vision for an organization, workgroup, or individual, and to summarize the ideal picture of the future in a concise, colorful statement. (Whiteley, 1991).
FUNCTION	1. Imagine that you are a journalist writing an article for your favorite business publication. 1. Create a story vividly describing the success you and your workgroup will have achieved at a future time, two, five or even ten years from now. (Whiteley, 1991, p.227).
CATEGORY	**DIVERGENT**: Imagining and creating a story.
SOURCES	Whiteley, R. C. (1991). The customer driven company: Moving from talk to action. Reading, MA: Addison-Wesley.
REMARKS	This tool could be used individually or in a small group, by combining individual stories or building together a story. A variation of this technique is "Headlines from tomorrow" : 1. Each individual writes down on a post it note an headline that synthetically describe the results that he/she wants to be achieved at a future time ("tomorrow" could mean next week, next moth, next year, and so forth). 1. Individuals share their headlines at table level; then each table selects and composes one headline that summarizes what the group would like to read on "tomorrow" paper about its accomplishment. 1. Headlines from different tables are hang up in a 'headline gallery' and members of the large group identify common themes and goals for the future. Adapted by Tim & Laura Switalski (Unpublished technique).

Table 3.16 Opportunity Analysis

TOOL	**OPPORTUNITY ANALYSIS**
PURPOSE	To evaluate quickly a long list of options against desired goals and available resources (Kanji & Asher, 1996, p. 147).
FUNCTION	1. Write down all your goals in the situation under review 1. Construct a matrix (**Figure 3. 11**) and rank each goal by - the degree of importance to satisfy the customer (High/Medium/Low) - and your ability to complete them (High/Medium/Low), according to the resources available to you (for each goal ask yourself: Do I have the required resources?) 1. Start from the challenges or opportunities that present the highest degree of importance and the highest degree of ability to complete them. (Kanji & Asher, 1996)
CATEGORY	**CONVERGENT**: Evaluating and ranking goals
SOURCES	Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage.
REMARKS	This TQM tool presents high similarity with 'Searching for success zone". Compared to the latter, Opportunity analysis : • looks simpler, more linear • focuses on the issue of customer satisfaction (central to the TQM theory).

Figure 3.11 Opportunity Analysis Matrix



Adapted from Kanji & Asher, 1996.

The next sub-section illustrates the thinking tools that were selected and categorized in the 'Formulating the Challenges' step.

SUB-SECTION 3- FORMULATING THE CHALLENGES

Formulating the Challenges is aimed at identifying the gaps that must be closed to achieve the desired outcome. The thinking skill linked to this step is "Problem Analytic Thinking" which refers to the ability to frame a challenge into a specific problem that becomes a springboard for idea generation.

Four classic tools are provided by the CPS toolbox for this step of the process:

- Brainstorming problem statements, Ladder of Abstraction (Isaksen, Dorval & Treffinger, 1994) and Word Dance (Miller, Vehar & Firestien, 2001) for the divergent phase; and
- Hits & Highlighting (Isaksen, Dorval & Treffinger, 1994; Miller, Vehar & Firestien, 2001) for the convergent phase.

Six "Other Tools" were identified, selected and categorized within this step: five divergent tools and one convergent tool. All these tools were drawn from the 'creativity tools' literature, accessing information both from books (de Bono,1982; Michalko,1991; Van Gundy, 1988) and websites (http//www5.open.ac.uk/b822; http://www.mindtools.com). Some of these tools, however, originally derived from the Problem Solving & Decision Making literature (Rickards, 1974). In addition, two Other Tools which were categorized and illustrated in the Assessing the Situation step, were included also within this step: Why-Why diagram (Table 3.2), classified as divergent, and Fishbone diagram (Table 3.4), classified as convergent. In fact

both of these tools can be effectively applied in Assessing the Situation and/or in Formulating the Challenges, depending on the task at hand: they are a useful means of gathering or analyzing data and, at the same time, they provide a natural springboard for the restatement of the problem.

An Overview Table for this step is displayed in **Table 3.17**. Each of the 'Other Tools' is then illustrated in the tables that follow (**Table 3.18 – 3.23**).

Table 3.17 Formulating the Challenges-Overview Table

PURPOSE OF STEP & THINKING SKILL	'CLASSIC ' CPS TOOLS	OTHER TOOLS	CATEGORY	PAGE
Purpose To identify the gaps that must be closed to achieve the desired outcome **Problem Analytic Thinking** Framing a problem into a springboard for idea generation.	• Generating problem statements (How to? IWWMI?) • Ladder of abstraction (Why? What's stopping you?) • Word Dance • Hits & Highlighting	• Multiple redefinition • Goal orientation • Boundary examination • False faces • Reframing Matrix • Why-Why diagram [see Assessing the Situation] • Toothache Tree • Fishbone diagram [see Assessing the Situation]	**Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Convergent** **Convergent**	60 61 62 63 64 27 66 32

Table 3.18 Multiple Redefinition

TOOL	**MULTIPLE REDEFINTION**
PURPOSE	To help develop imaginative and original redefinitions of a problem via a set of questions that takes you systematically through several different mental modes (The Open University: http//www5.open.ac.uk/b822/).
FUNCTION	1. Write down on a piece of paper an open–ended problem/ challenge which is important to you. 1. Complete the following statements with reference to your problem: "*There is usually more than one way to look at a problem. You could also define this one as…….*" "*….but the main point of the problem is….*" "*What I would really like to do is….*" "*The problem put in another way could be likened to…*" "*Another, even stranger, way of looking at it might be…*" "*If I could break all the laws of reality (physical, social, etc.) I would try to solve it by…*" 1. Take a break and allow some time for incubation. 1. Return to your original definition. Write down any redefinition that might help you see the problem in a different way (The Open University website: http//www5.open.ac.uk/b822/))
CATEGORY	**DIVERGENT**: Completing the statements and writing down redefinitions of the problem.
SOURCES	Original source: Rickards, T. (1974). Problem-solving through creative analysis. New York: Wiley. Other sources :The Open University website: http://www5.open.ac.uk/b822/frameset.cfm?file=techniques%2FMULTIPLE%5FREDEFINITION%2EHTML&caller=alpha
REMARKS	The list of questions could be widened and enriched and the statements can be completed in many different ways.

Table 3.19 Goal orientation

TOOL	GOAL ORIENTATION
PURPOSE	To provide a way of thinking about a problem for the purpose of clarifying its goals or objectives (Van Gundy, 1988, p.45).
FUNCTION	1. Describe the problem: write down a general description of the problem, being sure to include all pertinent information. 1. Ask "What do I want to accomplish?" List the **needs** implied by the problem. 1. Ask "What is preventing me from getting what I want"? List the **obstacles** that prevent you from achieving it. 1. Ask "What restrictions must I accept to solve the problem? List the **constraints** within which this particular episode of problem solving must operate. 1. Using these questions as guidelines, write down possible redefinitions of the original problem statement that reflect these needs, obstacle and constraints (Van Gundy, 1988, p. 45).
CATEGORY	**DIVERGENT**: Listing needs, difficulties and constraints and generating problem statements.
SOURCES	Original source: Rickards, T. (1974). Problem-solving through creative analysis. New York: Wiley. Other sources: • Van Gundy, A. B. (1988). Techniques of structured problem solving. New York: Van Nostrand Reinhold.
REMARKS	Goal Orientation provides a simple rational check-list (needs, obstacles and constraints) for the generation of different problem statements. As its original author (Rickards, 1974) states, Goal orientation is more an attitude than it is a technique: it provides an unstructured approach for redefining problems that needs practice in order to be effective.

Table 3.20 Boundary examination

TOOL	BOUNDARY EXAMINATION
PURPOSE	• To bring potentially relevant aspects of a problem back into awareness (de Bono, 1982). • To understand more clearly how the wording of a problem is affecting our assumptions about the boundary (The Open University website:www5.open.ac.uk/b822/).
FUNCTION	1. Write down an initial statement of the problem 1. Underline key words 1. Examine each key word for hidden assumptions. See how the meaning of the statement change if you replace a key word by a synonym or near synonym. 1. Having explored how the particular choice of key words affect the meaning of the statement, see if you can redefine the problem in a better way (The Open University website:www5.open.ac.uk/b822/)
CATEGORY	**DIVERGENT**: Exploring similar words and redefining problem statements.
SOURCES	Original source: de Bono, E. (1982) Lateral Thinking for Management. London: Penguin Books. Other sources: The Open University website : http://www5.open.ac.uk/b822/frameset.cfm?file=techniques%2FBOUNDARY%5FEXAMINATION%2EHTML&caller=alpha
REMARKS	This tool works similarly to Word Dance. It is based on the principle that the problem boundary is the notional 'container' which separates highly relevant features (inside the boundary) from less relevant ones (outside the boundary). The boundary setting may itself be part of the problem. An additional way of making a boundary more visible is to "Not-ing the problem statement": take each significant term in a problem statement and define it more clearly by saying 'what is not'.

Table 3.21 False Faces (Reverse Assumptions)

TOOL	**FALSE FACES (REVERSE ASSUMPTIONS)**
PURPOSE	To broaden your thinking and escape from looking at a challenge in the traditional way (Michalko, 1991).
FUNCTION	1. State your challenge 1. List all the assumptions implied by the challenge 1. Challenge your assumptions. Reverse each assumption: write down the opposite 1. Record different viewpoints that might prove useful to you for a change in perspective (Michalko, 1991)
CATEGORY	**DIVERGENT**: Listing and reversing assumptions.
SOURCES	Michalko, M. (1991). Thinkertoys. Berkeley, CA: Ten Speed Press.
REMARKS	Reverse Assumptions could be a useful tool to look at the problem from different perspective and to find different ways of stating it. The author maintains that this tool enables you to think provocatively, take a new position and work out its implications.

Table 3.22 Reframing Matrix

TOOL	**REFRAMING MATRIX**
PURPOSE	To look at business problems from a number of different viewpoints or perspectives. (http://www.mindtools.com/pages/article/newCT_05.htm)
FUNCTION	1. Put the question to be asked (the challenge) in a box in the middle of a piece of paper (**Figure 3. 12**) 1. Draw a grid around it 1. Each of the four cells will contain approaches to the problem seen from one perspective. From here two possible directions can be followed: The 4Ps approach: look at the problem from the following viewpoints or perspectives: ✓ Product (any challenge from this viewpoint? Anything wrong or that can be improved?) ✓ Planning: (what about the business or marketing plans?) ✓ Potential (how does the problem look from the potential perspective side) ✓ People: how do different people involved (customers, employees and the like) see the problem? The Professionals Approach How different professionals would approach the problem? Useful professions to consider would be doctors, engineers, system analysts, sales managers, etc. (http://www.mindtools.com/pages/article/newCT_05.htm)
CATEGORY	**DIVERGENT**: Generating problem statements from different approaches or viewpoints.
SOURCES	http://www.mindtools.com/pages/article/newCT_05.htm

REMARKS	Reframing Matrix is a formal technique used to look at problems from different perspectives. The chosen perspectives can vary from time to time, according to the specific situation and to its context. When used in an imaginative way, this tool could provide the starting point for a role-playing situation (i.e. The Professional Approach), in which different members of the team take on a different role and perspective to stretch the problem understanding and definition.

Figure 3.12 Reframing Matrix

[Graphic from http://www.mindtools.com/pages/article/newCT_05.htm]

Adapted from http://www.mindtools.com/pages/article/newCT_05.htm

Table 3.23 The Toothache Tree

TOOL	**THE TOOTHACHE TREE**
PURPOSE	To identify the quantity and quality of the major obstacles you need to overcome to achieve your goal. (Michalko, 1991, p. 137).
FUNCTION	1. State your challenge 1. Identify and list the major obstacles you need to overcome to achieve your goal. 1. Order you obstacle according to degree of complexity (from simpler to more difficult) 1. Draw a vertical line to represent a tree's trunk. Write the challenge on this trunk. (**Figure 3.13**) 1. Draw diagonal lines to represent branches. Write your obstacles on the branches, with the simple ones at the bottom and the most difficult at the top 1. Each obstacle becomes a specific tree branch that must be removed. Frame each obstacle as a specific challenge. 1. Prioritize and select the most pressing obstacles to overcome. (Michalko, 1991)
CATEGORY	**CONVERGENT**: Ordering, prioritizing and selecting obstacles on the trunk. This tool can be used in combination with a divergent Brainstorming technique which focuses on listing obstacles and reframing obstacles as challenges.
SOURCES	Michalko, M. (1991). Thinkertoys. Berkeley, CA: Ten Speed Press.
REMARKS	This tool resembles the Fishbone diagram, yet it differs from it in that it focuses on the 'obstacles' that need to be removed in order to achieve the desired goal, rather than on the 'causes' of the challenge. The use of this tool might be more appropriate when the challenge is qualified as an 'opportunity' rather than as a 'problem'.

Figure 3.13 The Toothache Tree

Adapted from Michalko, 1991.

Next sub-section presents and describes the thinking tools that have been selected and categorized in the 'Exploring Ideas' stage.

SUB-SECTION 4- EXPLORING IDEAS

Exploring Ideas focuses on generating novel ideas that address significant gaps/challenges. The thinking skill associated with this step is "Ideational Thinking" which refers to the ability to produce mental images and thoughts to respond to challenges or opportunities.

The classic CPS toolbox provides numerous tools that can be applied in this step, especially for the divergent phase of the process. Nine divergent tools have been identified in the classic CPS literature: Brainstorming, Brainstorming with Post-its/ Stick' em up Brainstorming, Brainwriting, Attribute Listing, SCAMPER, Morphological Matrix/Idea Box, Forced Fit/Forced Connections, VIR/ Visual Connections, and Excursions (Isaksen, Dorval & Traffinger, 1994; Miller, Vehar & Firestien, 2001).Two convergent tools are normally used in this step of the process in order to narrow down and organize the high number of ideas that are typically generated : Hits& Highlighting (Isaksen, Dorval & Traffinger, 1994; Miller, Vehar & Firestien, 2001) and Sorting Options - Must/ Wants, Useful/Novel, etc.- (Isaksen, Dorval & Traffinger, 1994).

Seven 'Other Tools' were identified, selected and organized within this step. Because the purpose of Exploring Idea is essentially a divergent one – generating novel ideas-, the selected tools are all divergent. They were drawn from different sources available in the 'creativity tools' literature, which offers an abundance of thinking tools targeted to idea generation (de Bono, 1992; Michalko, 1991; Segal,

2001; Van Gundy, 1988; Van Gundy, 1992; www5.open.ac.uk/b822/). Some of the tools are presented with more than one name: these are popular tools that have been described and labeled differently by their respective authors, yet they share a common purpose and methodology of application (with few variations).

An Overview Table for this step is displayed in **Table 3.24**. Each of the 'Other Tools' is then described in the tables that follow (**Table 3.25 – 3.31**).

Table 3.24 Exploring Ideas-Overview Table

PURPOSE OF STEP & THINKING SKILL	'CLASSIC ' CPS TOOLS	OTHER TOOLS	CATEGORY	PAGE
Purpose To generate novel ideas that address significant gaps/challenges. **Ideational Thinking** Producing original mental images and thoughts that respond to challenges or opportunities.	• Brainstorming • Brainstorming with Post-its • Brainwriting • SCAMPER • Morphological matrix • Attribute Listing • Forced Fit • Visual Connections • Excursions • Hits & Highlighting • Sorting (Must-Wants/Useful-Novel, etc.)	• Brain sketching • Cherry Split/Two words • Board of directors • Rolestorming • Greeting Cards • Concept Fan • Circle of opportunity	**Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Divergent** **Convergent** **Convergent**	71 73 75 76 77 79 81

Table 3.25 Brainsketching

TOOL	BRAINSKETCHING
PURPOSE	• To use visual images to generate ideas; and • To sketch ideas to help conceptualize them and to compare the idea sketches within a group. (Van Gundy, 1992)
FUNCTION	1. The problem statement is agreed and written on a flip-chart 1. Each group member privately and silently draws a sketch of how the problem might be solved 1. Each participant passes the sketch on to the person to their right when it is finished. 1. Participants modify or develop the original drawing and/or annotate it with comments; then they pass it on to the next person on their right when ready. Group members can also use the sketch received as a stimulus to start a new one of their own (and pass it on to their neighbor) 1. Continue the process of passing the drawings and modifying them for about twenty to thirty minutes 1. All sketches can be displayed and discussed for clarification and comments. 1. Group members move on to evaluation process, by categorizing the sketches and selecting a final solution or constructing a final solution from parts of different sketches. (Van Gundy, 1992; The Open University: www5.open.ac.uk/b822/)
CATEGORY	**DIVERGENT**: Sketching or drawing ideas and modifying and developing other's sketches.
SOURCES	• Van Gundy, A. B. (1992). Idea power: Techniques and resources to unleash the creativity in your organization. New York: American Management Association. • The Open University website: http://www5.open.ac.uk/b822/frameset.cfm?file=techniques%2FBRAIN%5FSKETCHING%2EHTML&caller=alpha

REMARKS	This technique is a variant of the Brainwriting tool. Instead of passing around the group written ideas, participants pass around idea sketches or drawings and 'build' on them. This technique could be applied also by using a Brainwriting sheet and having participants sketch their ideas in each box.

Table 3.26 **Cherry Split or Two words**

TOOL	**CHERRY SPLIT OR TWO WORDS**
PURPOSE	• To break a challenge into separate pieces and then reassemble the parts into new ideas (Michalko, 1991, p.58) • To provide new perspectives that might stimulate new ideas (Van Gundy, 1988, p. 126)
FUNCTION	1. State the essence of your challenge in two words (i.e., select two key words from the problem statement). For example, the challenge being "In what ways might we improve the methodology of picking cherries?" , the two-word phrase is "Cherry- picking" (usually the two words are a verb and a noun) 1. Split each attribute (or key-word) into two more attributes, by listing alternate meanings for each key word (for example:' cherry' can be split into 'delicate' and 'separate' and picking can be split in 'removing' and 'transporting'). 1. Continue splitting the attributes until you feel that you have enough to work with (for example, "delicate' might be split into "damaged" and "blemished", and so on). 1. Examine each attribute for ideas and try to combine the attributes from the two lists: using this combination as a stimulus write down any idea suggested. 1. Continue combining words until all possible combinations have been examined for stimulation. (Michalko, 1991; Van Gundy, 1988)
CATEGORY	**DIVERGENT**: Listing attributes / alternate meanings and using words combinations as a stimulus for generating ideas.
SOURCES	• Michalko, M. (1991). Thinkertoys. Berkeley, CA: Ten Speed Press. • Van Gundy, A. B. (1988). Techniques of structured problem solving. New York: Van Nostrand Reinhold.

REMARKS	The principle underlying this technique is to divide the challenge into 'separate blocks' which can be combined in different ways in order to generate a high number of alternative ideas. This tool is based on an analytical approach and mixes elements that are presents both in Attribute Listing (breaking issues into sub-parts) and Morphological Matrix (generating unusual ideas through the free-combination of different elements). The tool is described in two slightly different ways by Michalko and Van Gundy: • Michalko presents it through a more open-ended and flexible approach (splitting the attributes in many different ways – not necessarily by synonymous- and proceeding in a 'two by two' manner, using free associations); • Van Gundy proposes a more structured and linear approach (making a list of alternate meanings for each word).

Table 3.27 Board of Directors or Creative Heroes

TOOL	BOARD OF DIRECTORS OR CREATIVE HEROES
PURPOSE	To create a fantasy board of 'business leaders' or 'creative heroes' that will assist you in the generation of ideas to overcome your challenge. (Michalko, 1991; Segal, 2001).
FUNCTION	1. Select a limited number (3 to 5) of business leaders or creative heroes, living or dead, who you admire the most (if the technique is applied in a group, have each participant naming his 'creative hero' or favorite business leader and then select them) 1. If possible, get photographs of your board and research your" heroes" upfront (read everything about your heroes that you get your hands on to identify their heroic characteristics: what make them stand out, what are their secrets, and so on) 1. Write the name of each 'hero' on a flip chart along with their prime heroic characteristics 1. This will be your 'creative board of directors'. When generating ideas to overcome your challenge consult the members of your board and imagine how they would solve it (i.e., what ways would Thomas Edison suggest to look for new products?) (Michalko, 1991; Segal 2001).
CATEGORY	**DIVERGENT**: Using the board of directors to stretch for new ideas to solve your challenge.
SOURCES	• Michalko, M. (1991). Thinkertoys. Berkeley, CA: Ten Speed Press. • Segal, M. (2001). Creativity and personality types: Tools for understanding and inspiring the many voices of creativity. Huntigton Beach, CA: Telos.
REMARKS	This popular tool is based on a 'fantasy' approach and can be applied in a number of ways and combined with role-playing techniques. In this respect, see the remarks displayed in the next table which describes the Rolestorming tool.

Table 3.28 Rolestorming

TOOL	**ROLESTORMING**
PURPOSE	To provide new perspectives that can lead to increase quantity and quality of ideas. (Van Gundy, 1988).
FUNCTION	1. Using brainstorming principles, groups members generate 20 to 30 ideas 1. Each member then selects someone who is not present, yet known to the member. The selected person might be someone else in the organization (i.e. the CEO, the manager of another department, etc.), a typical consumer, a great leader, and so forth. 1. Based upon the selected person's attitudes, preference and opinions, group members brainstorm from his/her point of view. When generating ideas they might use such phrases as "My person would try to…", "My person would favor..." (Van Gundy, 1988)
CATEGORY	**DIVERGENT**: Brainstorming from other people' s identity.
SOURCES	Original source: Griggs, R. E. (1985). A storm of ideas. *Training, 22,* 66. Other Sources: Van Gundy, A. B. (1988). Techniques of structured problem solving. New York: Van Nostrand Reinhold.
REMARKS	Rolestorming proposes a technique that combines role-playing and classic brainstorming. Board of Directors/ Creative Heroes and Rolestorming can be combined, by proposing a role-playing game that ask participants to 'impersonate' or 'think like' their favorite heroes in order to stretch their way of thinking and come up with new and unusual ideas. Any of these techniques can be effectively used in the Exploring Ideas step of the process following a necessary warm-up period of classic brainstorming.

Table 3.29 Greeting cards

TOOL	**GREETING CARDS**
PURPOSE	• To use unrelated problem stimuli (such as pictures and themes) in order to generate unusual and unique ideas; and • To create a playful atmosphere and attitude that encourage creative thinking during the idea generation phase. (Van Gundy, 1988).
FUNCTION	1. The group is given general instructions about the technique. The problem is not presented until the greeting cards have been produced 1. The group can be divided in sub-groups (4-5 people each). Each sub-group is given a stack of magazines or catalogs. 1. Group members look through the magazines or catalogs and cut out pictures that look interesting. At least ten pictures should be cut out in each group. 1. Either as individuals or as a group, participants paste the pictures onto folded sheets of paper to form greeting cards. The cards should be based upon some themes such as birthdays, holidays, friendship, get well and other special occasions. 1. Once all the cards have been constructed the problem is revealed and discussed. 1. Using the themes and the pictures as stimuli, the group members attempt to generate ideas to solve the problem 1. If time is available and more than one group is involved, the groups can exchange cards and repeat step 6. (Van Gundy, 1988, pp. 154-155)
CATEGORY	**DIVERGENT**: Using pictures/ themes as unrelated problem stimuli to generate ideas.

SOURCES	Van Gundy, A. B. (1988). Techniques of structured problem solving. New York: Van Nostrand Reinhold.
REMARKS	This technique applies the same approach as the Visual Connections tool, by using pictures (and related themes) as stimuli to generate unusual ideas. The main differences presented by the Greeting Cards technique are as follows: • group members are actively involved in the construction of the stimuli; • a double stimulation source is provided (pictures and themes/words); • a playful atmosphere is generated within the group; the playful attitude could be enhanced by asking participants to develop cards with humorous themes; • the stimuli (Greeting Cards) are constructed before the problem is presented (to ensure that they are totally unrelated to the problem).

Table 3.30 Concept Fan

TOOL	**CONCEPT FAN**
PURPOSE	To provide a framework for generating alternative ideas, by offering a succession of 'fixed' or 'focus' points. (de Bono, 1992)
FUNCTION	See **Figure 3.14** for a visual representation of a Concept Fan. 1. Start at the purpose of your thinking which is the objective you want to reach and it is identified by your challenge [For example: How to cope with a water shortage"] 1. Move backward from the objective to the '**direction**' that would lead you to the objective and generate possible directions [possible directions for the 'water shortage' challenge would be: 'reduce consumption', 'increase supply', 'do without'] 1. Each of these directions becomes the 'fixed' point for generating alternative '**concepts**' [following the example, for 'reducing consumption of water' you might have as concepts: 'increased efficiency of use', 'less wastage', 'discourage use', 'education'] 1. At the end of the previous stage you will have a number of alternative concepts in the 'concept layer'. Each of these concepts now becomes a fixed point for the next layer. For each concept, seek alternative **ideas**, which are 'specific ways' to put the concept to work. Ideas must be specific and ready to be put into practice. [For example, for the concept of 'discourage use' you might get alternative ideas as 'meter the water', 'charge for water use', 'put a harmless bad smell in the water, and the like]. (de Bono, 1992).
CATEGORY	**DIVERGENT**: Generating directions, concepts and ideas.
SOURCES	de Bono, E. (1992) Serious creativity: Using the power of lateral thinking to create new ideas. New York: Harper Business.

REMARKS	This tool provides a structured way to come up with a good number of alternative ideas to solve a challenge. It works through a 'cascade effect' , starting from the objective and moving backward through: ➢ the directions = very broad concepts or approaches ➢ the concepts = general methods or ways of doing something ➢ the ideas = specific concrete ways to put a concept to work As De Bono clearly states, Concept Fan is an 'achievement fan' and it is concerned with "how do we get there". According to de Bono, Concept Fan is different from an analysis tree that divides a subject into its sections. The emphasis is on action, i.e., on generating several and alternative specific ways to solve the challenge.

Figure 3.14 Concept Fan

[Graphic from de Bono, 1992.]

Adapted from de Bono, 1992.

Table 3.31 Circle of Opportunity

TOOL	**CIRCLE OF OPPORTUNITY**
PURPOSE	To explore associations and links that would not ordinarily be brought to bear on your challenge (Michalko, 1991, p. 185).
FUNCTION	1. State the challenge you want to solve 1. Draw a circle and number it like a clock (from 1 to 12) 1. Select any twelve common attributes (i.e., including color, shape, texture, sound,…) or choose twelve attribute specific to your challenge (attributes might represent various aspects of the challenge: for example marketing, selling, manufacturing, etc.) 1. Pick a pair of dice: Throw one die to choose the first attribute to focus on. Throw both dices to choose the second attribute. 1. Consider the attributes both separately and combined and free-associate about the individual attributes and the combination. Write down the associations as they occur to you. 1. Search for a link between your association and your challenge. Ask yourself: What do the associations remind me of? What analogies can I make from the associations? What are the relationship between the associations and the challenge? The random selection process can be reiterated several times. (Michalko, 1991, pp. 181-183)
CATEGORY	**DIVERGENT**: Free- associating and making connections between associations and the challenge
SOURCES	Michalko, M. (1991). Thinkertoys. Berkeley, CA: Ten Speed Press
REMARKS	This technique employs a forced connection approach based on the random selection of one or more attributes characterizing the challenge. The underlying principle is defined by Michalko as 'selective concentration' which allows our brain to process existing information into new relationship and meanings, thereby leading to insights and original ideas.

Next sub-section presents and describes the thinking tools that were selected and categorized in the 'Formulating Solutions' step.

SUB-SECTION 5- FORMULATING SOLUTIONS

Formulating Solutions focuses on transforming the best ideas generated in the Exploring Ideas step into workable solutions. The thinking skill linked to this step is Evaluative Thinking, which refers to the ability to assess the reasonabless and quality of ideas in order to develop workable solutions that resolve the challenge previously identified.

Six classic CPS tools are normally used within this step:

- Generating Criteria (Isaksen, Dorval & Treffinger, 1994), for the divergent phase
- ALUo/ PPCo, Evaluation Matrix (Isaksen, Dorval & Treffinger, 1994; Miller, Vehar & Firestien, 2001), PCA (Isaksen, Dorval & Treffinger, 1994), Card Sort and Targeting (Miller, Vehar & Firestien, 2001), for the convergent phase.

Six Other Tools were identified, selected and categorized within this step. Since Formulating Solutions entails operations that are mostly convergent (i.e., focused on evaluation and refinement of ideas), all the tools selected for this step are convergent tools. The identification and selection of convergent tools for this step mirror and balance the identification and selection of divergent tools for the Exploring Ideas step. Although both steps include a divergent and convergent phase, Exploring Ideas does have a prominent divergent focus

whereas Formulating Solutions has a prominent convergent focus. The tools selection conducted for this project therefore reflects the 'natural balance' existing between these two respective steps. The chosen six Other Tools were drawn from the TQM literature (Kanji & Asher, 1996) and the Problem Solving and Decision Making literature (Janis & Mann, 1977). Further tools were found within sources belonging to the 'creativity tools' literature (de Bono, 1994; Majaro, 1991).

An Overview Table for this step is displayed in **Table 3.32** and each of the Other Tools is then illustrated in the tables that follow (**Table 3.33- Table 3.38**).

Table 3.32 Formulating Solutions-Overview Table

PURPOSE OF STEP & THINKING SKILL	'CLASSIC ' CPS TOOLS	OTHER TOOLS	CATEGORY	PAGE
Purpose To move from ideas to solutions	Generating Criteria		**Divergent**	
Evaluative Thinking Assessing the reasonableness and quality of ideas in order to develop workable solutions.	ALUo/PPCo	• Cost -Benefit Analysis	**Convergent**	85
	Targeting	• Solution Effect Analysis	**Convergent**	86
	Card Sort	• Decision Balance Sheet	**Convergent**	87
	Evaluation Matrix	• Spider Diagram	**Convergent**	89
	PCA	• Screening Matrix	**Convergent**	91
		• PMI	**Convergent**	93

Table 3.33 Cost-Benefit Analysis

TOOL	**COST-BENEFIT ANALYSIS**
PURPOSE	• To estimate the real cost and benefits of a project under consideration (Kanji & Asher, 1996, p. 33). • To determine the worth of a proposed improvement/solution and to choose among several possible improvements /solutions (Whiteley, 1991, p.251).
FUNCTION	1. Calculate the known costs of the proposed improvement/solution. Devote time to thinking of additional costs you may have forgotten. Costs are either one-off or may be ongoing. 1. Calculate the potential benefits of the proposed improvement/solution. Benefits are most often received over time, so you may want to calculate a 'pay-back' period over a specified period of time (usually 3 or 5 years period). 1. You may want/need to include intangible benefits in your analysis (i.e. improved customer satisfaction). You then must estimate a value for these intangible benefits. In this case the tool can be used without actual cost figures, but using weightings. 1. Subtract the costs from the benefits. The remainder will be the objective of the analysis. (Whiteley, 1991; www.mindtools.com).
CATEGORY	**CONVERGENT**: Calculating and comparing costs and benefits.
SOURCES	• Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage. • Whiteley, R. C. (1991). The customer driven company: Moving from talk to action. Reading, MA: Addison-Wesley. • http://www.mindtools.com/pages/article/newTED_08.htm
REMARKS	Cost-benefit analysis is a classic TQM tool that can be useful in the evaluation and refinement of ideas.

Table 3.34 Solution Effect Analysis

TOOL	**SOLUTION EFFECT ANALYSIS**
PURPOSE	• To examine solutions to problem to find out whether there are any detrimental consequences or side-effect; and • To decide which solution to implement (Kanji & Asher, 1996, p. 113).
FUNCTION	1. Brainstorm all possible effects of the solution selected for analysis 1. Classify the effects under headings/categories (suggested headings are: materials, methods, equipment and people) 1. Draw a solution -effect diagram: follow the same process applied for the Fishbone diagram (**Figure 3.3**), with the 'solution' being the head of the fish and the potential effects being the branches/bones. 1. Write the effects in the diagram under the classification chosen 1. Analyze, identify (and plan for the removal of) any detrimental side-effects (Kanji & Asher, 1996).
CATEGORY	**CONVERGENT**: Classifying and analyzing the potential effects. This tool can be used in conjunction with the divergent tool of Brainstorming, in order to generate a list of potential effects of the solution selected for analysis.
SOURCES	Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage.
REMARKS	This TQM tool uses the same process adopted for the Fishbone Diagram and applies it to the analysis of potential solution (as opposed to the analysis of the problem).

Table 3.35 Decision Balance Sheet

TOOL	**DECISION BALANCE SHEET**
PURPOSE	To assist individuals in making decisions by providing a structured format for exploring all relevant alternatives and evaluating the gains and the losses associated with each. (Van Gundy, 1988, p. 219).
FUNCTION	1. Draw a balance sheet (**Figure 3.15**) that allows an analysis of each alternative/option in terms of different categories of expected consequences: - expected gains and expected losses; - for yourself and for others; - in tangible form (possessions, money, health, etc.) and subjective form (approval, confidence, self-image, reputation, etc.) . 1. The cell entries would be lists of items (gains and losses for yourself/others, in tangible/subjective forms). 1. Analyze which option appears the best when rated on these dimensions (the final decision would normally be a matter of judgment rather than calculation). (The Open University website: www5.open.ac.uk/b822/).
CATEGORY	**CONVERGENT**: Comparing options against potential gains and losses.
SOURCES	Original source: Janis, I. L. & Mann, L. (1977). Decision Making. New York: Free Press Other sources: • Van Gundy, A. B. (1988). Techniques of structured problem solving. New York: Van Nostrand Reinhold. • http://www5.open.ac.uk/b822/frameset.cfm?file=techniques%2FPERSONAL%5FBALANCE%5FSHEET%2EHTML&caller=alpha
REMARKS	This decision-making tool has been used primarily in the areas of career choice and health-related decisions and it was originally designed for use in the presence of someone like a counselor. The procedure can be useful for a variety of other decision situations, as well as for solo use.

Figure 3.15 Decision Balance Sheet

[Graphic from the Open University website.]

Adapted from the Open University website.

Table 3.36 Spider Diagram

TOOL	**SPIDER DIAGRAM**
PURPOSE	To organize and evaluate large number of ideas into more manageable segment or categories (Majaro, 1991).
FUNCTION	1. **Sorting the ideas**: ideas are grouped into general categories 1. **Filling in the diagram**: each category is allocated a segment of the Spider Diagram (**Figure 3.16**) and individual ideas are listed in the appropriate segments. The Spider Web should be sufficiently elastic to accommodate whatever number of ideas logically belongs in any particular segment (you might have 20 entries in a segment and only 3 in another; some ideas might be allocated in more than one segment). 1. **Evaluating the categories:** Each category or segment of the diagram may be assessed according to the predetermined relevant criteria 1. **Evaluating the ideas**: The ideas in each suitable segment might then be screened and best ideas can be identified through the use of other appropriate evaluative tools. (Majaro, 1991)
CATEGORY	**CONVERGENT**: Sorting and grouping ideas and evaluating categories and ideas.
SOURCES	Majaro, S. (1991).The creative marketer. Oxford: Butterworth-Heinemann
REMARKS	Spider Diagram can be a useful preliminary sorting tool which provides a visual way of grouping ideas into related clusters. Other convergent tools can be combined to the Spider Diagram in order to evaluate and refine best ideas.

Figure 3.16 Spider Diagram

[Graphic from Majaro , 1991.]

Adapted from Majaro , 1991

Table 3.37 Screening matrix

TOOL	**SCREENING MATRIX**
PURPOSE	To allow a large number of ideas to be judged simultaneously in terms of both their inherent attractiveness and their practicality (Majaro, 1991, p. 144).
FUNCTION	1. **Draw a two dimensional matrix** (**Figure 3.17**): - Horizontal axis: level of 'creative excellence' /idea attractiveness (when an idea is considered solely on its own merit) - Vertical axis: compatibility with firm's needs (idea's degree of compatibility with the aims and resources of the organization) 1. **Define criteria** for each of the two dimensions represented by the axes according to the nature of the need to be addressed (i.e. originality/ market appeal; corporate objectives or image). 1. **Evaluate ideas**: assign each idea under consideration a code number and evaluate it separately on a 4 point scale - Excellent /Good / Fair /Poor – in meeting criteria established for the two axes. 1. **List idea on the matrix and analyze**: write the code number of each idea in the relevant cell of the matrix, according to the idea's ratings. By analyzing the matrix you can immediately identify: best ideas/good ideas/ideas with some potential. (Majaro, 1991)
CATEGORY	**CONVERGENT**: Evaluating and analyzing ideas in a matrix.
SOURCES	Majaro, S. (1991).The creative marketer. Oxford: Butterworth-Heinemann
REMARKS	A variation suggested by the author is the "Quantified Screening Matrix". The screening procedure remains the same except that each axis is divided into 10 segments so that the matrix contains 100 cells or rating points. Each idea is given a score from 1 to 10 on each axis and the idea's code number is listed in the appropriate cell of the matrix.

Figure 3.17 Screening Matrix

[Graphic from Majaro , 1991.]

Adapted from Majaro , 1991.

Table 3.38 Plus, Minus, Interesting (PMI)

TOOL	**PLUS, MINUS, INTERESTING (PMI)**
PURPOSE	To deliberate direct our attention first toward the Plus points, then toward the Minus points and finally toward the Interesting points of an idea or concept, in order to set the mood for objectivity and scanning when evaluating a situation (de Bono, 1994).
FUNCTION	1. In front of an idea/concept/suggestion deliberately carry out the PMI operation by listing: - First, the Pluses or good points - Second, the Minuses or the bad points - Third the Interesting points: points that are neither positive nor negative but that encourage you to further explore and expand the idea ("It would be interesting to see if…") 1. Observe and react to what has been turned up by the PMI scan. (de Bono, 1994).
CATEGORY	**CONVERGENT**: Scanning and analyzing ideas through their plus, minus and interesting points.
SOURCES	de Bono, E. (1994) De Bono's thinking course (1994). New York: Facts on File.
REMARKS	PMI is one of the many attention-directing tools devised by de Bono. Although it functions like ALU or PPC, the principle underlying PMI appears slightly different. De Bono explicitly states that it conceived PMI not as a judgment/evaluating tool, but as a 'scanning' tool that allows the individual to see more clearly a given situation and to react accordingly.

The next sub-section illustrates the thinking tools that were selected and categorized in the 'Exploring Acceptance' step.

SUB-SECTION 6- EXPLORING ACCEPTANCE

The purpose of Exploring Acceptance is to increase the likelihood of success by testing solutions. The thinking skill associated with this step is 'Contextual Thinking', which refers to the ability to understand the interrelated conditions and circumstances that will support or hinder success.

Two tools are provided by the CPS toolbox for this step of the process:

- Generating Sources of Assistance and Resistance (Isaksen, Dorval & Treffinger, 1994; Miller, Vehar & Firestien, 2001), for the divergent phase
- Hits (Isaksen, Dorval & Treffinger, 1994; Miller, Vehar & Firestien, 2001), for the convergent phase.

Six 'Other Tools' were identified and organized within this step: one divergent tool and five convergent tools. These tools were drawn mostly from the Strategic Management and TQM literature, which often overlap in tools selection and description (Beckard & Pritchard, 1992; Dick, 1997; Kanji & Asher, 1996; Mason & Mitroff, 1981), partly from the Problem Solving and Decision Making literature (Kepner & Tregoe, 1976), and partly from the 'creativity tools' literature (de Bono, 1994; Majaro, 1991; Michalko, 1991; Van Gundy, 1988), which frequently reports

tools originating from the above-mentioned fields (TQM, Strategic Management, Problem Solving, and Decision Making).

An Overview Table for this step is displayed in **Table 3.39**. Each of the 'Other Tools' is then described in the tables that follow (**Table 3.40 – 3.45**).

Table 3.39 Exploring Acceptance-Overview Table

PURPOSE OF STEP & THINKING SKILL	'CLASSIC ' CPS TOOLS	OTHER TOOLS	CATEGORY	PAGE
Purpose To increase the likelihood of success by testing solutions.	• Generating sources of Assistance and Resistance	• OPV (Other People's View)	**Divergent**	96
Contextual Thinking Understanding the interrelated conditions and circumstances that will support or hinder success.	• Hits	• Force-Field Analysis • Stakeholder Analysis • Commitment Chart • Opus • Potential-Problem Analysis (PPA)	**Convergent** **Convergent** **Convergent** **Convergent** **Convergent**	97 100 104 106 107

Table 3.40 Other People's View (OPV)

TOOL	**OTHER PEOPLE'S VIEW (OPV)**
PURPOSE	To direct attention to the other people involved in a situation …and to have the thinker put himself in other person shoes' in order to look at the world from that position (de Bono, 1994, p. 95).
FUNCTION	1. Identify the other people who are really part of the situation. For example if the context is 'farm produce' the parties involved might be the farmers, the wholesalers, the retailers, the food processors, the food buyers, and so forth. 2. Get inside the thinking of all these other people and try objectively to look at the world from that point of view and to add what is thought to be the actual point of view. (de Bono, 1994).
CATEGORY	**DIVERGENT**: Getting out of our 'thinking zone' and trying to look at the situation from other people's view.
SOURCES	de Bono, E. (1994) de Bono's thinking course (1994). New York: Facts on File.
REMARKS	OPV is another of the CORT tools, the attention-directing tools devised by deBono. The thinking required by OPV is described by deBono as a "blend between the 'position' point of view and the 'actual point' of view (for example, as a reporter might find it)" (de Bono, 1994, pp. 97-98). In the Exploring Acceptance step, OPV may be effectively applied in combination with the Stakeholder Analysis (see Table 3.42), when examining where the stakeholders of a given situation are with respect to the proposed solution or change plan. OPV can also be applied within a group through a role-playing approach.

Table 3.41 Force-Field Analysis

TOOL	**FORCE-FIELD ANALYSIS**
PURPOSE	• To identify those forces that both help and hinder you in closing the gap between where you are and where you want to be (Kanji,& Asher, 1996, p.98). • To predict the probable impact and success of a potential innovation and to facilitate the implementation of the most promising ideas. (Majaro, 1991).
FUNCTION	1. Represent the potential solution or the desired change as a horizontal line across the middle of the page or flipchart (**Figure 3.18**). 2. Identify and list the factors that would promote its success – "driving forces"- and those that would hinder it – "restraining forces"-. Brainstorming techniques can be applied to identify these forces. 3. Insert these factors in the diagram: draw all the driving forces as arrows that pull or push the line upward and the restraining forces as arrows that pull or push the line downward. 4. Assign a score to each force, in relation to its strength on the dimension and scale decided by the group (i.e., high/low impact; easy/difficult to be modified; scale from 1 to 10 or 1 to 5) 5. Analyze the force-field diagram in order to: - Assess the likelihood of success of the proposed solution - Generate ideas about how to strengthen the driving forces or how to lessen or remove the restraining forces. (Majaro, 1991).
CATEGORY	**CONVERGENT**: Examining opposing forces to a change and analyzing the potential of success of the proposed solution. Force-field analysis is a convergent tool designed to spur a divergent process (generating ideas about how to strengthen driving forces or lessen the restraining ones).

SOURCES	Original source: Lewin, K. (1951) Field, theory and social science: Selected theoretical papers. New York: Harper & Row. Other sources: • Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage. • Majaro, S. (1991).The creative marketer. Oxford: Butterworth-Heinemann
REMARKS	Force-field analysis originates from the Gestalt theories and the work of Kurt Lewin, who believed that change resulted from the relative strengths of competing driving and restraining forces. Force-field analysis is a 'classic' tool which is used in TQM as well as in several other strategic management approaches. When analyzing the force-field diagram, it is advisable to consider that it is usually more effective to eliminate or diminishing the restraining forces than it is to strengthen the driving forces.

Figure 3.18 Force–Field Diagram

Adapted from Majaro , 1991.

Table 3.42 Stakeholder Analysis

TOOL	**STAKEHOLDER ANALYSIS**
PURPOSE	To examine the reactions of people or groups likely to be involved in a proposal for action and to look at how these people might affect outcomes (The Open University website: www5.open.ac.uk/b822/).
FUNCTION	1.Identify and list the key stakeholders in your plan (See checklist, **Figure 3.19)** 2. Draw a six columns chart (**Figure 3.20**). 3. List the selected Stakeholders in Column 1: these may be individuals or stakeholder groups or some combination. 4. Estimate attitude and influence of the stakeholders: for columns 2 to 5 work across the page. Record your estimate of the following in the columns: - Column 2: your best estimate of the stakeholders' attitude, from supportive to opposed - Column 3: How confident you are about your estimate in column 2 - Column 4: Your best estimate of the influence of the stakeholder - Column 5: How confident you are about your estimate in column 4 5. Plan your strategies for approaching and involving each person or group: in Column 6 list actions related to obtain more information or to involve the stakeholders in the planning of change. (Dick,B. (1997) Stakeholder analysis [On line]. Available at http://www.scu.edu.au/schools/gcm/ar/arp/stake.html).
CATEGORY	**CONVERGENT**: Examining the possible reactions of the stakeholders involved in a proposal for actions and categorizing them by attitude and level of influence. The preliminary lists of Stakeholders (step 1) can be generated through the use of a divergent tool such as Brainstorming.

SOURCES	Original source (for the Stakeholder analysis concept): Mason, R. O. & Mitroff, I. L. (1981) Challenging strategic planning assumptions: Theory, cases and techniques. New York: Wiley. Other sources: • Dick,B. (1997) Stakeholder analysis [On line]. Available at http://www.scu.edu.au/schools/gcm/ar/arp/stake.html • The Open University website: http://www5.open.ac.uk/b822/frameset.cfm?file=techniques%2FSTAKEHOLDER%5FANALYSIS%2EHTML&caller=alpha
REMARKS	Stakeholder analysis is a concept and a tool that comes from the strategic management literature and application. The original definition of the 'stakeholder' concept has been provided by Mason & Mitroff (1981). "Stakeholders are parties on whom the company depends in some way for the full realization of the plan or who depend on the company for the realization of some of their own goals. Stakeholders have a vested interest in the plan" (p.100) The version proposed here mixes inputs retrieved in two different sources on the Internet. In the Exploring Acceptance step, Stakeholder analysis can be very useful in order to analyze the possible reactions to a proposed solution of people or groups that are likely to be involved in its implementation. The resulting analysis will guide the strategy aimed to obtain support from the key-players. This might entail a divergent phase of thinking: listing actions in order to involve the stakeholders in the planning of change. The actions required in order to gain support will become a part of the final plan for action.

Figure 3.19 Checklist for Stakeholders Generation

[Graphic from: Mason & Mitroff (1981); The Open University website.]

Adapted from: Mason & Mitroff (1981); The Open University website

Figure 3.20 Stakeholder Chart

[Adapted from: Dick, B. (1997) Stakeholder analysis [On line].
Available at http://www.scu.edu.au/schools/gcm/ar/arp/stake.html]

Adapted from: Dick, B. (1997) Stakeholder analysis [On line]. Available at
http://www.scu.edu.au/schools/gcm/ar/arp/stake.html

Table 3.43 Commitment Chart

TOOL	**COMMITMENT CHART**
PURPOSE	To determine the minimum commitment required from each player or group in order to allow the change to happen (Beckard & Pritchard, 1992, p. 77).
FUNCTION	1. Make a four column grid (**Figure 3.21**). 2. On the vertical axis list all the key-players, both individual and groups, who make up the critical mass, which is defined as the smallest number of people and /or groups who must be committed to a change for it to occur. 3. Along the horizontal axis draw four columns headed: "Against (or no commitment)"; "Let it happen"; "Help it happen"; "Make it happen" 4. Determine the necessary level of commitment for each key-player and mark an "O" in the appropriate box. **5.** After locating the "**desired state**" **(O**) for a player, you then locate his or her **present state** and mark the box with an **"X"** 6. Connect with an arrow the present position, X, with the required position, O. 7. Develop a strategy to move everyone to the required position. When and X and an O are in the same box you have the desired commitment. (Beckard & Pritchard, 1992).
CATEGORY	**CONVERGENT**: Analyzing and determining the commitment to the desired change required for each key-player.
SOURCES	Beckard R. & Pritchard, W. (1992) Changing the essence: The art of creating and leading fundamental changes in organizations. San Francisco: Jossey-Bass.

REMARKS	The Commitment Chart is a convergent tool that 'naturally' complements the Stakeholder Analysis. Once the attitude and influence of each stakeholder towards a solution/ plan for change has been determined, the Commitment Chart helps identify the minimum commitment necessary for success. From this analysis a strategy involving each key-player need to be put forth in order to ensure support for the desired change.

Figure 3.21 Commitment Chart

[Graphic from Beckard & Pritchard, 1992.]

Adapted from Beckard & Pritchard, 1992.

Table 3.44 Opus

TOOL	**OPUS**
PURPOSE	To survey how an idea (or potential solution) will be received by a given audience (i.e. prospective customers, colleagues working in another department, and so forth) (Michalko, 1991).
FUNCTION	1. Prepare a box, about 16 inches by 4 inches by 1 inch. The interior of the box should be divided into four compartments, labeled "agree", "partly agree", "disagree, "no opinion". 2. The box should contain a description of your idea and several sets of index cards . On each card a statement of concern about the idea is typed (for example: The major benefit is…;The best way to market it is…"; "the problems it will solve are…"; I expect the following results..") 3. Give each respondent a set of cards and ask them to put each card into one of the four compartments. 4. The cumulative results give you a feel for how your idea will be received. (Michalko, 1991).
CATEGORY	**CONVERGENT**: Evaluating an idea or potential solutions through a survey device.
SOURCES	Michalko, M. (1991). Thinkertoys. Berkeley, CA: Ten Speed Press.
REMARKS	Opus is drawn by Michalko from a market research technique used by TerraFirma AB, a Swedish research company. According to Michalko (1991) the tool is "fast and easy to do and most people enjoy doing this kind of physical survey" (p. 331). The nature of the outcomes is quantitative but results can be further investigated through qualitative comments or interviews.

Table 3.45 Potential-Problem Analysis (PPA)

TOOL	**POTENTIAL-PROBLEM ANALYSIS (PPA)**
PURPOSE	To prevent problems from occurring during implementation and to reduce their effects should they occur (Van Gundy, 1988, p.260).
FUNCTION	1. Define Objectives, i.e., the key-requirements or 'musts' that need to occur for a solution to be successfully implemented. 2. Generate a list of potential problems: the Reverse Brainstorming technique can be used in order to identify everything that could possibly go wrong and have the solution/ plan fail. 3. Identify the specific nature of each problem, by asking "What?" , "Where", "When?", " To What Extent"? 4. Determine the amount of risk associated with each problem: categorize each problem according to its degree of risk, reflecting both the likelihood of it happening and the severity of the impact if it did (for example, High likelihood/high impact). These two judgments combined will estimate the overall risk. 5. Search for possible causes of each problem: develop a list of causes that could be associated with each problem. 6. Develop Preventive Actions that will prevent causes or minimize their effects. You can then estimate the likelihood of a cause occurring after having taken preventive action (on a scale from zero to 100%). This probability estimate is the 'Residual Probability'. 7. Develop Contingency Plans, for the most serious problems, that will specify exactly what actions will be taken if the problem occurs, despite the preventive actions. 8. Draw a chart and fill the following columns (**Figure 3.22**): Possible Problems & Causes; Probability of Risk; Preventive Actions; Residual Probability; Contingency Plans. (Van Gundy, 1988).

CATEGORY	**CONVERGENT**: Analyzing the potential risks for failure of a solution or action plan. Two divergent tools are associated to the analysis of the potential problems: Reverse Brainstorming (identifying potential problems) and Brainstorming (devising Preventive Actions).
SOURCES	Original source: Kepner, C. H. & Tregoe, B.B. (1976) The rational manager. Princeton, NJ: Kepner-Tregoe, Inc. Other source: Van Gundy, A. B. (1988). Techniques of structured problem solving. New York: Van Nostrand Reinhold.
REMARKS	PPA was developed by Kepner and Tregoe in order to provide a rational and systematic approach for anticipating problems that can hinder the success of a solution or of a plan for action. This tool can be applied both in: • Exploring Acceptance, as a way to 'test the solution' and anticipate the potential obstacles that might hinder the success of the solution, in relation with the conditions of the context; and • Formulating a Plan, when a Plan for Action has already been devised and each action can be analyzed to troubleshoot possible problems that might be encountered along the way. PPA provides a rational framework that can be a source of creative triggers if approached in imaginative ways.

Figure 3.22 PPA Chart

[Graphic from Van Gundy , 1988.]

Adapted from Van Gundy , 1988.

Finally, next sub-section presents and describes the thinking tools that were selected and categorized in the 'Formulating a Plan' step.

SUB-SECTION 7- FORMULATING A PLAN

The final process step of the new CPS framework is aimed at developing an implementation plan. The thinking skill associated with this step is 'Tactical Thinking', which focuses on devising a plan in specific and measurable steps for attaining a desired end and monitoring its effectiveness.

Three classic CPS tools are normally used in this step of the process:

- Generating Action Steps (Isaksen, Dorval & Treffinger, 1994; Miller, Vehar, Firestien, 2001) for the divergent phase; and
- Implementation Plan and Sequencing Short, Intermediate and Long-Term Action Steps (Isaksen, Dorval & Treffinger, 1994; Miller, Vehar, Firestien, 2001) for the convergent phase.

Five Other Tools were identified and categorized within this step: one divergent tool and four convergent tools. The divergent tool was drawn from the 'creativity tools' literature (Majaro, 1991), whereas the convergent tools were drawn from the TQM and Strategic Management literature (Kanjii & Asher, 1996; Senge, Kleiner, Roberts, Ross, Roth & Smith, 1999; http://www.mindtools.com). Additionally, one Other Tool which was described and categorized within the Exploring Acceptance step, was included also in this step: Potential Problem Analysis (Table 3.45), classified as a convergent tool. This tool can be in fact applied first in Exploring Acceptance, to test solutions and anticipate the potential

obstacles, and then be used again in Formulating a Plan as a way to troubleshoot possible problems that might be encountered along the way.

Table 3.46 displays an Overview for this step. Each of the Other Tools is then described in the tables that follow (**Table 3.47- 3.51**).

Table 3.46 Formulating a Plan- Overview Table

PURPOSE OF STEP & THINKING SKILL	'CLASSIC ' CPS TOOLS	OTHER TOOLS	CATEGORY	PAGE
Purpose To develop an implementation plan. **Tactical Thinking** Devising a plan in specific and measurable steps for attaining a desired end and monitoring its effectiveness.	• Generating action steps • Implementation Plan (What/who/by when, etc.) • Sequencing Short, Intermediate and Long-term action steps.	• How- How Diagram • PPA (See Exploring Acceptance) • Gantt Chart • Critical Path Analysis (CPA) • Improve Internal Process Plan (IIP) • Performance Dashboard	**Divergent** **Convergent** **Convergent** **Convergent** **Convergent** **Convergent**	111 107 113 115 117 119

Table 3.47 How-How Diagram

TOOL	**HOW-HOW DIAGRAM**
PURPOSE	To identify the steps necessary to implement a solution (Higgins, 1994, p. 191).
FUNCTION	1. Place the solution on the left side of a piece of paper or flipchart. 2. Identify the initial steps needed to implement the solution and write them in the appropriate blanks to the right of the solution (use a decision-tree diagram shape: **Figure 3.23**) 3. Consider each step individually, breaking it down into its detailed, constituent stages, by repeatedly asking "HOW" it might be achieved. Each stage is recorded in the diagram. 4. The process continues until each step has been drawn out to its logical limit 5. Examine the complete diagram for recurring elements, which tend to indicate the most crucial stages in the process of implementation. (Majaro, 1991; Higgins, 1994).
CATEGORY	**DIVERGENT**: Generating 'steps' or actions needed to implement the solution, by repeatedly responding to the open ended question "How". This tool is complemented by an analysis of the crucial stages to focus on, which has a convergent purpose.
SOURCES	• Majaro, S. (1991).The creative marketer. Oxford: Butterworth-Heinemann • Higgins, J (1994). 101 Creative Problem Solving techniques. Winter Park, FL: New Management Publishing Company
REMARKS	The How-How Diagram works in a similar way to the Why-Why diagram discussed in Assessing the Situation. By asking repeatedly "HOW" and by breaking down each step into its detailed stages, this tool forces to confront the practical issues involved in implementation and often highlights possible problems or discrepancies that need to be overcome.

Figure 3.23 How- How Diagram

[Graphic from Majaro, 1991.]

Adapted from Majaro, 1991.

Table 3.48 Gantt Chart

TOOL	**GANTT CHART**
PURPOSE	To plan and schedule the necessary steps to implement projects. (Kanji& Asher, 1996).
FUNCTION	1. Break down the implementation plan into achievable tasks and activities (make a list). 2. Estimate how long each task will take and set a realistic completion date. 3. Break down the steps into a logical sequence. Lines denote when a task is due to commence and end (**Figure 3. 24**). The relationship over time between each task is immediately visible. 4. Assess each step individually, identifying: - any issue that stops you completing a stated task (key issue) - any dependent task that must be completed before another task is begun. (Kanji & Asher, 1996, p. 46).
CATEGORY	**COVERGENT**: Breaking down task in activities, scheduling and plotting them in a chart.
SOURCES	Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage.
REMARKS	Gantt Charts are useful for planning and scheduling complex projects. They allow you to: • assess how long a project should take • determine the resources you need • lay out the order in which tasks need to be carried out (and manage the dependencies between tasks) • monitor a project's progress over time Although you can draw Gantt Charts manually, software tools like **Microsoft Project** can be used to effectively build and manage Gantt Charts.

Figure 3.24 Gantt Chart

[Graphic from Kanji & Asher, 1996.]

Adapted from Kanji & Asher, 1996.

Table 3.49 Critical Path Analysis (CPA)

TOOL	**CRITICAL PATH ANALYSIS**
PURPOSE	• To schedule and manage complex projects; and • To help identify ➢ tasks which must be completed on time (i.e., activities that lie on the 'critical path', for which any delay or speeding up will affect the overall time for the project) ➢ tasks that can be delayed for a while if resources needs to be reallocated on the critical path activities. (http://www.mindtools.com/pages/article/newPPM_04.htm)
FUNCTION	1. List all activities in the plan: proceed as indicated at steps 1 and 2 of the Gantt Chart. 2. Plot the activities as a circle and arrow diagram (**Figure 3.25**): **circles** show events within the project (i.e., points in time that mark the start or end of an activity) and are normally numbered; an **arrow** running between two event circles shows the activity needed to complete the task. A description of the task is written underneath the arrow; the length of the task is shown above it. 3. Draw the flowchart of all activities. Where one activity cannot start until another has been completed, start the arrow for the dependent activity at the completion of the previous activity 4. Identify the 'critical path' activities (software are available to calculate them): these are activities that must be very closely managed to ensure that all activities are completed on time. 5. If jobs on the critical path slip, immediate action should be taken to get the project back on schedule. You might need to allocate additional resources to the critical path activities. (http://www.mindtools.com/pages/article/newPPM_04.htm)
CATEGORY	**COVERGENT**: Scheduling and plotting activities on a chart.

SOURCES	• Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage. • http://www.mindtools.com/pages/article/newPPM_04.htm
REMARKS	CPA Analysis is a useful tool to manage complex projects. As with Gantt Chart, project managers tend to use software tools like **Microsoft Project** to create CPA charts. A software tool also makes easier to monitor progress against the plan and to intervene with the necessary modifications. A variation of CPA is PERT (Program Evaluation and Review Technique). PERT is a tool that takes a more skeptical view of the time needed to complete each project stage. Through the application of a formula, PERT helps to bias time estimates away from the unrealistically short time –scales normally assumed.

Figure 3.25 CPA Diagram

[Graphic from: http://www.mindtools.com/pages/article/newPPM_04.htm]

Adapted from: http://www.mindtools.com/pages/article/newPPM_04.htm

Table 3.50 Improve Internal Process (IIP)

TOOL	**IMPROVE INTERNAL PROCESS (IIP)**
PURPOSE	To provide the structure to develop work plan details for a task using various factors, such as measurement, responsible resources, time and previous task owner (Kanji& Asher, 1996, p. 134).
FUNCTION	Create a matrix composed of seven columns (**Figure 3.26**): 1. **Task** : List and number each task 2. **Allocation**: Allocate responsibility for the completion of each task 3. **Overall responsibility** : Indicate who have Overall Responsibility for each task 4. **Measurement**: Provide the measure of completion for each task. The measure should be clearly defined data, quantity and level of performance 5. **Resources:** Give details of the resources required for each task 6. **Time**: Write the time when each task will be completed 7. **Previous Owner**: Find the previous owner for each task (Kanji & Asher, 1996, p. 134).
CATEGORY	**CONVERGENT**: Developing work plan details and categorizing and evaluating them against a set of factors.
SOURCES	Kanji, G. K. & Asher, M. (1996). 100 methods for Total Quality Management. London: Sage.
REMARKS	IIP is a TQM tool that provides a useful framework for devising a detailed Implementation Plan. The focus on measurement comprised in IIP can help monitoring the effectiveness of the devised plan for action over time.

Figure 3.26 IIP Matrix

[Graphic from Kanji & Asher, 1996.]

Adapted from Kanji & Asher, 1996.

Table 3.51 Performance Dashboard

TOOL	**PERFORMANCE DASHBOARD**
PURPOSE	To provide a visual representation of progress and potential trouble spots in your plan and to monitor the progress and success of your plan. (Senge, Kleiner, Roberts, Ross, Roth & Smith , 1999).
FUNCTION	**1. DEVELOP A SET OF INDICATORS** (See examples-**Figure 3.27**) Develop a set of gauges that can be effective for monitoring the progress of the plan. Consider the following guidelines: ➢ Avoid the conventional standard company measures and ask yourself questions like: "What are the most revealing measures in your work/plan ?", What indicators do you already use to track progress"? ➢ Look for "process' measures that tell you how you are progressing as you try to achieve your goals. ➢ Include 'soft' (human-oriented) measures along with the 'hard' measures. Soft measures are variables that cannot be measured precisely - such as motivation, commitment, ownership, and resistance to change- and demand more scrutiny and judgment. ➢ Pick measures that you believe will count for the key constituents. **2. COMBINING THE MEASURE INTO A DASHBOARD** ➢ Share the proposed measures within the team and select them. ➢ Consider the following criteria for selection: Are the critical objectives tracked? Are all red alert conditions monitored? **3. TRANSFORMING YOUR INDICATORS INTO A DASHBOARD** ➢ Create a visual dashboard and make it visible (post it on the wall). ➢ Meet regularly to review the measurements and update the dashboard prior to each meeting. ➢ Look for variance between targets and indicators you choose. ➢ Use the performance dashboard to spark conversations within the team and to act proactively (do not rush to negative conclusions). (Senge et al. 1999).

CATEGORY	**CONVERGENT**: Developing measures and examining progress against a set of indicators. The first step of the tool entails a divergent activity, in that it fosters the generation of a list of indicators of performance which go beyond the 'conventional' measures used by companies.
SOURCES	Senge P. , Kleiner A., Roberts C. , Ross R. , Roth G., & Smith B. (1999). The dance of change: The challenge of sustaining momentum in learning organizations. New York: Doubleday.
REMARKS	Performance Dashboard is a powerful tool for measuring the progress of a plan which works well also at a qualitative level, by including 'soft measures' like motivation, commitment, and the like. It is based upon a simple metaphor (the car dashboard) which allow the user to comprehend the most critical parameters at a glance (like when we are driving a car). Following the metaphor of a car dashboard, the goal is to create a multiple-gauge format dashboard (composed of a variety of gauges and indicators) that can function as a key- feedback mechanism to monitor the progress of a plan/project. Examples provided by the authors of how the metaphor works are as follows: • Speedometer = real-time data, showing the rate of performance at any time (i.e., week by week levels of overheads or competitive product quality). • Odometer = cumulative track of progress (i.e., progress toward a project milestone). • Warning lights= a big problem is brewing. Performance Dashboard is a tool conceived for being applied in a team. It can be particularly useful for multifunctional teams that need to establish a common set of measures and a common language to coordinate action.

Figure 3.27 Sample Gauges from a Prototype Performance Dashboard.

[Graphic from Senge et al (1999).]

Adapted from Senge et al (1999).

Conclusions

This section reviewed the findings and the analysis of the data gathered by this study. Forty-four thinking tools, other than the 'classic' CPS tools, were collected, analyzed, described and categorized within the seven steps of the new CPS framework, according to the main categories of divergent and convergent thinking . In each step, at least six 'other tools' were collected , analyzed and categorized, thereby attaining the goal set for this study in the Methodology section. An Overview Table was displayed at the beginning of each step. Twenty-seven figures were added in order to provide a graphic representation of the tools for which a visual illustration was required for a clear description of the tool.

The next section provides implications and conclusion suggested by this study, as well as recommendations for future research in this area.

SECTION 4
Key Learnings and Recommendations for Further Study.

Introduction

The purpose of this section is to discuss the findings of this study in the larger context of the proposed new framework for CPS and the thinking tools literature. Key learnings and insights gained through the execution of this project are described and recommendations for future studies are presented.

Key Learnings

Thinking skills and Thinking Tools

This project has provided an opportunity to reflect upon the re-conceptualization of CPS as a framework for developing thinking skills. The introduction of a set of thinking skills, linked to each step of the process, brings significant value to the CPS model, by re-positioning CPS in the field of creativity methods as a conceptual framework that helps organize our thinking. In describing the new CPS model, Puccio, Murdock and Mance (personal communication, March 14, 2003) emphasize the descriptive nature of the CPS process, which is seen as a "thinking person process" as opposed to a prescriptive, sequential process. Like our thought, the CPS process is fluid and flexible and the progression through the steps is determined in accordance with the specific situation at hand, which often changes and evolves as the process unfolds. From this perspective, simply learning the CPS steps - and the tools that can be used within them - allows us to apply the

process in a fairly 'mechanical' way. On the other hand, using the learning and practice of CPS as a framework for developing thinking skills enables us to integrate CPS into our thought and behavior, thereby improving our ability to manage the task and to increase the level of performance regardless of the challenges any new situation poses. Ultimately, developing thinking skills is a key aspect of developing and nurturing creative thinking, an 'essential life skill' (Puccio & Murdock, 2001) that is demanded any time we face a challenge or opportunity for which we don't have an established, learned response or way to approach it. The proposed new framework for CPS therefore significantly strengthens the usefulness of this model: by learning and practicing CPS not only do we learn the steps and the tools of a process, but we learn 'how to think' and how to sharpen our thinking abilities.

This new approach for CPS entails some meaningful implications in relation to thinking tools. This project has offered a first opportunity to start investigating and validating the following implications:

- Thinking tools are valuable resources for applying and enhancing our thinking skills. In this project, a 'thinking tool' has been defined as '*a structured or systematic means of focusing a thought process in order to accomplish a purpose*'. Through the application of thinking tools, the thinking skills linked to each step of the process can be focused and sharpened. Each thinking skill can be enhanced through the use of many diverse tools which respond to the same purpose yet

function according to different styles of thinking and different conditions of the context. The more tools are available in quantity and variety, the broader and richer the thinking skill development will be. By integrating more thinking tools, the CPS framework provides not only a wider and diversified toolbox, but, most importantly, more opportunities for developing and promoting flexibility of thought. And the more we sharpen and exercise our thinking skills the more we are able to apply and combine thinking tools effectively and creatively. An important discovery made through this project is in fact the possibility to apply, adapt and combine tools coming from different areas and constructs.

- Thinking tools are useful means of linking CPS to other areas or constructs. The re-conceptualization of the CPS framework offers the premise for integrating into this model thinking tools that are already in use in other models or processes, inside the realm of creativity as well as in other areas of theory and practice, such as Total Quality Management or Strategic Management. This approach significantly broadens the boundaries of CPS which evolves from a relatively 'closed system' with its own process steps and tools to an inclusive conceptual framework that can interface with other disciplines and methods and bring in the diversity of approach and thinking that is highly needed in the distinct steps of the process. Thinking tools therefore might represent the 'highways' that connect CPS to other areas or disciplines. This project has shown, for example, how a tool drawn from the Total Quality Management field could

greatly fulfill the need for data collection and analysis in Assessing the Situation or how a Strategic Management tool could bring a new perspective into the process when we need to establish future directions, in Exploring the Vision. The classic CPS 'toolbox' is fairly rich in tools aimed at idea generation and solution formulation but it is clearly deficient in tools that help accomplish the purposes stated by the steps at the front end (Assessing the Situation, Exploring the Vision, Formulating the Challenges) as well as at the back end of the process (Exploring Acceptance and Formulating a Plan). By drawing thinking tools from other areas and constructs, not only do we fill the need for more tools to be used in the CPS process but we can also aspire to enhance the 'transdisciplinary' potential of this model.

- Thinking tools are a 'means' for learning and applying the CPS process, and not an end. The true value of the CPS process lies in its conceptual framework which provides the purposes and the guiding principles that allow us to integrate and to apply a large variety of tools. The usefulness of a thinking tool is determined by the context in which that tool is applied and by the thought process underlying it. This project has presented a wide array of tools whose meaningfulness and usefulness are clearly enhanced by the context in which they have been organized as means of accomplishing a specific purpose, by following a set of basic principles, such as the divergent and convergent thinking guidelines. The literature that has been reviewed to collect and organize data offers an

abundance of tools which are often presented outside of any sound framework that can guide their application in a systematic and purposeful way. This remark holds true particularly in regards to the 'creativity tools' literature. This project has intended to be a first step toward a direction that attempts to go beyond the 'tools approach' in the creativity literature.

Some observations about the current state of the tools literature and the key learnings gained through this investigation are presented next.

The Tools Literature: A Bird's-Eye View

The tools literature appears vast and prolific: this project has just begun a 'journey' that will hopefully continue throughout future studies in this field. The following observations do not pretend to be an exhaustive report about the current state of the literature, but rather a collection of remarks and key-learnings derived from this investigation.

Although a distinction has been made in the methodology section of this project among different areas of the literature to be searched, such as Total Quality Management (TQM), Strategic Management, Problem Solving, Decision Making and Creativity Processes and Methods (other than CPS), the reality of the 'field' reveals a frequent overlap of tools coming from different areas. In other words, the literature is crowded with books or websites which report a miscellany of thinking tools drawn from different disciplines. Many of these sources keep a major focus on one particular area (for example, TQM) and at the same time enrich

their tools collection with tools that originally derive from other fields (for example, creativity). Perhaps the most defined and confined area is represented by the Strategic Management literature which seems to focus more on theory and principles, than on tools application: within a given theoretical context, some tools for diagnostic, strategic and tactical thinking are then provided. On the opposite extreme, the 'creativity' literature offers an abundance of books and websites focused on collection of 'tools' , which are heterogeneous as for their original sources and are often presented outside of any context or conceptual framework . This wide and diversified bevy of tools reinforces the dominant perception of a 'tool approach' in the field of creativity. The following comments are concerned particularly with the 'creativity tools' literature which needs to be structured and organized.

- The 'creativity tools' literature is generous and 'wild'. An abundance of tools is presented: the same tools are often listed with different 'names' and variously described. Frequently these tool collections lack any rigorous reference system. Probably, Brainstorming is the tool that suffers from the highest 'maltreatment': various and often inconsistent descriptions of Brainstorming are provided in the literature and very rarely cite the original source (Osborn, 1953). Furthermore, the tools are often presented outside of any solid framework, so that it is hard to identify their ultimate purpose and meaning. There have been few attempts to organize and categorize tools by the main areas of 'problem clarification', 'idea

generation', and 'solution evaluation and implementation'. Here authors such as Van Gundy (1988) and Majaro (1991) are the exceptions. These authors can be considered as 'pioneers' in the 'tools literature' who did a great job in collecting and organizing tools within the main steps involved in any problem solving process. This project has intended to go beyond their work by beginning a systematic collection and organization of tools drawn from different areas of theory and practice within a solid conceptual framework such as the proposed new framework for CPS.

- The 'creativity tools' presented in the literature are often redundant and typically concentrated in one area: idea generation. The impression of a large quantity of tools, recurrently underscored by the wide-spread "100 (and more) tools" approach, is mostly apparent. The actual discreteness of such tools is pretty limited: below the surface, few original tools can be identified, most of which were developed a long time ago, and many variations of these same tools are provided. The majority of the idea generation tools clearly descend from few basic approaches, such as Brainstorming, Brainwriting, Forced Connections, Attribute Listing, and Morphological Matrix. Furthermore, there is a dominant focus on idea generation tools, whereas very little is offered for the other essential steps of the creative problem solving process (i.e., gather data, establish goals and vision, clarify the problem statement and refine and implement solutions). This project has initiated a pathway of research that

attempts to collect and select thinking tools according to criteria of distinctiveness and diversity, by taking into account all the discrete steps of the CPS frameworks and the different purposes and thought process underlying each of them.

- The 'creativity tools' literature does not provide any organization of the tools by divergent and convergent categories (except for the classic CPS literature which was not the object of the present investigation). Since divergent and convergent thinking are the two main categories of thought within the creative process, the lack of a systematical approach that classifies tools by divergent and convergent categories appears like a 'void' that needs to be filled. This project has undertaken the 'ambitious' endeavor to systematically organize all the selected thinking tools by divergent and convergent categories, in order to provide a more structured approach to this tools collection.

Finally, a broader view of the tools literature that has been surveyed through this project points out an important key-learning regarding the 'classic' CPS toolbox. Because of the overlap that exists among many areas and disciplines in the tools literature and because of the redundancy often found in the field, it seems like there are no such things as 'CPS tools', meaning that there are few thinking tools that are specific and 'original' to the CPS method. With the exception of Brainstorming, introduced to the world by the seminal work of one of the fathers of CPS (Osborn, 1953), the majority of the tools that are currently listed in the

CPS toolbox seem to have been developed by combination with or elaboration upon thinking tools derived from other approaches within the realm of creativity (divergent tools) or in other areas such as TQM, Problem Solving, and Decision Making (convergent tools). This realization supports and strengthens the new approach to thinking tools entailed by the proposed new framework for CPS, which makes explicit a practice that has been, so far, implicit. Thinking tools originating from different areas or constructs can be adapted and incorporated within a conceptual framework such as CPS that provides a sound theoretical context for the application of those tools. Similarly, a theory like TQM has integrated tools drawn from the creativity field, such as Brainstorming and other idea generation techniques, to accomplish purposes defined by its own framework and guiding principles. Hence, the mutual exchange of thinking tools between different areas of theory and practice is a 'fact' that can be made more structured and deliberate in order to broaden the boundaries and the potentials of any given theory as well as to foster a transdisciplinary approach to our thinking process.

Insights gained through this investigation and their related implications for future studies are shared next.

Insights and Implications for Future Studies

Thinking Tools by Divergent and Convergent Categories

One of the most surprising and insightful outcomes of this project concerns the classification of the selected thinking tools by divergent or convergent categories. In the end, out of the 44 selected thinking tools 22 were classified as divergent tools and 22 as convergent tools. Yet, the overall balance achieved between divergent and convergent tools across the seven steps of the new CPS framework does not correspond to a balance between divergent and convergent tools within each step of the process. In this respect, each of the steps shows a clear dominance either of divergent or convergent tools, as it is displayed in **Table 4.1.**

Table 4.1. Distribution of Divergent and Convergent Tools by each step of CPS

STEP OF THE CPS FRAMEWORK	# OF DIVERGENT TOOLS	# OF CONVERGENT TOOLS
Assessing the Situation	2	5
Exploring the Vision	6	1
Formulating the Challenges	5	1
Exploring Ideas	7	-
Formulating Solutions	-	6
Exploring Acceptance	1	5
Formulating a Plan	1	4

The resulting uneven distribution of divergent and convergent tools within each step of the CPS framework raises a legitimate question: since both divergent and convergent thinking are involved in each step of the process, why do the results of this investigation highlight such a predominance of divergent or convergent tools in each of the steps?

With reference to this question, a hypothesis can be made, which entails important implications for future studies. The prevalence of divergent or convergent tools in each step of the process might reflect the distinction between a more conceptual and a more concrete step within each stage of the new CPS framework. According to Puccio, Murdock and Mance (personal communication, March 14, 2003), the language used to describe the new CPS framework, points out a difference within each of the main stages of the model (Clarification Stage, Transformation Stage and Implementation Stage) between a more conceptual and abstract step expressed by the word "Exploring" and a more concrete and specific step conveyed by the word "Formulating". Each stage of the CPS framework begins with a more conceptual step (for example, Exploring the Vision) aimed to a broad search of possibilities, and then move to a more concrete form of thought aimed to a formulation of the results (for example, Formulating the Challenges). Thus, the words Exploring and Formulating seem to highlight respectively a dominance of divergent thinking (and divergent tools) or convergent thinking (and convergent tools) within each of the steps. In line with this perspective, the results of this

investigation (see **Table 4.1**) seem to point out the following insights and related implications:

- Two 'conceptual' steps of the new CPS framework – **Exploring the Vision and Exploring Ideas** – underline a clear emphasis on divergent tools which are needed in order to accomplish the broad search of possibilities and options required by these two steps. Likewise, two 'concrete' steps of the CPS framework – **Formulating Solutions** and **Formulating a Plan** – stress the prevalence of convergent tools that can support the need for analysis and evaluation demanded by these two steps.
- Conversely, **Formulating the Challenges** and **Exploring Acceptance** emphasize respectively the dominance of divergent and convergent tools. Consequently, a need for re-balancing the presence of convergent tools in Formulating the Challenges and of divergent tools in Exploring Acceptance seems to emerge.
- **Assessing the Situation** underscores a prevalence of convergent tools, although few divergent tools have also been identified and categorized within this step. Assessing the Situation represents the heart of the new CPS framework and has a twofold purpose: 1) identifying and describing the nature of a situation by 'exploring' all the relevant data, needs and opportunities, and 2) using this information to 'determine' the next process step. The two tasks demanded by Assessing the Situation appear respectively to emphasize the need for divergent

and convergent thinking tools. Hence, more divergent thinking tools need to be searched and identified for this critical step of the process.

A closer look to the results achieved for each step of the process, through this investigation in the 'tools literature', is given next in order to point out the most useful directions that might be pursued for future studies.

Thinking Tools: 'Step-by-Step'.

A goal of six thinking tools per each step of the new CPS framework was set for this project. The achievement of this goal was not equally easy and satisfactory for the seven distinct steps of the proposed new framework for CPS. A brief examination of the results achieved for each step is reported here below, along with some recommendations for future investigations.

- ***Assessing the Situation***. The 'classic' CPS toolbox offers very few tools for this critical step of the process, yet an abundance of tools for gathering and organizing data is available in the literature. The thinking tools selected for this step were drawn from several areas, ranging over the Total Quality Management (TQM), the Problem Solving and the 'creativity tools' literature. Particularly, the TQM field appears rich in thinking tools aimed to analyze and organize data: several other tools could be added to the ones selected through this project. However, the majority of the TQM tools are 'convergent' tools, which are designed for analysis, organization and evaluation of data. More tools would be needed in order to encourage the divergent production of data drawn from

diverse perspectives. Perhaps, the qualitative marketing research field can offer new and useful tools that address the need for generating open-ended questions, capable to spur a larger quantity and variety of information.

- ***Exploring the Vision***. Few tools are provided by the classic CPS toolbox for this step of the process. Finding thinking tools aimed to establish goals and future directions was not easy, mostly because this step of the process seems to elude the application of 'simple' tools to accomplish its purpose. The majority of the tools selected for this step in fact tend to cross the boundaries of a single step and to encompass the three main steps underlying the front end of the process: Assessing the Situation, Exploring the Vision and Formulating the Challenge. In other words, most of these tools link the future desired state with the analysis of the current reality and the identification of the gaps (i.e. challenges) that must be closed to attain the desired outcome. Thus, the techniques that can be applied for Exploring the Vision might be considered more as methods or approaches than as specific tools confinable to a given step. More of such methods can be searched for in the Strategic Management literature which focuses on strategic and visionary thinking.
- ***Formulating the Challenges***. The thinking tools selected for this step of the process were mostly drawn from the 'creativity tools' literature. They are mainly divergent tools which focus on reframing and redefining the challenge or on re-examining the boundaries and the assumptions underlying it. In this respect, the

selected tools look quite similar to the classic tools provided by the CPS toolbox. While it is important to have more divergent tools that can support a large production of problem statements from diverse angles and perspectives, it appears critical to identify tools that can help the convergent phase of the process in this step, by clustering, organizing and re-stating the results in order to properly 'formulate' the final statement of the challenge which can function as a springboard for idea generation. Little material was found in the literature to fulfill the convergent needs of this step of the CPS process. Future studies might broaden this search and /or focus on developing new convergent tools for this step.

- ***Exploring Ideas***. Both the CPS toolbox and the 'creativity tools' literature are rich in divergent tools that foster the production of many, diverse and unique ideas. Finding thinking tools for this step of the process was a fairly easy task. The selection of the tools to be included in this project was probably the hardest thing, given the abundance of material available in the literature. Subjectivity (i.e., attractiveness to this project's author) played a significant role in the selection process. Many other divergent tools for idea generation could have been included and might be added in the future.
- ***Formulating Solutions***. Several tools are available in the literature for this step of the process. The thinking tools selected through this project widen a CPS toolbox already rich in tools aimed to refine and formulate solutions. They are all

convergent tools which derive from different areas of the literature, ranging over the fields of TQM, Problem Solving and Decision Making. The supremacy of convergent tools in this step balances the sheer dominance of divergent tools selected for the previous step.

- ***Exploring Acceptance***. Very few tools are provided by the classic CPS toolbox for this step of the process. It was quite difficult to identify thinking tools aimed at exploring and understanding the interrelated conditions of the context that can support or hinder the success of a solution. The selected tools were drawn mostly from the Strategic Management and TQM literature: the majority of these tools appear to have a convergent focus, albeit many of them entail important divergent operations in their function (for example, the Stakeholder Analysis). Since Exploring Acceptance is a stage whose purpose is to scan the environment for sources of assistance and resistance to a proposed change or solution, more divergent tools are needed for this step of the process in order to encourage a broader search that can involve many diverse perspectives. Perhaps, the 'Systems Thinking' literature could offer more divergent tools that can help accomplish the purpose of this step. Alternatively, future endeavors might focus on the development of divergent tools specific to this step of the CPS framework.
- ***Formulating a Plan***. The classic CPS toolbox appears particularly deficient in tools that can support a thorough and successful implementation of a desired change or solution. Likewise, the literature surveyed for this project appears

scarce in tools designed to devise a plan and monitor its effects. Particularly, this step of the process calls for thinking tools that help monitor the results of a plan and ensure its effectiveness. The selected tools, mostly convergent, were mainly drawn from the TQM and Strategic Management literature. While many of these tools provide good directions for formulating a detailed plan for action, only one of them (Performance Dashboard) seems to address the need for monitoring the success of the plan in a long term perspective. More thinking tools targeted to sustain the implementation of a plan seem to be needed for this crucial final step of the process.

Concluding Remarks and Recommendations

This project intends to represent the first building block of a new approach towards the collection and organization of thinking tools within the new CPS framework. Many more tools are available in the literature and can be searched and added to this first collection. Striving for a better balance between divergent and convergent tools in each step of the process and finding or developing thinking tools for the steps of the CPS framework that appear in the highest need, such as Assessing the Situation (divergent tools), Exploring Acceptance (divergent tools), Formulating the Challenges (convergent tools) and Formulating a Plan (convergent tools for monitoring results), seem to be the main directions to follow for future

studies that aim to further widen and enrich the array of thinking tools applicable within the CPS framework.

Another important endeavor is the future application of the tools presented in this project within CPS facilitation sessions. All the thinking tools presented through this project were drawn from other areas of theory and practice: their application within the CPS framework needs to be carefully assessed and adapted according to the guiding principles provided by this model. The challenges that lie ahead could be stated as follows: "How to apply thinking tools in a flexible way and consistently with the theoretical elements of the context in which they have been integrated"? "How to creatively adapt the application of a tool drawn from another discipline within the facilitation of CPS"? Hopefully other students at the International Center for Studies in Creativity (ICSC) will be eager to undertake this challenge, by carrying out a project aimed to verify and adapt the tools presented here within the practical application of the CPS process. One wish of the author of this project would be the establishment at the ICSC of a new advanced course in thinking tools which will function as a 'creative laboratory' where students might learn, practice, experiment, adapt, import and develop thinking tools drawn from different areas and disciplines within the facilitation of the CPS process.

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APPENDIX: CONCEPT PAPER

Theme:
Developing or Improving Our Understanding of CPS
Initiative:
Linking CPS to Other Areas or Constructs

Project Title: Evaluating and Organizing Thinking Tools in Relationship to the CPS Framework.

Rationale and Questions: The purpose of this project is to survey and then catalog existing thinking tools drawn from several areas of theory and practice, such as idea generation, problem solving, quality improvement, decision making and strategic management and to place them within the proposed new framework for CPS.

Specific questions that will guide this study are:

- What is an accurate description of each of the thinking skills linked to the proposed new framework for CPS?
- What existing thinking tools can be coherently incorporated within the new CPS framework, according to the criteria provided by the thinking skills descriptions?
- What is a description of the purpose and the function of these tools within the different stages?
- How can each tool be categorized within the different stages (and related thinking skills) of the new CPS framework?
- How do these tools align with the existing divergent and convergent categories?

Statement of Significance: According to Isaksen, Dorval and Treffinger (1994), CPS has an inherent dynamic nature. The way CPS has been conceptualized and described has in fact changed over time through many years of research, development and practice. Since the seminal work of Alex Osborn (1953), the CPS model has been further developed and revised thanks to the significant contributions of many scholars at the Center of Studies in Creativity, from Parnes (1967), through Parnes, Noller and Biondi(1977), Isaksen and Treffinger (1985), Isaksen, Dorval and Treffinger

(1994; 2000) until the most recent versions offered by Miller, Vehar and Firestien (1996;2002).

The latest development of CPS (Puccio, G., Murdock M. & Mance M., personal communication, February 7, 2002) repositions the CPS framework as a model for developing thinking skills. In this approach, CPS is considered as an inclusive conceptual framework that can absorb thinking tools already in use in other models and processes, inside the realm of creativity (i.e. ideas generation tools) as well as in other areas of theory and practice (i.e. problem solving, quality improvement, decision making tools), in order to help sharpen those skills. At this point no framework or research has been done to synthesize tool approaches from a CPS and thinking skills perspective. This project will meet that need by focusing on the effort to link CPS to other areas or constructs, by surveying, selecting and analyzing existing tools and by organizing them within the stages and the thinking skills proposed by the new CPS framework. By doing that, this study will fill the need for widening and enriching the existing array of tools that can be used within the CPS model.

In addition, this project will contribute to refine and improve the definitions of the thinking skills that have been linked to each stage of the new CPS framework.

Description of the Method or Process: Three important areas will provide the framework for selecting and analyzing the tools:

- The purpose statement that describes each stage: a preliminary description of the purpose of each stage is already available (Puccio, G. Murdock, M. & Mance, M., personal communication, March 6, 2002) and will be further refined along the study.
- An accurate definition of the thinking skills associated with each stage of the new CPS framework.
- The definitions of the existing divergent and convergent categories, within which the tools will be classified. Isaksen, Dorval and Treffinger (1994) define divergent thinking as "generating many possible responses, ideas, options, or alternative in response to an open-ended question, task or challenge" (p. 376) and convergent thinking as "bringing possibilities together, or choosing from among alternatives, to strengthen, refine or improve ideas and to reach a conclusion, synthesis, or correct response"(p.373).

The general methodological approach will be a content analysis study. The study will be conducted through the following stages:

1. **Preparation**: Explore the literature to find an appropriate definition of the thinking skill that matches each stage of the CPS framework. Where established definitions for some thinking skills do not exist, working definitions of those thinking skills will be created.
2. **Validation**: Conduct a focus group composed of Creative Studies alumni and majors that focuses on the parallel and distinct aspects of the thinking skills definitions from the preliminary stage.
3. **Data collection**: Review the literature to identify thinking tools in five areas: Creative Problem Solving, other popular creativity processes and methods (such as deBono, Synectics and TRIZ), total quality management, strategic management and problem solving and decision making.
4. **Data analysis and organization**: The analysis and organization of the tools within the new CPS framework will start from the standard CPS tools and then broaden to the other areas. Using the literature, the purpose and function of each tool will be defined. Next each tool will be analyzed to assess how it aligns with the new CPS framework as a model for developing thinking skills. The analysis will be based on the comparison between the language used for the description of the tool (purpose and function) and the language used to define purpose of the stage, thinking skill, divergent or convergent category. Based on this analysis, the tools will then be described and categorized within the different stages, thinking skills and divergent/convergent categories. A goal of six tools per each stage, beyond the standard CPS tools, has been set.

Learning Goals:

- To gain a deeper understanding of the thinking skills that underlie each stage of the new framework for CPS;
- To conduct an accurate literature review, ranging over different domains;
- To widen and enrich my knowledge of existing and emerging thinking tools across several areas of theory and practice; and
- To sharpen my analytical and organizational skills.

Outcomes:

- Two Executive Summaries of a completed Master's Project for ICSC Web Site and one CBIR annotation of my project.
- Project write-up in the form of a product that could be potentially used as a booklet in support of undergraduate and graduate classes.

Timeline:

February 2002:	Draft of Concept Paper
March 2002:	Refine Concept Paper draft Begin thinking skills literature review
April 2002:	Continue thinking skills review Concept paper further refined
May 2002:	Concept paper approved Refine thinking skills descriptions and definitions Conduct a focus group to validate the thinking skills definitions Begin literature review of thinking tools
June 2002:	Continue literature reviews of thinking tools
July 2002:	Begin analysis of tools Start organizing tools within the new CPS framework
August 2002	Finalize the organization of the material: categorize tools within the stages (organizational chart) and write-up tools descriptions
September 2002	Start project write-up: prepare first draft
October - November 2002	Complete write-up: refine and finalize draft
December 2002	Master's project complete and approved; Graduate

Principal Investigators:

Faculty Advisor: Dr. Gerard Puccio; Student/Advisee: Laura Barbero Switalski

Related Literature:

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