

Matrix-Collage: An Innovative Methodology for Qualitative Inquiry in Social Systems

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Abstract: This study developed a framework for qualitative inquiry and administration of social systems. It describes the mechanisms that decision-makers, such as the police detectives, military commanders, and transformative managers use in their problem solving initiatives. First, the framework was reviewed and constructed for: (1) the theory of qualitative data analysis; (2) problem solving process; and (3) the correlation matrices. Then, based on 14 Points, an extracted framework and its methodology are presented. Finally, a manifest (praxis) is introduced for the framework developed for a project in development planning. This innovative framework can be used for policy-making, qualitative data analysis, or problem solving and administration of social systems.

Keywords: data classification and analysis, framework analysis, land-use planning, problem solving, qualitative data analysis, qualitative methods

1 Introduction

During a national project on socioeconomic planning in southeastern Iran in 2011, we were confronted with a large volume of incoming qualitative data gathered from the region (the first author served this initiative as project manager and senior scholar). It was necessary to analyze this data and apply it to solutions within the limited time of six months. The data included 100 hours of recorded interviews, 300 related papers and reports, and countless memos about field observations. The topics were problems voiced by habitants, insights gathered about the region, solutions and ideas presented by residents and their proposals for implementing those solutions. However, the problem remained as to how to analyze all this data and attain to practical conclusions on problem(s), insights and solutions regarding the region.

We began by going back to the formal frameworks available about the issue. We found frameworks too general (such as the strengths, weaknesses, opportunities, and threats (SWOT) analysis) or time-consuming, bureaucratic, and non-agile (such as *Aménagement du territoire*; This is a French expression dedicated to a French-based doctrine of regional planning. Its incomplete translation is *land-use planning*). We shaped our research as follows to *analyze a pool of incoming data gathered from different sources about a system, reach conclusions about the problems and environment and achieve practical solutions*.

We reviewed literature from land-use planning to strategic management and system engineering. Through *action research* by personal innovation, we designed a framework for analyzing the data and development planning in the region. The framework was implemented in the region over 12 months. The outcomes were valued and used by the government and included elaboration of the problem definition, two macro-policies, and a detailed policy package for the region. Briefly, the framework is *an interrelationship qualitative matrix (Figure 7) that establishes a connection between universal-problem-solving processes (in rows) and data collection sources (in columns) that can be customized for each subject under investigation (e.g. Figures 9 and 10). Any data entry can be filled by corresponding memos (data pieces). We attempt to solve row vectors (problem-lines) together iteratively. After attaining theoretical saturation by reaching a conclusion on column vectors, we attained a problem definition, environment analysis, practical solutions, and considerations about implementing solutions*.

As noted by St. Pierre and Jackson (2014), data analysis is a “black hole” in qualitative analysis. To confront this dilemma, methods like content analysis, grounded theory and discourse analysis have been popularized. These often rely on codification of data (Carrera-Fernández, Guàrdia-Olmos, & Però-Cebollero, 2014). Qualitative

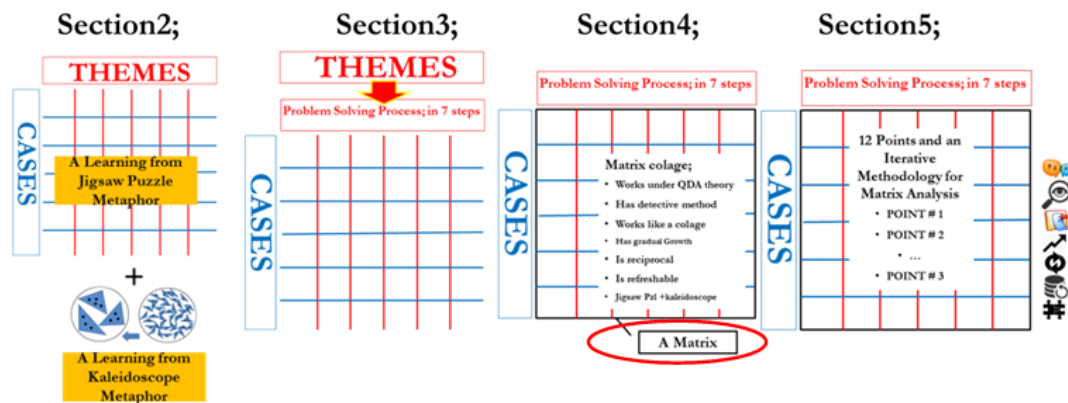


Figure 2: An outline on the paper's logic and sections interplay

In section 2 first we explain qualitative data analysis (QDA) and use qualitative metaphors to extract some rules and foundations for QDA. Two important qualitative metaphors are Kaleidoscope and Jigsaw Puzzle and two examples for them are Grounded theory and Framework analysis respectively. Synthesizing 12 Points(extracted from this section), led us to find a set of comprehensive **sources** and **themes** among data(*Jigsaw Puzzle*) and then analyze them iteratively through clustering and conceptualization (*Kaleidoscope*). We conclude this section with 12 rules and points of QDA.

In section 3, to find main themes among incoming data, we review **problem-solving process** and find it comprehensive as it covers all themes of incoming data through a social inquiry (Point#13). We find a conclusion on problem solving process and propose a general set of steps to be used as **data themes** (for rows) of our matrix collage (Table2 appendix).

In section 4 we find out interrelated themes and sources of data through ROWs and COLUMNs of a **correlation matrix** and build our matrix-collage(Point#14).

In section 5 we summarize extracted tips, conclude them into 14 points and present a methodology for matrix-collage construction and analysis.

In section 6 we briefly describe a praxis of using matrix-collage in a real case.

For the remainder, we present our discourse toward the mindware while concluding each part through a point $i(i=1, \dots, 14)$ periodically.

2 Theory of Qualitative Data Analysis

2.1. Data collection sources, metaphors, and analogies for analysis

The word "analysis" has wide implications. It derives from the prefix "ana" meaning "above" and the Greek root "lysis" meaning "to break up or dissolve" (Bohm, 1983 cited by Dey, 1993). At each step of the problem-solving process, data is the raw material that should be analyzed. How this data should be analyzed is the second half of the discussion.

One viewpoint divides data collection and analysis into quantitative and qualitative methods (Schutt, 2015; Buchman and Schutt, 2015). Qualitative research and analysis entails thinking outside the box and generates and requires creativity in questioning, research processes, and solutions (Suter, 2012). The necessity of qualitative analysis and research, especially for social problems has been frequently discussed. We focused on and presume qualitative analysis and qualitative sources of data for this research. Scholars such as Schutt (2015) and Thorne (2015) believe that the main qualitative research designs are the case study, grounded theory, narratives, comparative analysis, ethnography, and phenomenology. The next section considers *grounded theory* and *case study* to obtain practical tips about construction of our mindware and reviews a recently presented method for QDA entitled *framework analysis*.

In practice, qualitative analysis includes documentation (recording data by methods such as interview, observation, and field notes), coding and categorizing (clustering and classification schemes),

conceptualization (attaching concepts to categories), linking and combining (integrating) abstract concepts, creating theory from emerging themes, and writing an understanding (Suter, 2012; Schutt, 2015).

- **Point 1:** QDA includes coding, categorizing, grouping, clustering, conceptualization, linking, integrating, and creating theory.
- **Point 2:** Cases (Figure 6) such as people interviewed, observed phenomena, or papers considered can be summarized as data collection sources. These sources are observations, interviews, documents, and focus groups (participatory approaches).

Thorne (2015) states that "what makes a study qualitative is that it usually relies on *inductive reasoning* processes to interpret and structure the meanings that can be derived from data". "Induction, deduction and abduction are three forms of logical reasoning that are used in every type of research and they create the basis of all research" (Reichertz, 2014). "These forms of thinking are not concepts, nor are they methods or tools of data analysis, but means of connecting and generating ideas" (Reichertz, 2014). "Generally, inductive reasoning uses the data to generate ideas (hypothesis generating), whereas deductive reasoning begins with the idea and uses the data to confirm or negate the idea (hypothesis testing)" (Thorne, 2015).

Qualitative analysis relies mainly on analytical induction (Suter, 2012) or inductive reasoning (Schutt, 2015; 322). In induction analogy, a qualitative researcher first builds a structure to articulate his findings, then compares this structure against collected data while revising their models. As each new finding and possible explanation emerges, it is checked against other sources of data until a point of theoretical saturation is reached, thus completing the analysis (Schutt, 2015). Mostly defined by qualitative research, the saturation point signals a need to continue data collection and analysis, because incoming data will no longer contribute, but only confirm past-shaped understanding (Suter, 2012).

- **Point 3:** The main analogy used in QDA is induction, the process of constantly comparing a primary shaped structure against collected data and revising it until theoretical saturation.

The process of qualitative analysis can be well-interpreted using *qualitative metaphors*. A metaphor is a comparison between two indirectly-related things using their similarities and ignoring their differences. It serves as a template for organization and analysis of qualitative research data (Dye, Schatz, Rosenberg & Coleman, 2000). Suter (2012) has divided useful qualitative metaphors into *kaleidoscope*, *jigsaw puzzle*, and *symphony*, although all have been derived from the same basic analogy.

- **Point 4:** The process of QDA can be well interpreted by the qualitative metaphors of kaleidoscope, jigsaw puzzle, or symphony.

The kaleidoscope metaphor refers to grouping similar data bits together, then comparing bits within a pile (Figure 3). Differentiation creates subpiles, which eventually become connected by the pattern they share. This process requires continual back and forth refinement until a grand concept emerges (Suter, 2012). Figure 3 demonstrates a process of categorization and refinement between raw data bits to take category arrays. Dye et al. (2000) stated that this metaphor represents a *constant comparison method* that comprises the following stages (Lincoln and Guba, 1985, cited by Dye et al, 2000):

1. Comparing incidents applicable to each category
2. Integrating categories and their properties
3. Delimiting the theory
4. Writing the theory

One of the most well-known manifests of the kaleidoscope metaphor at QDA is grounded theory.

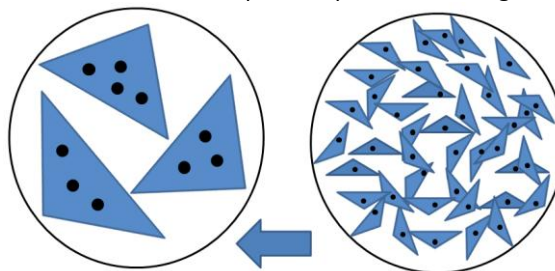


Figure 3: Kaleidoscope metaphor redrawn by authors based on Dye et al. (2000).

- **Point 5:** The kaleidoscope metaphor for QDA includes coding, labeling, grouping and clustering data bits around piles and themes of broad scope.

Second qualitative metaphor entitles *jigsaw puzzle metaphor* (Suter, 2012, 348). Jigsaw puzzle is a picture cut up into fragments. One strategy to solving a jigsaw puzzle is to group all pieces that look alike and place them in their expected locations (Figure 4 (right)). To explain the jigsaw puzzle metaphor, LeCompte (2000) gave the example of *Crows Over a Wheatfield*, a 1890 painting by *Vincent van Gogh*. This tableau depicts a yellow wheatfield at the bottom and a dramatic, cloudy blue sky at the top that ranges from light blue to dark blue. Many stylized crows fly through this darkening sky. To complete a jigsaw puzzle based on this tableau, the puzzle solver usually groups the blue pieces and places them near the top, arranging and rearranging them to find a coherent pattern of a sky. Other objects that appear to be wheat are grouped together by similar characteristics (e.g., hachure, color) with properties making conceptual sense (LeCompte, 2000).

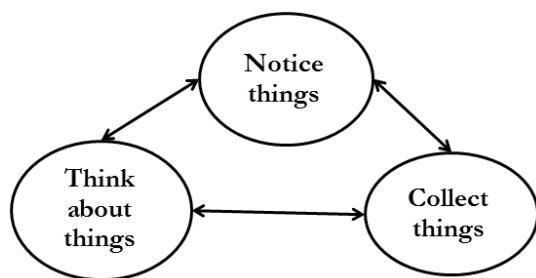


Figure 4: Symphony metaphor redrawn by authors based on Seidel (1998) (left); jigsaw puzzle (copyright free image extracted from <https://pixabay.com/en/jigsaw-puzzle-a-piece-of-grandmother-497143/>) (right).

QDA using the jigsaw puzzle metaphor eventually leads to an structure that is the model or theory that explains the phenomenon of interest. For example, consider a qualitative researcher studying socioeconomic development in a region (e.g., southeastern Iran). The desired structure for he/she is an explanation for underdevelopment, causes, solutions, and practical implications for the region. This structure will gradually form a shape from the puzzle-shaped pieces of data include the problems, ideas, and other insights related to the region and gathered from different data collection sources. These sources include conversations, observations, documents, records, and journals. A high-quality QDA using the jigsaw puzzle metaphor will generate a rich and accurate description of underdevelopment as experienced, declared, and theorized by locals, experts, and the elite.

LeCompe (2000) has articulated this natural process(QDA using the jigsaw puzzle) in 5 stages:

- Stage 1: Tidying up available information by organizing it in the form of notes, memos, creating files of interviews, labeling, coding and indexing information, and reviewing questions if applicable.
- Stage 2: Finding items (puzzle pieces), which are things that must be coded, counted, and assembled.
- Stage 3: Creating stable sets of items.
- Stage 4: Creating patterns.
- Stage 5: Assembling the structure (puzzle), theory, or final explanation (pattern) about the phenomena.

Assembling the data into an explanation is akin to reassembling puzzle pieces (LeCompte, 2000). This job includes rearranging the puzzle multiple times before it emerges into a coherent pattern (explanation).

- **Point 6:** The jigsaw metaphor for QDA includes arranging and rearranging of data pieces in a reciprocal way toward achieving a sensible pattern (theory, hypothesis).

A third metaphor has been presented by Seidel (Suter, 2012; Seidel, 1998), who claimed that QDA is a *symphony* based on three notes: *noticing things*, *collecting them*, and *thinking about interesting things* (Figure 4 (left)). These parts are interlinked and cyclical. For example, while thinking about things, you notice further things and collect them. Seidel's process has been described as iterative (a repeating cycle), recursive (returning to a previous point), and "holographic" (each "note" containing a whole) with "swirls and eddies" (Suter, 2012, 348).

- **Point 7:** The symphony metaphor for QDA includes noticing, collecting, and thinking in a continuous and interrelated way.

The use of metaphors is a popular way to make sense and build a theory in qualitative analysis (Aubusson, 2002). Qualitative metaphors provide a good understanding using QDA and provides good tips for applied QDA. The next subsection describes three main QDA methods (grounded theory, case study, and framework analysis) using qualitative metaphors and extracts further points to developing and presenting our framework.

2.1 Grounded theory: from plurality to unity, a kaleidoscope metaphor

Grounded theory (GT), a popular research design, was developed by Barney Glaser and Anselm Strauss (Birks and Mills, 2011). Glaser's definition of grounded theory is "a general methodology of analysis linked with data collection that uses a systematically applied set of methods to generate an inductive theory about a substantive area" (Glaser, 1992 cited by Evans, 2013). This means a "systematic theory developed inductively, based on observations that are summarized into conceptual categories, reevaluated in the research setting, and gradually refined, linked to other conceptual categories" (Schutt, 2015) and shaped empirical generalizations. GT is a main manifest of kaleidoscope metaphor using the *constant comparison method* as stated by Dye et al. (2000). GT is the most widely-used research method in a wide range of disciplines, including the social sciences, nursing and healthcare, medical sociology, information systems, psychology, and anthropology (Bryant and Charmaz, 2007).

GT is most often derived from qualitative (interpretive) data sources. Theoretical *memoing* is the core stage of GT methodology (Glaser, 1998). "Memos are the theorizing write-ups of ideas about substantive codes and their theoretically-coded relationships as they emerge during coding, collecting, and analyzing data, and during memoing" (Glaser, 1998).

Each memo comprises ideas shaped by coding about relationships between concepts. Codes of similar content are grouped into concepts. Broad groups of concepts shape categories and a collection of categories become a grounded theory. Writing memos, sorting, and integrating them are the heart of theory-building in GT. From memo to theory, unity in plurality is established systematically among notes and insights. Figure 5 shows how memos work in the real world. Writing memos and synthesizing them is critical. Our mindware was subjected to this collage mechanism (pasting data to a board).



Figure 5: Memos on a pin board (free copyright image extracted from <https://pixabay.com/en/pinboard-communicate-communication-436478/>).

GT and a more recent developed method, *framework analysis*, are so important that experts like Lacey and Luff (2009) and Crinson and Leontowitsch (2006) have described them as main approaches for QDA. GT focuses on analytic induction and framework analysis, as shown below, relies on thematic analysis.

- **Point 8:** In line with the kaleidoscope metaphor, grounded theory is based on memoing and systematic private note writing (Figures 3 to 5). This mean little notes form the final theory, structure or explanations, finally.

2.2 Framework analysis: a jigsaw puzzle metaphor

Analytical induction has long been represented by GT as the prominent method for qualitative analysis. In this style of QDA, data management and interpretation are concurrent (NatCen, 2015). Developed by Jane Ritchie and Liz Spencer primarily for health research at the National Centre for Social Research (NatCen), framework analysis is *a thematic framework* used to classify and organize incoming data according to key themes, concepts, and emergent categories (Onlineqda, 2015). For each research study, “the framework identifies a series of exclusive main themes subdivided by a succession of related subthemes or topics. These themes and categories evolve and are refined as an iterative process through the researcher's familiarization with the raw data and the subsequent cross-sectional labeling data (emerging issues)” (Onlineqda, 2015) or come directly from *a priori* issues. This thematic framework should be developed and refined during subsequent stages (Lacey and Luff, 2009). The process of applying the thematic framework to the data employs numerical or textual codes to identify specific pieces of data that correspond to the different themes (Lacey and Luff, 2009). Once researchers judge that they have reached a comprehensive list of main themes and subthemes, or saturation, they can construct or chart its matrix or chart the data (Figure 6) (Onlineqda, 2015).

Thematic Chart

	Case 1	Case 2	Case <i>i</i>
Theme			

Case Chart

	Theme 1	Theme 2	Theme <i>i</i>
Case			

Figure 6: Thematic chart (up); Case chart(down) based on NatCen (2012)

Headings from the thematic framework can be used to create charts of data so that it is possible to easily read across the whole dataset. Charts can be either specific to a theme across all respondents (cases) or by case for each respondent across all themes (Figure 6) (Lacey and Luff, 2009). Any response or incoming piece of data then is allocated to a row with each column representing a separate subtopic (Crinson and Leontowitsch, 2006). The final stage involves summarizing or synthesizing the original data from each case (subject) within the appropriate parts of the thematic framework (Ritchie and Lewis, 2003). This stage includes searching for patterns, associations, concepts, and explanations in the data aided by visual displays and plots (Lacey and Luff, 2009).

Unlike GT, the framework method is not necessarily concerned with generating a social theory, but can greatly focus on social *problem-solving* and facilitates *constant comparative techniques* by reviewing the data across the matrix (Gale, Heath, Cameron, Rashid, & Redwood, 2013) where data management and interpretation are sequential (Not concurrent) (NatCen, 2015). NatCen (2015) states that framework analysis is **a case- and theme-based approach** using a matrix display to reduce data through summarization and synthesis. The matrix retains links to original data and output allows comprehensive and transparent data analysis. Problem-solving orientation in framework analysis leads to a matrix framework and method. Among the main notes we found in our review was a good match between our matrix-based model as presented and applied independently in 2011 and framework analysis.

Framework analysis has limitations and pitfalls beside problem orientation and a well-grounded mechanism. It is time- and labor-intensive with no guarantee of an outcome. It is in danger of becoming process- rather than

outcome-focused, but is not as pragmatic as required for problem-oriented research. It needs to be reflexive, by not forcing square pegs into a round hole (NatCen, 2015).

- **Point 9:** Framework analysis is a case- and theme-based approach. In line with Jigsaw puzzle metaphor, this research design relies on finding key themes among data originated from a set of cases or sources.

2.3 Case study and detective method; examples of jigsaw puzzle metaphor

A case study is a common research design in social science, from sociology and political science to psychology, business, and economics. Suter (2012) defines it as "an approach to qualitative research that focuses on the study of a single person or entity using an extensive variety of data." Robert Yin (2003) theorized that the mental framework of case study research is the *detective method*. Mills, Durepos, & Wiene (2010) described the detective method as "a good analogy for case study research. When solving a crime, a detective's investigation occurs at two levels: the first involves collecting evidence (i.e., carrying out data collection) and the second involves simultaneously entertaining hypotheses about how and why the crime occurred. The detective's hunches (i.e., hypotheses) and theories about the crime, tentative at first and later becoming firmer as more evidence is collected, may be considered the detective's *mental framework*. A case study investigator's mental framework exists and evolves in the investigator's mind and private notes. The investigator does not openly expose this framework when interacting with others." The methodology for case study research and its detective method is as follows:

- It is based on evidence collection and conclusion about evidence toward a hypothesis and theories about *how, what and why* is reality.
 - It is formed gradually and evolves step by step.
 - Private notes play a critical role in the detective method.
- **Point 10:** Like when solving a jigsaw puzzle, case study design uses the detective method to make hypotheses. The detective method is described as an evidence board of pasted pictures and collected evidences (like Figure 5).

2.4 Other proofs

This section briefly describes related stories that are not research design, but are a form of QDA and allow us to incubate and present our mindware.

Police detectives: In movies and in actual detective work, you may have seen *evidence boards*. Through the process of evidence collection and scrutiny, detectives paste pictures of evidence on a board and rearrange the elements mentally to try to develop and depict a relation between them. These evidence boards are used a graphical method to solve a multi-aspect problem. Detectives may set up this board in their minds and not reveal it to others until arriving at a final hypothesis or theories. "As the good detective may not reveal her or his crime-solving hypotheses until much evidence has been collected, the case study investigator also keeps the mental framework to himself" (Mille et al., 2010).

Military intelligence operation: Military intelligence is a military discipline that exploits a number of information collection and analysis approaches to provide guidance and direction to commanders in support of their decisions (IBP USA, 2011). This analysis consists of assessment of an adversary's capabilities and vulnerabilities (IBP USA, 2011).

Military intelligence operations are developed gradually using cumulative collected data from field (IBP USA, 2011). Hassan Bagheri, an Iranian military commander and top war strategist during the Iran-Iraq war was known for collecting various information from different sources and integrating these insights into maps of battlefields. Military intelligence operation is a good example of a symphony metaphor because intelligence officers try to notice and collect evidence from any reliable source and think about them to shape a picture of the battlefield.

- **Point 11:** The detective method and military intelligence operations use the jigsaw puzzle and symphony metaphors to evolve a graphical or mental map of the battlefield or problem based on data gathered from all possible and reliable sources.
And in general we could say that;
- **Point 12:** QDA metaphors are usually iterative and evolving through time until theoretical saturation.

Now refer back to figure2, based on the above-mentioned points we should find out a comprehensive set of themes (Point9) among data and sources (Points 2&9) for data plus an iterative (Point6), inductive (Point3), detective (Points 10&11) method of analysis. This method includes clustering, conceptualization (Points1&5), pattern recognition (Point7,6&11) and memoing (Point8). In the next section, we continue this quest by finding main covering *themes* for data as is requested through Point 9.

3 Problem-solving and Decision-making: Pragmatism in Thinking

Karl Raimund Popper, a reputable Austrian-British philosopher of science, in his book *All Life is Problem-solving* asserts that the starting point of natural science as well as social science is a problem (Popper, 1999). He described problem-solving process as involving three steps: (a) problem recognition, (b) attempted solutions, and (c) elimination. The problem arises when a disturbance takes place. In Popper's view, this means either an innate expectation or an expectation that has been discovered or learnt by trial and error (Popper, 1999). The second stage of Popper's model is to try to solve the problem (Popper, 1999). This is where decision-making enters to select among alternatives and choices. The final stage in the model is elimination of unsuccessful solutions; this involves learning and feedback loops.

Before Popper, the most prominent educational philosopher was John Dewey (1910), who described problem-solving as the basis for a new paradigm in learning and education: *learning through problem-solving*. This is conducted using the critical thinking that Dewey and his colleagues believe should be developed in the educational system. John Dewey elaborated critical thinking and divided it into two stages. The first stage is sensing complexity, skepticism, and hardship. This leads to the second step: curiosity and the quest for a solution to eliminate the skepticism. In this quest, Dewey proposed five steps to problem-solving (Meyers, 1986):

1. Problem/need recognition
2. Information search and determination of problem cause
3. Generation of alternative solutions
4. Evaluation of alternatives and making decisions
5. Implementation and feedback

The ideas proposed by John Dewey and William James about critical thinking for prediction, action, and problem-solving formed an American philosophy referred to as *pragmatism*. From the beginning of the 20th century, pragmatism as a philosophy of modern education in the UK and USA was propagated for problem-solving-oriented learning and problem-solving in different fields of studies. As articulated by Max Weber, the thinking behind modernity and modern society known as instrumental rationality is on setting goals, analyzing the present situation, and searching among alternatives having much benefit and less cost. Since then(beginning of the 20th century), Dewey's model has been used in fields from social science to engineering (Ranade and Corrales, 2013), medicine (Margolis, Jotkowitz & Sitter, 2004) and regional planning. It could be considered to be the backbone of every problem-solving framework in science and the humanities.

We start our framework construction from problem solving process. The fundamental importance of this process and its replication in different fields of social and applied science has been noted in many references where *main themes* of problem solving process could cover almost all steps of human inquires in social systems.

To apply problem-solving to applied science, we have synthesized the different perspectives about problem-solving process as reflected in Table 2 in Appendix 1. This brief synthesis comprises a comprehensive problem-solving process as follows:

1. Problem definition/opportunity recognition; includes status review

2. Collecting information and determining causes
3. Developing a hypothesis and/or using theories or frameworks on the issue
4. Generating alternatives and/or solutions
5. Assessing alternatives
6. Selection and implementation of a solution
7. Outcome evaluations and revision of plan, if necessary

These steps conform to the six steps of the problem-solving model described by Gobbo (2008, p. 240), plus an additional step (step 3) that generates and considers hypothesis and theories about the phenomena. As Gobbo (2008, p. 240) insisted, "Although all problem-solving involves some decision-making, decision-making does not always involve problem-solving."

The comprehensiveness and prevalence of problem-solving in social science means it does not seem wrong to consider its steps as **major themes** for all human inquiry based primarily on qualitative data; *A human confronting a disturbance tries to recognize the problem, gather information about it, find and attempt solutions, implement the selected solution, and apply modifications based on outcomes.*

- **Point 13:** In section 2, the problem-solving process as illustrated in Table 2 (7 steps) is manifested in many disciplines and could be used to cover main themes and milestones in applied social research. Considering framework analysis, these steps can be applied as a general themes (Figure 6) of the matrix. On the other hand, the 7 steps of problem-solving could also be assumed to be a meta-theme that covers all aspects of an investigation.

Now we have found 13 points for qualitative data categorization and analysis. At section 4, we find the last point to interlink abovementioned points and rules.

4 Correlation Matrices and Diagrams

We are now going to conclude the notes and models discussed in the promised mindware. To integrate the concepts pragmatically (Points 1-13), in line with framework analysis, we have used a *conceptual correlation matrix*. In management and engineering, many models incorporate integration and interrelation of intentions using correlational matrices:

- **Quality management:** This has been initiated by companies like Ford and Toyota and includes graphical problem-solving tools like *house of quality*.
- **Strategic management:** The *Ansoff matrix*, *BCG matrix*, and mainly *quantitative strategic planning matrix (QSPM)* are reputable matrices in the field of strategic management. Ansoff and BSC categorize strategic positions held by a company and QSPM quantifies the SWOTs that may confront a company.

In both fields, matrices are employed to make correlations between and depict relations with two groups of concepts, one in the rows and another in columns. Sometimes a third dimension (triplet) is added; for example, in the form of radiant bubbles (in bubble charts) or a correlation triangle matrix (in house of quality).

- **Point 14:** with regard to section 4 matrices could be employed to make correlations between and depict relations with two groups of concepts.

5 Discussion, Model and Mindware: A Matrix-Collage Metaphor

Based on notes and insights presented in sections 2,3 and 4, the following have thus far been learned about creating problem-solving mindware:

- **Point 1:** QDA includes coding, categorizing, grouping, clustering, conceptualization, linking, integrating, and creating theory.
- **Point 2:** Cases (Figure 6) such as people interviewed, observed phenomena, or papers considered can be summarized as data collection sources. These sources are observations, interviews, documents, and focus groups (participatory approaches).
- **Point 3:** The main analogy used in QDA is induction, the process of constantly comparing a primary shaped structure against collected data and revising it until theoretical saturation.
- **Point 4:** The process of QDA can be well interpreted by the qualitative metaphors of kaleidoscope, jigsaw puzzle, or symphony.
- **Point 5:** The kaleidoscope metaphor for QDA includes coding, labeling, grouping and clustering data bits around piles and themes of broad scope.

- **Point 6:** The jigsaw metaphor for QDA includes arranging and rearranging of data pieces in a reciprocal way toward achieving a sensible pattern (theory, hypothesis).
- **Point 7:** The symphony metaphor for QDA includes noticing, collecting, and thinking in a continuous and interrelated way.
- **Point 8:** In line with the kaleidoscope metaphor, grounded theory is based on memoing and systematic private note writing (Figures 3 to 5). This mean little notes form the final theory, structure or explanations, finally.
- **Point 9:** Framework analysis is a case- and theme-based approach. In line with Jigsaw puzzle metaphore, this research design relies on finding key themes among data orginated from a set of cases or sources.
- **Point 10:** Like when solving a jigsaw puzzle, case study design uses the detective method to make hypotheses. The detective method is described as an evidence board of pasted pictures and collected evidences (Figure 4&5).
- **Point 11:** The detective method and military intelligence operations use the jigsaw puzzle metaphor to evolve a map of the battlefield or problem based on data gathered from all possible and reliable sources.
- **Point 12:** QDA metaphors are usually iterative and evolving through time until theoretical saturation.
- **Point 13:** In section 2, the problem-solving process as illustrated in Table 2(7 steps) is manifested in many disciplines and could be used to cover main themes and milestones in applied social research. Considering framework analysis, these steps can be applied as a general themes (Figure 6) of the matrix. On ther hand, the 7 steps of problem-solving could also be assumed to be a meta-theme that covers all aspects of an investigation..... covers main themes among data
- **Point 14:** with regard to section4 matrices could be employed to make correlations correlations between and depict relations with two groups of concepts.

Thus, a combination of these insights, points, and tools are provided in Figure7 (right) using a correlation matrix-collage(Point14). Points 2 and 13 show that this matrix is recruited to correlate between two groups of concepts: (a) problem-solving as introduced in section 3 (meta-themes for social research); and (b) data collection sources (meta-cases to feed the matrix). This matrix works for qualitative metaphors and analogies for analysis as described in sections 2 & 3.

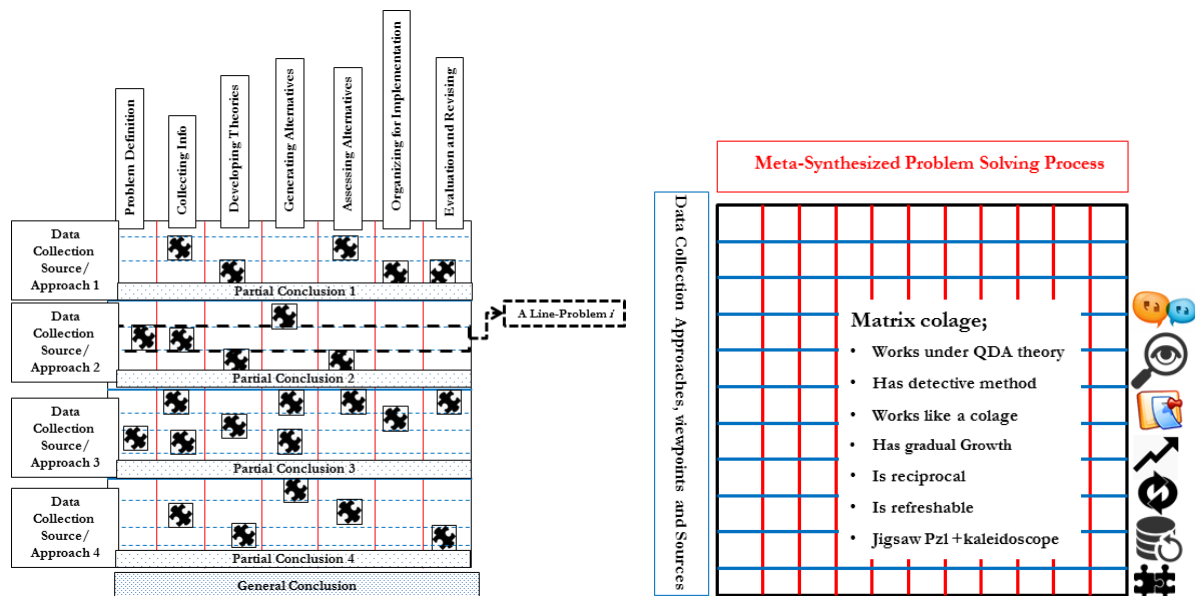


Figure 7. Row and column arrangement + specified line-problem (left); general proposed mindware (right).

The primary idea and framework for this matrix was formed based on the author’s initiative about rural planning in southeastern Iran. As mentioned before, we needed an agile framework for land-use planning (Aménagement) that could reflect and react to fast-moving regional economic and social changes in the region and conclude large amounts of incoming data from different sources. The model depicted in Figure9 and Figure10 was implemented in the region and the results were presented to and accepted by the employer. Since then, the model has been retheorized and modified over years of collaboration. In the general model (Figure 7), the matrix builds a correlation between two dimensions:

1. *Point13*; Problem-solving process concluded in 7 steps through Table 2 in column vectors (Figure 8 (left)).
2. *Point2*; Data collection themes and/or sources that form the matrix row vectors (Figure 8 (right)).

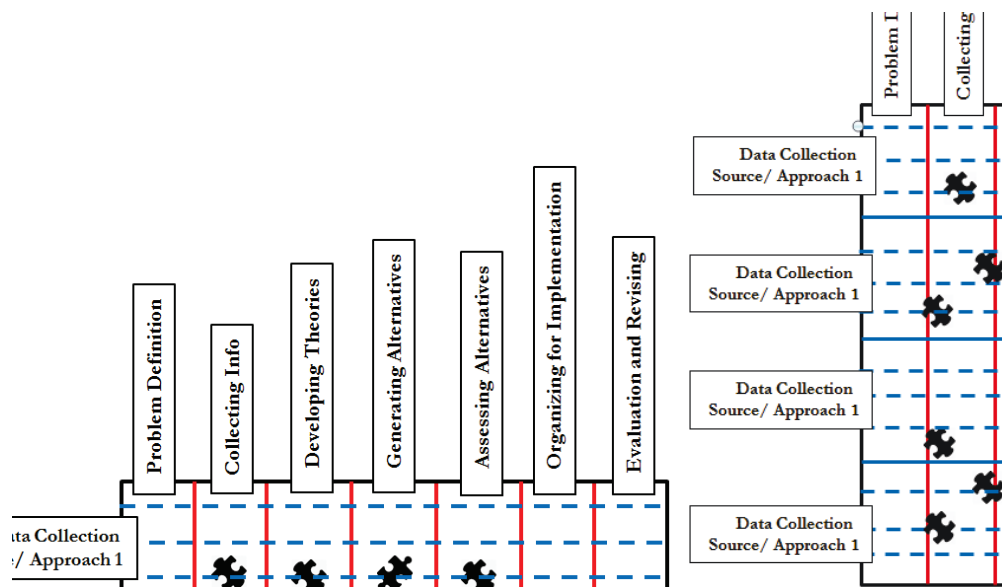



Figure 8: Columns (left); rows in matrix-collage (right).

In the mindware, the task is to complete the cells (entries) of the matrix-collage using as much reliable incoming data as possible (some cells may remain vacant) and then conclude each column of the matrix as described later using *Points 1 through 13*. For example, the phenomenon under study was “underdevelopment in southeastern Iran”(Figure9&10). Using matrix-collage, each time during research when we come across a document (paper, report, etc.) about our topic, we try to discover:

- How this document defines the problem of underdevelopment in southeastern Iran
- How the document explains the phenomenon and regional environment
- What theories explain the problem, causes, and solutions in the document
- What solutions and/or alternatives are proposed in the document
- If and how the document evaluates or appraises alternatives
- If it provides advice for implementation of solutions and forecasts about challenges facing the proposed solutions
- How does it document the implementation of similar solutions and how are similar cases useful for this project

These issues are in line with the seven step comprehensive model of problem-solving shown in Table 2(*Point13*). Each document (papers, reports, etc.) are divided by source; each could have answers to all issues or could answer just one(*Point2*). Each answer could form a row vector to be placed in the matrix-collage.

When we face an expert during an interview or make an observation in the region, we can ask the same questions in line with the seven steps of problem-solving about underdevelopment in southeastern Iran. We can bring up these issues for a document, interview, or observation for any other phenomenon under study(*Point2*).

In line with *point13*, each source that contains at least one answer to one of the issues will form a *problem line* and is placed as a row vector as depicted in Figure 7 (left). Each row in the matrix is a *problem line* that contains at least one piece of data and at most seven pieces (the puzzle icons  pasted in each row in Figure 7 (left)). Note that, each data piece is entered into the matrix in the form of little memos(based on *Point 8*).

5.1 Arrangement of rows

The arrangement of the matrix rows is based on data collection sources or cases cited in Framework analysis (Point 9). With regard to point 2, The problem lines extracted from interviews are entered in the first row, the ones from observations in the second, problem lines sourced by documents in the third, and panel data that provides problem lines in the fourth (Figure 8-right).

To customize the matrix for a specific social issue under study, further closed classification and arrangement in rows is carried out for related literature and data collection sources. For example, the praxis in section 6 is land-use and development planning in southeastern Iran. Literature on land-use planning (Aménagement) advises four data collection themes or approaches. These are chosen for the classification of the rows of the related matrix. These themes are (Figure 9): cultural development, political development, economic development, and system sustainability. These data collection approaches form a general classification for the rows in the matrix related to underdevelopment in southeastern Iran.

5.2 How to conclude the matrix

First, we learned how to construct the matrix and fill it with pieces of data gathered from different sources. This is a synthesis of past metaphors giving birth to the new *matrix-collage metaphor*. The main question remains of how to analyze this galaxy of data pieces provided in the form of memos. The answer is to conclude each row by shaping notes, then distribute and redistribute the notes to all row vectors of matrices. We articulate this mechanism in the matrix-collage as follows (Figure 7 -left) using the qualitative metaphors and Points 1, 3 and 12 as:

1. Based on Point 1, provide a conclusion for each group of rows under each data collection approach and place it in the subsequent *partial conclusion* row (rows 1, 2, 3, 4 at Figure 7-left).
2. Based on Point 1, A conclusion for partial conclusion rows (row 1, 2, 3, or 4 at Figure 7-left) is placed in the *general conclusion* row at the bottom of the matrix (Figure 7-left).
3. Insights gathered from step 2 (and stored in general conclusion row) are redistributed to whole rows and their entries. This is an inductive process of clustering, grouping and clustering and is based on Points 1, 3 and 5.
4. Steps 1, 2, and 3 are repeated to harmonize the matrix until theoretical saturation. This is a reciprocal, iterative and evolving process and based on Points 6, 10, 11 and 12.
5. Using the conclusion in the column vectors, we attain the problem definition, environmental analysis, advisable solutions and their appraisals, plus considerations and experiences of implementation for the issue under investigation respectively.

Detailed implementation of this process is presented at praxis (section 6). Suter (2012) states that the “qualitative researchers become skilled at coding and pattern seeking using analytic induction. Making sense of data in the form of graphics, video, audio, and text requires clear thinking that is aided by theory, models, constructs, and perhaps metaphor.” Using its qualitative metaphor, data is classified and handled for analytical induction; this matrix-collage can serve decision-makers when building a research hypothesis, constructs, or solutions about a subject.

6 Praxis

In this section, a case using the matrix-collage is presented to demonstrate the mindware for development of a customized model of problem-solving and decision-making for a specified phenomenon. The case was about development planning in southeastern Iran (Sistan and Baluchestan Province). As shown, presented matrix-collage is customized for each phenomenon under consideration based on the literature available about data collection approaches and/or themes for that issue.

6.1 Regional planning: Aménagement du territoire

An application of matrix-collage model in development planning was presented for development policy-making in southeastern Iran for the first time in 2011. A framework (Figures 9 & 10) was designed that includes problem-solving processes and shapes a system of simultaneous socioeconomic equations. To find a suitable solution, this complex should be completely analyzed and resolved. This was achieved through a reciprocal or

iterative method for the system of socioeconomic equations based on the method presented in section 5.2. The steps can be summarized as follows (Figures 9 and 10):

- 1. Model socioeconomic system
- 2. Collect qualitative and quantitative data
- 3. Harmonize the matrix
- 4. General conclusion
- 5. Redistribution
- 6. Conclusion to column 2
- 7. Conclusion to column 3
- 8. Conclusion to column 4
- 9. Conclusion to column 5
- 10. Conclusion to column 6
- 11. Conclusion to column 7
- 12. Conclusion to column 8
- 13. Conclusion to column 9

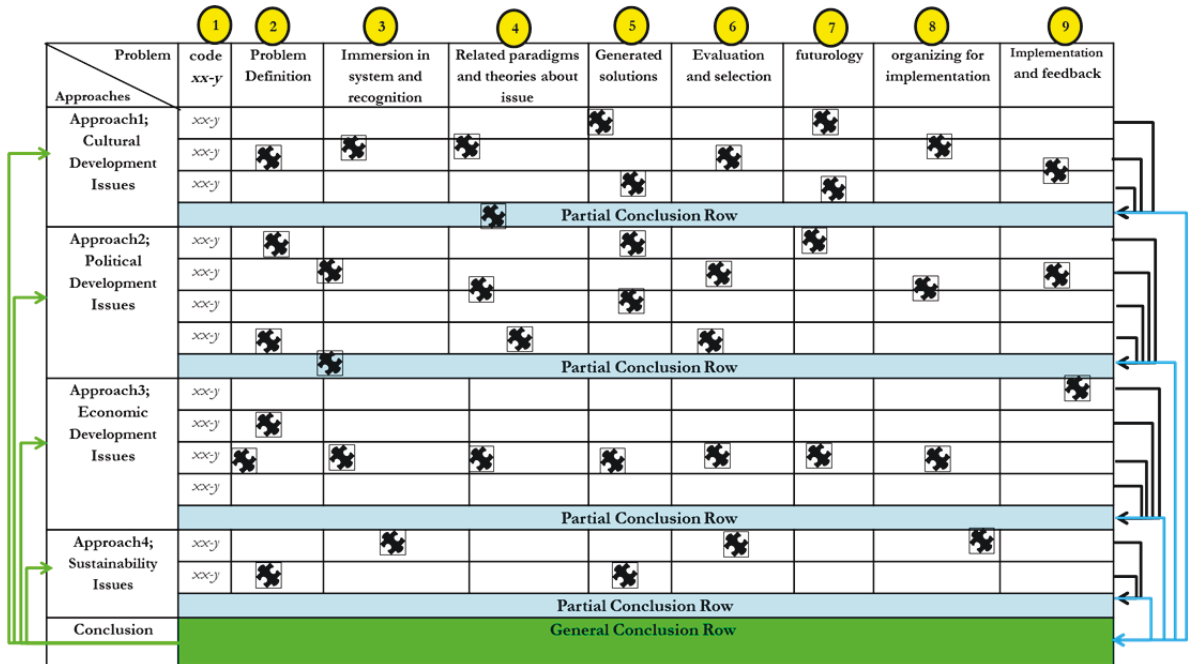


Figure 9: A system of socioeconomic equations and iterative method for solution

1-Model socioeconomic system; model socioeconomic system in a $n \times m$ matrix including the problem-solving processes (problem-lines) that should be solved together (Figure9).

2-Collect qualitative and quantitative data; collect qualitative and quantitative knowledge, concepts, and insights from different sources to complete the collage of problems in the matrix and form socioeconomic equations (problems-lines $xx-y_1, \dots, xx-y_p, \dots, xx-y_n$). When we came across a document (paper, report, etc.) or interview/observation memos about an underdevelopment issue in southeastern Iran, we called it a *problem-line*, assigned each problem-line an identification code($xx-y$) as reflected to column No.1 and through which we tried to discover;

1. How this document defines the problem of underdevelopment in southeastern Iran? Any answer to this inquiry was placed at column No.2.
2. How the document explains the phenomenon and regional environment? Insights gathered in this regard were placed at column No.3.
3. What theories could be found to explain the region's problem, causes, and solutions into the document? Answers to this question were placed at column No.4.
4. What solutions and/or alternatives are proposed in the document through that problem-line? Answers to this question were placed at column No.5.
5. If and how the document evaluates or appraises alternatives? Any appraisal for solutions were stated at column No.6.

6. If a problem-line provides advices for implementation of solutions? Such advices were stored at column No. 7.
7. If problem-line forecasts about opportunities or challenges in front of the proposed solutions? Extracted predictions were placed at column No.8.
8. Finally, for the post- implementation period, any experience or feedback could be stored at column No. 9. This could be used for future revision of matrix collage and its solutions.

These issues are in line with the seven-step comprehensive model of problem-solving plus a further column for future studies and hypothesis for region (Futurology). Note that each problem line contains at least one piece of data.

Based on data collection approaches in this case, we grouped each problem-line at one of four main *cultural, political, economic* and *sustainability* branches of rows at Figures 9 &10.

As an example look at Figure10, a part of the original matrix is depicted that contains just 8 problem lines (refer to column one and codes; 2-4, 30-5, 56-4, 19-4, 45-4, 29-5, 14-5, 15-4). They equal with 8 sources of data, include at least one data piece (🔗) and are extracted from a paper, interview or observation. We labeled each problem line with a two-digit code xx-y. From the left to right xx is number of source and y is its perceived importance of source in relation to development of the region based on Five-Point Likert scale (five for most importance and one for least importance). For the group of problem lines in our research, we also provided a table like Table1 to clarify labeling, type and origin of each problem line. For example based on Table1, code 56-4(budgeting inefficiency) is 56th problem line extracted from a paper and we appraised its importance, 4 on Likert scale.

Table1: A sample table of problem lines and their codes provided for matrix-collage

No.	Concept name	Source type	Data theme	Other notes	Its code
1	out-group social capital	Paper/report	Cultural	-	2-4
2	entrepreneurial culture	interview	Cultural	-	30-5
3	budgeting inefficiency	Paper/report	Political	-	56-4
4	radicalism	Observation	Political	-	19-4
5	Inconsistent capabilities	interview	Economics	-	45-4
6	Cluster development	Paper/report	Economics	-	29-5
7	Poverty	observation	Sustainability	-	14-5
8	Insecurity	observation	Sustainability	-	15-4

3-Harmonize the matrix; harmonize the problem-solving processes through each row (in this example rows 2-4, 30-5, 56-4, 19-4, 45-4, 29-5, 14-5, 15-4) by concluding columns vertically and writing conclusions in *harmonizing (partial conclusion) rows*. Harmonization produces new notes and insights that will be stored vertically in lower rows (harmonizing rows). Consider our example (Figure10), look at blue elbow arrow connectors at the right side of the matrix (figures9 and 10).

- A conclusion on problem lines 2-4(out-group social capital) and 30-5(entrepreneurial culture) is stored in its lower partial conclusion row (cultural theme of data); *Building a community of development deans powered by government based on regions and tribes where deans could work among their tribes and propagate an entrepreneurial thinking among their community. These people should be selected from among respected elders who are and/or interested in being an entrepreneur!*
- A conclusion on problem lines 56-4 (budgeting inefficiency) and 19-4 (radicalism) is placed in its following partial conclusion row (political theme of data); *Making regional authorities to some extend independent to be able to customize regional budgets based on regional needs and conditions. A considerable part of the budget should be targeted to inject a controllable amount of modernization among local families and tribes to make them immune against radicalism as a disease.*
- A conclusion on problem lines 45-4 (Inconsistent capabilities) and 29-5 (cluster development) is placed in its following partial conclusion row (Economic theme of data); *Uniform development at the region is impossible because resources and capabilities are highly scattered. However, development at some clusters where minimum capabilities are provided, could be generated which then leads to peripheral area. These clusters are implemented into two groups of producto-polises or capillary value adding networks.*
- A conclusion on problem lines 14-5 (Inconsistent capabilities) and 15-4 (cluster development) is placed in its following partial conclusion row (Sustainability themes of data); *Providing basic needs*

including job, security and standard level of welfare for local people could end vicious circle of Misery in the region.

4-General conclusion; Notes stored in Partial conclusion rows will be concluded and synthesized as new concepts to be stored in the last conclusion row of the matrix entitled General conclusion (Figure9). Look at blue elbow arrow connectors at the right side of the matrix (figures9 and 10). In our example(Figure10), this conclusion was as follows; *Providing basic needs and a standard level of welfare at selected regions entitled producto-polises (cluster cities) or capillary value adding networks could attract local people to work there in a low-wage and tax system of production that could be competitive. In which development deans facilitate entrepreneurship initiatives among tribes and families, local people get modernity, development stream leaks to peripheral area and clusters could end vicious circles of misery.*

5-Redistribution; we Redistributed concepts extracted from the last row (General conclusion row) to all of problem-solving rows and repeat steps 2 through 4 to attain theoretical saturation. Look at green elbow arrow connectors at the left side of the matrix (figures 9 and 10).

This cycle finally led to a Policy statement extracted from general conclusion row at the final cycle. This statement was an elaboration on our two extracted macro-policies; *Producto-polises(cluster cities) or capillary value adding networks* to end vicious circle of misery in the region. Moreover, we achieved to more insights from the final conclusion on columns of matrix.

6-Conclusion to column 2, led to a *problem definition*; this region suffers from *Low out-group social capital, Low entrepreneurial culture, radicalism, Inconsistent development capabilities, Poverty, unemployment and insecurity.*

7-Conclusion to column 3, led to a *comprehensive environmental analysis*. In this regard for example we found that *local people have more trust within their tribe than beyond. Local people don't have business mind and entrepreneurial thinking in general. Budgeting is not compatible with region's conditions and remarks. Some local people are threatened by radicalism, extremism or membership in gangs. Economic development sources like water, mines and fertile soil are very sporadic and poverty, unemployment and insecurity form a vicious circle of misery in the system. However there many scattered capabilities in the region in terms of agriculture or mines or commercial transportation and logistics that could be leveraged toward region's development.*

8-Conclusion to column 4, led to a *well-grounded theory or set of theories about regional development*. Based on Figure10, among them we attained to *Social capital theory, theory of Entrepreneurial thinking, concepts of Regionalism and federalism, Modernization, Cluster development, and basic needs theory.*

9-Conclusion to column 5, leads to *solutions and policies for socioeconomic development in the region; Making competitions among families in terms of development and entrepreneurship could be managed by a group of development deans among families and tribes. Building development clusters in the form of Producto-polises (cluster cities) or capillary value adding networks could end vicious circle of misery in the region and inject a controllable amount of modernization to alleviate extremism and anarchy. For this purpose, government should facilitate federalism in planning and budgeting.*

10-Conclusion to column 6, *evaluates policies or solutions* extracted from step 9. We eliminate this part from our example!

11-Conclusion to column 7, *summarizes expert forecasts and futurology about region*. For example we forecasted that *development deans could shape an entrepreneurship atmosphere at the region.*

12-Conclusion to column 8, indexes *considerations necessary for implementation of policies*. Among these considerations are; *Empowering local elites who have had entrepreneurship experience is necessity to play the role of development deans at region, Imposed levels of modernization should be controlled to prevent consumerism and alienation at the region and location studies are needed to find suitable places for producto-polises(cluster cities) or capillary value adding networks.*

13-Column 9 is dedicated to experiences gathered during and after implementation of policies and revisions takes place after evaluation.

	1	2	3	4	5	6	7	8	9
Problem	codes xx-y	Problem Definition	Immersion in system	Related theories	solutions	Evaluation ...	futureology	organizing for implement	Implmnt & fdbck
Approaches									
Approach1 cultural	2-4	Low out-group social capital in the region	Local people have more trust between their tribe than beyond	Social capital theory	Making competitions among families in terms of development and entrepreneurship	-	-	-	-
	30-5	Low entrepreneurial culture	Local people don't have business mind in general	Entrepreneurial thinking	A group of development deans among families	-	Development deans could shape an Enrtp atmosphere	Empowering local elites who have had Entrp experience	-
	Building a community of development deans powered by government based on regions and tribes where deans could work among their tribes and propagate an entrepreneurial thinking among their community. These people should be selected among respected elders who are and/or interested to be entrepreneur!								
Approach2 Political	56-4	budgeting inefficiency	Budgeting is not compatible with region's remarks	Regionalism and federalism	Federalism in planning and budgeting	-	-	-	-
	19-4	radicalism	Some local people are threatened by radicalism, extremism or membership in gangs.	Modernization	Modernization could alleviate anarchy come from underdevelopment	-	-	Imposed levels of modernization should be controlled on local people	-
	Making regional authorities to some extent independent to be able to customize regional budgets based on regional needs and conditions. A considerable part of budget should be targeted to inject a controllable amount of modernization among local families and trbes to make them immune against radicalism as a disease.								
Approach3 Economic	45-4	Inconsistent development capabilities	Economic Development sources like water, mines and fertile soil are very Sporadic	-	-	-	-	-	-
	29-5	-	-	Cluster development	Built development cluster	-	-	Need to location studies	-
	Uniform development at the region is impossible because resources and capabilities are highly scattered. However, development at some clusters where minimum capabilities are provided, could be generated and then leaks to peripheral area. These clusters are implemented into two groups of producto-polises or capillary value adding networks.								
Approach4 Sustainability	14-5	Poverty and unemployment	poverty, unemployment and insecurity and ... form a Vicious cycle in the system	Basic needs theory	To ending this Vicious cycle we need a breakdown initiative	-	-	-	-
	15-4	Insecurity		--		-	-	-	-
	Providing basic needs including job, security and standard level of welfare for local people could end vicious cycle of Misery in the region.								
General Conclusion	Providing basic needs and a standard level of welfare at selected regions entitled producto-polises(cluster cities) or capillary value adding networks could attract local people to work there in a low-wage and tax system of production that could be competitive. In which development deans facilitate entrepreneurship initiatives among tribes and families, local people get modernity, development stream leaks to peripheral area and clusters could end vicious cycles of misery.								
Row									

Figure 10: Matrix-collage presented in figure 9 is filled for 8 problem lines.

This framework was implemented in the region over the course of 12 months and led to problem elaboration, two macro-policies, and a detailed policy package including problems of region, related insights and development theories, future studies, main solutions, their evaluation and consideration for implementation.

7 Conclusion

The quest for qualitative mindware started with qualitative metaphors (mainly Kaleidoscope and Jigsaw Puzzle) and problem-solving process as articulated by John Dewey and other theorists. Problem-solving process has been used in fields of science and the humanities from land-use planning and policy studies to management and industrial engineering.

The main component of problem-solving is data and how to analyze data for problem-solving objectives. The focus on creating qualitative mindware requires qualitative data collection and QDA. The main metaphors for understanding QDA are kaleidoscope, jigsaw puzzle, and symphony. These metaphors introduce QDA as a reciprocal, iterative, evolving, and inductive procedure for collecting data pieces and memos and extracting a pattern from them. Suter (2012) emphasized that "qualitative data analysis is often performed during data collection with emerging interpretations--a working hypothesis--guided by a theoretical framework." While QDA evolves throughout the research project and works like a kaleidoscope or jigsaw puzzle solution, we designed a general theoretical framework for handling QDA.

Using a correlation matrix, we created interaction between the problem-solving of the columns and data collection methods or approaches of rows to be analyzed using the 14 points explained in section 5. The

proposed model and mindware theorize, then systematize and combine these two axes using qualitative metaphors and the innovative procedure in section 5.2.

Figure 7-left shows that the matrix-collage works like a collage of data pieces that produce order from chaos or unity from plurality. Looking at the procedure we implemented at section 6, in alignment with QDA theory, qualitative metaphors and the detective method, matrix-collage works like an evidence board. It exhibits gradual growth and is reciprocal, traceable in procedure, and refreshable by new incoming data.

As explained in section 6, we implemented a form of this methodology in 2011 for development planning in the south-east of Iran. The results were appreciated by the employer (Center for Strategic Studies; www.css.ir) and was used for agenda setting before the trip made by the Iranian president, Hassan Rouhani to Sistan and Balochestan Province. Despite most of the past initiatives, this research could consider almost all inquiries about the region and any form of related data. Moreover, it is possible for matrix-collage to be updated, harmonized and modified with later incoming data, after the research is completed. The model could be implemented with any level of available resources (researcher, money and informants' participation) although fewer resources affect the comprehensiveness of the findings and conclusions.

In general as cited by Thorne (2015), there is deep need for qualitative methods of data analysis especially when huge volumes of data are gathered from different sources. We tried to invent and implement a new framework for analysing such data qualitatively.

The novel mindware is a new qualitative metaphor called matrix-collage. This methodology serves as a case study protocol for formal problem-solving initiatives as required by Yin (2003). It can be used as a qualitative data analysis and classification method or a comprehensive method for problem solving in organizations and social systems. Our main contribution is to invent a methodology to organize data gathered from different sources and analyse them semi-systematically towards problem definition, environmental analysis, theory construction and incubating the solutions for each phenomenon under study.

This model must be developed in theory and practice. To do so, the framework should be used by other practitioners for problem-solving in different fields. In this regard, we welcome all collaboration and assistance.

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Appendix1-a general Problem Solving Process

Table 2: Extracted steps of problem-solving process for different fields

Name	Visual model of managerial problem solving	Systems Decisions Process	Problem-solving process	Problem-solving model	The classic approach to decision making	Wilson's problem-solving model	Conclusion
Field	Management	System Science	Engineering	Behavioral science	Social Science	Social Science	Present study
Source	Meyer, 1986	Parnell, Driscoll, & Henderson, 2011	Yazdani and Tavakkoli-Moghaddam, 2012	Newton et al. 2009	Adair, 2007	Wilson, Ford, Ellis, Foster, & Spink, 2002	Present study
Steps;	Problem Identification (Opportunity detection)	Problem Definition	Recognition of problem existence and determining its importance	Review Status and Identify Problems	Define the objective	Problem Identification	Problem recognition & definition (Opportunity detection)
	Determination of Cause		Identifying, defining & recognizing the problem		Collect relevant information	Problem Definition	Collect information, determination of causes
	Generation of alternative solutions	Solution Design	Constructing & finding alternative solutions	Develop and refine hypotheses			Develop and refine hypotheses
	Evaluation of tentative choice				Generate feasible options	Problem Resolution	Generate Alternatives
	Potential Problem Analysis	Decision Making	Assessing alternatives & selecting one of them	Discuss and select solutions	Make the decision		Assessing alternatives
	Final Choice and Implementation	Solution Implementation	Imposing the selected solution	Develop and implement action plan		Solution Statement	Final Choice and Implementation
				Evaluate and revise action plan	Implement and evaluation		Evaluate and revise action plan
Tools			Brainstorming, Fishbone, AHP method			Case-based reasoning	