Opinion Mining and Strategic Decision Making: Application of Priority-Pointing Procedure in a MIS-Based Project in Xi'an, China

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Abstract: In this research the Priority-Pointing Procedure (PPP), a qualitative research-based diagnostic procedure, was used as a tool of opinion mining and an approach to making strategic decision on the direction that an organization should take. We present an application of the PPP to the opinion mining and strategic decision making in a MIS-based project, Xi'an Government's Department of Fiscal Affairs' Management Information Systems (MIS), in Xi'an, China. PPP has been proven to be able to do collective opinion mining by synthesizing responses to open-ended questions about the direction that an organization should take. It shows that, when solving a problem in management that is related to people, PPP can be used in the Chinese culture to obtain a balanced integrated solution.

Introduction

When solving management decision making problems that are related to people, we can benefit from knowledge and theory from cognitive science, such as Nomology, which provides the basis for the qualitative research-based strategy diagnostic Priority-Pointing Procedure (PPP). When facing the problems in strategic management, the number of alternatives is typically much smaller than the number of criteria, and thereby the focus will turn to the definition of the strategic questions (Brugha, 2001), the opinion mining, and then pointing to priorities.

PPP is a qualitative research-based diagnostic procedure that synthesizes responses to open-ended questions about the direction an organization should take. It can point to a priority for action by measuring imbalances in the numbers of responses in the context of the structure of adjustment decision-making from Nomology. In Ireland, PPP has been used to solve the strategic problems in University College Dublin's (UCD's) Graduate Business School, to diagnose Ireland's preparation for entry into the European Monetary Union, and to solve Dublin's transport problems (Brugha, 2009). Furthermore, in recent years, the Executive MBA students who took the course "Strategic Direction and Decision Workshop" in UCD have implemented PPP in projects in their course to solve strategic problems in many different companies and institutions (Du et al, 2009).

As China's economy grows, Chinese systems methodologies have attracted increasing attention from researchers in the field of decision making in both China and the other parts of the world. For example, Gu and Tang (2006) presented an outline of an Oriental systems methodology: the Wuli Shili Renli approach (WSR), which has been used successfully to guide China's systems projects. In the early 1990s a Chinese system scientist, Qian Xuesen (Tsien HsueShen in the Western world) proposed a Meta-synthesis method to tackle with open complex giant system problems which cannot be effectively solved by traditional methods. The method emphasizes the synthesis of collected information and knowledge of various kinds of experts, and combining quantitative methods with qualitative knowledge. In recent years, more efforts have been made to apply systems methodologies to modeling activities in solving decision problems (Gu et al, 2007; Liu et al, 2006; Makowski, 2005; Makowski and Wierzbicki, 2003).

Most studies of complex systems try to explore the methods and procedures that can be used in OPINION MINING AND STRATEGIC DECISION MAKING. To understand the complex phenomena in complex systems and to help people to make decisions, some researchers have proposed soft approaches that use the fundamental ideas incorporated in systems methodologies. For example, [17] suggested that appropriate methods should be designed and employed to address and tackle Wuli, Shili and Renli elements in a theoretically informed and systematic way, and outlined the background, philosophy, process, principles, and some practical applications of the methodology. [21] addressed modeling knowledge in terms of model-based decision and soft computations. [26] emphasized a soft approach that uses both the logic and the educated intuition of people. This approach originates in Sawaragi's shinayakana systems approach that is based on the Japanese intellectual tradition, which, to some degree, matches the Chinese systems methodology. As one of soft approaches, PPP originates in the West systems approach that is based on the ancient Western philosophy, but has potential to bridge the soft approaches in the West and the East.

Considering the difference between the Eastern culture and Western culture, one may wonder whether PPP works well or not in the context of the Eastern culture. China is the major source of the ancient Eastern philosophy. Therefore we choose China as a context to test the feasibility of PPP in the Eastern culture. We

applied PPP to the opinion mining and strategic decision making in a MIS-based project in Xi'an Government's Department of Fiscal Affairs. Government Fiscal Management Information System (GFMIS) was approved by State Council Informatization Office in China in 2002. GFMIS has developed rapidly in recent years. The increasing use of GFMIS definitely has improved the quick-response capability and work efficiency of governmental sectors. However, there are still some problems in applications of GFMIS in local governmental fiscal departments. To find and solve those problems, local governmental fiscal departments have launched some projects to investigate the situation. Shaanxi Provincial Fiscal Department is one of them. It launched many projects in 2008, among which MIS-based Management Innovation in Fiscal Department (MIS-MIFD) is one of those projects. We applied PPP to design a set of open-ended questions for our survey in Xi'an Government's Department of Fiscal Affairs, which was conducted in March 2009, and used PPP to make analysis of collected answers in June 2009.

Procedure of Priority-Pointing in MIS-based Project
There are seven steps in the procedure of Priority-Pointing: objective definition, respondent identification, survey and questionnaire design, survey interpretation and constructs definition, synthesis and analysis, imbalances measurement, and feedback to participants.. The seven steps described below reflect the experience derived from the MIS-based Project and many other previous applications of PPP.

(1) Define the objective
The objective should be presented in the form of a problem or challenge, e.g. "to make the MIS in governmental fiscal department function well" in the case of the MIS-based Project in Xi'an. Here, MIS refers to the local management information system in Xi'an Government's Department of Fiscal Affairs.

(2) Identify the respondents
The respondents should have an overview of the problem, and should be actively involved in and committed to its solution. In the MIS-based Project in Xi'an, the potential respondents include high level management and senior people who work in Xi'an Government's Department of Fiscal Affairs and whose work is relevant to the MIS in the department. We presumed that these people had rich experience with their local MIS and thereby had an overview of the problem in the use of their local MIS.

(3) Design questionnaire and survey
In the MIS-based Project in Xi'an, the method used was based on six open-ended questions, such as are described in [1-3]. The brevity of the questionnaire helped to ensure a high response rate from the respondents. Two questions were general and the other four were specific to the four sectors of activity: *proposition, perception, pull* and *push*. Questions were asked in each of the four sectors in order to get a deeper insight into the imbalances in the thinking of the groups. The six questions were equally divided into *punch* and *prevention* questions, and were given as follows.
– General *punch* question: Generally, what is needed to make our local MIS in governmental fiscal department function well?
–General *prevention* question: Generally, what most is preventing our local MIS in governmental fiscal department from working well?
–*Prevention* question in the *proposition* sector: What specific factor is most hindering the success of our local MIS in governmental fiscal department?
–*Punch* question in the *perception* sector: What could help to increase our understanding of how to improve our local MIS in governmental fiscal department?
–*Prevention* question in the *pull* sector: What is holding us back from working better together to help a better use of our local MIS in governmental fiscal department?
–*Punch* question in the *push* sector: Is there any major specific change that could help to improve the contribution of our local MIS to our success in governmental fiscal department?
　　To make sure that the questions relate clearly to the objective and are expressed in colloquial language familiar to the respondents, we drafted the questions with care and revised them for several times after pilot-tests. We distributed the questionnaires to relevant people when we visited Xi'an Government's Department of Fiscal Affairs. Respondents answered them privately and without reference to the views of other people. It takes about 10–15 minutes to fill in the questionnaire. When respondents found a question difficult to answer, they were asked to pass to the next question or to consult our survey team members who were responsible for answering questions.

(4) Survey interpretation and variable definition
The output of the survey in Xi'an Government's Department of Fiscal Affairs was a diverse set of views. We use the *adjustment* theory [1-3] to make coherent sense of the results. As a research approach, this falls most

strictly into the theory-generation category of grounded theory. It satisfies the criteria proposed in [16, 25]. Clustering similar answers together revealed a pattern. Analysis of the responses to the above questions showed that they fell into 8 categories based on the nature of the procedure being used by the respondents. These are given in Figure 1.

Table 1 outlines the eight principal activities expressed in the language of the MIS-based project in Xi'an. These 8 issues provided the language within which the discussions and arguments in Xi'an Government's Department of Fiscal Affairs tended to take place. Differences between points of view seemed to be more about emphasis on what to do, i.e. about the appropriate mix to use of the 8 corresponding processes. Usually, the answers were given in positive terms, such as 'there is a great need to get training'.

Table 1 Principal activities and descriptions in the language of the MIS-based project in Xi'an

Activity	Terms in the MIS-based project	Description in the language of the MIS-based project
Pounce	Equipment and technology	This reflected the need for more inputs in both tangible and intangible assets related to the local MIS in governmental fiscal department.
Procedure	Learning and training	This referred to the need for more knowledge and skills to make full use of the local MIS in governmental fiscal department.
Price	Awareness and understanding	This related to the need to understand better the values of the local MIS in governmental fiscal department.
Policy	Policies and regulations	This concerned the need to build MIS-relevant policies and regulations that can be followed in governmental fiscal department.
Promotion	Promotion and leadership	This related to the need for more promotion and support about the local MIS from the leaders in governmental fiscal department.
Productivity	Efficiency and Coordination	This referred to the need to use the local MIS more integrated and more efficient in governmental fiscal department.
Pliability	Reliability and availability	It concerned the need for the reformulation of the local MIS so that the equipment and staff can match well to have reliability and availability in governmental fiscal department.
Practice	Operation and actual use	This referred to the need for improving practical operation and increasing actual usage of the local MIS in governmental fiscal department.

The variables described in Table 1 are differentiated from each other using the structure described in Figure 2. This ensures that the corresponding clusters do not overlap each other, and therefore they can be described as "qualitatively independent". Consequently, they could be used as the input to a simple multi-criteria analysis procedure that counts the number of responses at different levels of abstraction. Because the principal activities form a complete set, any response must fall into one of the eight categories. Nevertheless, the biggest difficulty with the procedure is the allocation of answers to the categories that emerge as the responses are synthesized. The method developed over many cases has been to allocate the easier ones first. Then the more difficult ones are discussed within our research team. To make the most difficult allocations, we used Figure 1 and allocated the answer on the basis of dichotomies. Sometimes it is helpful to look at the respondents' answers to other questions to clarify what they meant. The result of the PPP is a pointing to one activity as the priority or next step that should be addressed. The cluster of answers that were allocated to that activity, or possibly two activities, is then synthesized in the language of the respondents.

(5) Synthesis and analysis

In our questionnaire survey in Xi'an Government's Department of Fiscal Affairs, we distributed and collected the answered questionnaires from 23 senior people who hold posts relevant to the local MIS work in Xi'an Government's Department of Fiscal Affairs. This number of answered questionnaires is valid for PPP Synthesis and analysis. The spread of answers by the 23 respondents (Figure 1) shows some of the imbalances and points to priorities in the actions that can be taken in the future. Sometimes respondents may choose 'wrongly' out of frustration, making the PPP method a less secure method of pointing to a problem. Therefore, generally speaking, the 'corporate mind' of the key participants in a management system can usually identify the problem by the imbalances in their answers, but may not always be correct in their identification of the solution. This

feature differentiates the PPP from a simple polling of views. In the MIS-based Project in Xi'an, the answers to the six questions provided further information and helped to deal with the problem of 'incorrectly identified' problems.

(6) Identify imbalances
Imbalances in the scores in Figure 1 can be measured as follows. Where a dichotomy is being compared, a sample proportion, described by p', which comes from participants' responses, is used. For two scores to be in balance, the expected proportion, described by p, should be 0.5. One score divided by the total for the two clusters being compared gives the sample proportion. The proportion can be converted to a t-score with n-1 df as below.

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Here, n is the number of responses, p' the sample proportion, and p the expected proportion that equals 0.5. p' can be derived by the answers of respondents.

(7) Feedback to participants
An essential part of the procedure is the feedback to respondents of a synthesis of the priority response expressed in their own language or terminology. In the MIS-based Project in Xi'an, a report will be submitted to Xi'an Government's Department of Fiscal Affairs. This feedback will appeal to the people who are concerned about the improvement of Xi'an local MIS in governmental fiscal department.

Data Analysis in MIS-based Project
The answers from the 23 valid questionnaires to the six questions were classified into one of the eight activities, as shown in Table 2, giving 138 answered questions. Some respondents did not or felt they could not answer some of the questions and stated that they had no idea, hence there are some non-answered (n/a) ones.

Table 2   Distribution of responses by question

Distribution of responses by question	Q1	Q2	Q3	Q4	Q5	Q6	total	Quadrants	Lateral halves	Horizontal halves
n/a	0	3	1	0	3	3	10			
pounce	5	4	0	1	1	0	16	Proposition 46	Planning (right) 65	Place (top) 75
procedure	6	2	2	10	0	10	30			
price	1	3	5	0	6	0	15	Perception 19		
policy	0	3	1	0	0	0	4			
promotion	4	1	0	8	7	5	25	Pull 34	Putting (left) 63	People (bottom) 53
productivity	4	3	0	0	1	1	9			
pliability	2	1	2	2	0	1	8	Push 29		
practice	1	3	7	2	5	3	21			
total	23	23	23	23	23	23	138			

The results of the high level analysis implied that issues around *procedures* are hindering the local MIS in Xi'an Government's Department of Fiscal Affairs from functioning well, and issues around *promotion* of good activity, as in leadership, are also deterring from the local MIS in Xi'an Government's Department of Fiscal Affairs from working well. In addition, issues around good *practice* are having some negative impacts on the function of the local MIS in Xi'an Government's Department of Fiscal Affairs.

In the following we examine the responses to the individual questions and make analysis of them by question.

Question 1 –General *punch* question: Generally, what is needed to make our local MIS in governmental fiscal department function well?

This is the main question of the survey. It is the general "*punch*" question which seeks to find the most important positive step that will improve the current situation. The original answers to Question 1 are not addressed here but the results are shown in Figure 3. According to PPP theory this spread of answers was not dramatically significant, although it does point to a weakness in the *proposition* phase, and not in *perceptions*. This suggests the need for initial "*proposing*" activity.

Q1
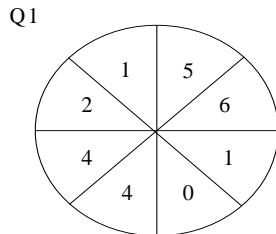
Fig. 1 Results of PPP analysis for Question 1

Question 2 –General *prevention* question: Generally, what most is preventing our local MIS in governmental fiscal department from working well?

This is the general question about the activity preventing the local MIS from working well. The results of an analysis of the answers to this question are shown in Figure 4. This spread of answers was not significant, and suggests no major factor *preventing* the system from working well.
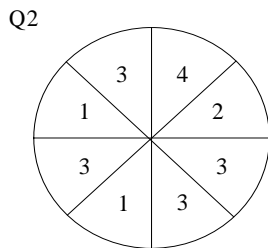
Q2

Fig. 2 Results of PPP analysis for Question 2

Question 3 –*Prevention* question in the *proposition* sector: What specific factor is most hindering the success of our local MIS in governmental fiscal department?

This question tries to uncover negative factors that are preventing initial solutions. The results of an analysis of the answers to this question are shown in Figure 5. This spread of answers was not very significant, but suggests a factor *preventing* the system from working well might be in the narrow *place* areas, of *practice* and *pounce*, i.e. the responsibility of management to provide some initial solutions.
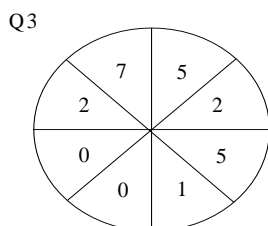
Q3

Fig. 3 Results of PPP analysis for Question 3

Question 4 –*Punch* question in the *perception* sector: What could help to increase our understanding of how to improve our local MIS in governmental fiscal department?

The original answers to Question 4 in both Chinese and English language are summarized in Appendix and the results are shown in Figure 6. This result is very clear, points to the need for work in the *procedure* and *promotion* areas, where the content of the answers (in the Appendix) indicate *procedure* refers to better training, and in *promotion* refers to better leadership and personal guidance by management to resolve the problems. It is significant that *procedure* and *promotion* are both *personal* activities, implying the need for more interpersonal engagement about the issues amongst staff.
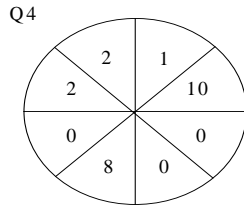
Q4

Fig. 4   Results of PPP analysis for Question 4

Question 5 –*Prevention* question in the *pull* sector: What is holding us back from working better together to help a better use of our local MIS in governmental fiscal department?

The results of an analysis of the answers to this question are shown in Figure 7. This spread of answers was not very significant, although the lack of leadership (*promotion*) and appreciation of the value of the MIS-based system (*price*) might be factors *preventing* the system from working well.

Q5
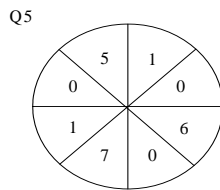
Fig. 5   Results of PPP analysis for Question 5

Question 6 –*Punch* question in the *push* sector: Is there any major specific change that could help to improve the contribution of our local MIS to our success in governmental fiscal department?

The results of an analysis of the answers to this question are shown in Figure 8. This result is very clear, suggesting the need for a culture change in the *procedure* area, relating to better training.
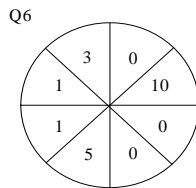
Q6

Fig. 6   Results of PPP analysis for Question 6

Discussions and Conclusion

To prove the feasibility of PPP's application in the environment of an Eastern cultural background, we have applied PPP to opinion mining and strategic decision making in a MIS-based Management Innovation in Fiscal Department (MIS-MIFD) project in Xi'an Government's Department of Fiscal Affairs. In this paper, we have illustrated the application of PPP in the MIS-based project, and obtained some results from the survey in the project. We have made a data analysis of answered questionnaires, which were collected in the MIS-based project. We have also shown our findings and their implications. It was shown that PPP is useful for defining constructs and variables for the project MIS-MIFD, and it is also useful for opinion mining and identifying imbalances in the action to improve the application of MIS in Xi'an Government's Department of Fiscal Affairs. We found that when solving a problem in management that is related to people, PPP can be used to obtain a balanced integrated solution.

More applications of PPP to the cases in the environment of the Chinese cultural background need to be performed so as to test whether PPP can work well in Chinese cultural environments. At the same time, we are relating PPP to the Wuli Shili Renli systems approach and the Meta-synthesis approach in China.

References

References

Brugha, C.M. (1998a). The structure of qualitative decision making. European Journal of Operational Research, 104: 46-62.

Brugha, C.M. (1998b). The structure of adjustment decision making. European Journal of Operational Research, 104: 63-76.

Brugha, C.M. (1998c). The structure of development decision making, European Journal of Operational Research, 104: 77-92.

Brugha, C.M. (2000). An introduction to the priority-pointing procedure, Journal of Multi-Criteria Decision Analysis 9(2)

Brugha, C. M. and Bowen, K. (2005). Decision research using cognitive structures. Systemic Practice and Action Research, 18(1): 67-88.

Du, R., Ai, S. & Brugha, C. (2009). Priority-Pointing Procedure and its application to an intercultural trust project. In Y. Shi et al. (Ed.) Cutting-Edge Research Topics on Multiple Criteria Decision Making: 296-303, Springer.

Glaser, B., and Strauss, A. (1967). The Discovery of Grounded Theory. Aldine, New York.

Gu, J, and Zhu, Z. (2000). Knowing Wuli, Sensing Shili, Caring for Renli: Methodology of the WSR Approach, Systemic Practice and Action Research 13(1).

Gu, J. and Tang, X. (2005).Meta-synthesis approach to complex system modeling, European Journal of Operational Research 166(3)

Gu, J. and Tang, X. (2006).Wuli-shili-renli system approach/theory and applications. Shanghai: Shanghai Press of Science and Technology Education.

Gu, J., Wang, H. and Tang, X. (2007). Meta-synthesis method and systems. Beijing: Science Press.

Liu, J. Dang, Y. and Wang, Z. (2006). Complex network properties of Chinese natural science basic research, Physica A: Statistical Mechanics and its Applications.

Makowski, M. (2005).A structured modeling technology, European Journal of Operational Research 166(3)

Makowski, M., and Wierzbicki, A.P. (2003). Modeling Knowledge: Model-Based Decision and Soft Computations. In: X. Yu and J. Kacprzyk, Editors, Applied Decision Support with Soft Computing, Springer-Verlag, Berlin.

Nakamori, Y. and Sawaragi, Y. (2000). Complex systems analysis and environmental modeling, European Journal of Operational Research 122(2).