INTEGRATING GIS AND BCG MODEL FOR MARKETING STRATEGIC PLANNING

Hongwei Lu, Lihua Zhao
School of Marketing, The University Of New South Wales, Sydney Australia
hongwei@student.unsw.edu.au
lihua.zhao@unsw.edu.au

ABSTRACT

As marketing strategic planning is the basis for achieving organizational objectives, strategic planning tools are developed to help managers in identifying market potential and seeking the approaches to improve the product performance. Among these tools, the Boston Consulting Group’s (BCG) Product-Portfolio Analysis is one of the important and popular-used tools in the last three decades. Given the known limitations of this tool (such as highly subjectivity, introducing irrational emotions into the decision-making process etc.) and the need of extending this tool into spatial dimension, this paper discusses and demonstrates the roles of Geographical Information System (GIS) in enhancing BCG analysis in spatial dimension. Taking automobile Brand X market performance analysis as the case study, this paper illustrates the significance and the benefits of using GIS tools (such as database management, classification and interactive based exploratory tools) in marketing strategic planning.

INTRODUCTION

Strategic planning is the basis for sound decision making in any situation in business world. To improve the effectiveness and efficiency of marketing decision making on resource allocation, few strategic planning support tools are developed. Among the available tools, the famous BCG’s product-portfolio matrix analysis offers an effective tool for strategic planning by classifying the products market positioning and performance from two different perspectives (i.e. product performance in industry and company level). The BCG matrix has gained widespread acceptability over the past two decades. It is widely taught in marketing courses as a guide for product market decisions. Managers and potential managers reported that they were familiar with the BCG matrix in the surveys of the actual use of BCG in marketing daily life practice. They are presented as diagnostic aids and as prescriptive guides for selecting strategic options. Wind and Mahajan provide a review of matrix methods. However, in the real world practice, there are still some drawbacks on the effectiveness of BCG. For instance, in a survey on the usage of BCG in practice, when it is asked - “To what extent do you believe that the BCG matrix is useful for strategic decision- making in marketing”, 66% of the 175 respondents believed that the BCG matrix would “produce better (or significantly better) decisions under certain circumstances”. However, these respondents were unable to describe circumstances in which the BCG matrix would be useful. Also, in academic research, few limitations are found and summarized in academic field. Given the known limitation of BCG, it is argued BCG can be a helpful tool, but it can also be misleading.

In addition, with the rapid development of database marketing and direct marketing, the study on product performance and industry growth rate in spatial dimension are becoming an imperative study topic in both marketing and decision support field. This is because BCG analysis in spatial dimension helps answer the questions of ‘how to improve the product performance within the study area (e.g. trading areas)?’ and ‘how to approach consumers in the study area?’ The answers are critical to marketing strategy implementation.

When BCG matrix analysis is extended to spatial dimension, the essential idea of BCG matrix analysis is enriched from an evaluation/classification tool of the products’ type in a large geographical area (e.g. region, country, and trading area) to an area market potential measurement for a specific product. This extension of BCG matrix can reveal the spatial variation in terms of product performance and potential; consequently, provide valuable information for strategic planning.

Although the relative under-emphasis on regional-spatial analysis in marketing in current literature, the high relative stress in the literature of marketing on consumer-behavioural studies and the behavioural sciences in general has provided the foundation for a broad integration with other disciplines, especially economics and geography. Especially, the achievement in quantitative spatial analysis and spatial information system research provides series effective tools (e.g. GIS) to accelerate the further development of the existing marketing planning tools into spatial dimension, which provides invaluable decision support for strategic planning.

Therefore, based on these evaluations on BCG matrix analysis and discussions on the importance of BCG matrix analysis in spatial dimension, the next important step is how to further develop this tool for marketing strategic
planning. In this paper, GIS is integrated to extend BCG matrix analysis into spatial dimension. Although the value of GIS is being recognised by more and more researchers and practitioners in marketing, the significance of GIS in BCG matrix analysis has not been examined.

Standing on these points, this paper focuses on two things: 1) Illustrating the extension usage of BCG in spatial dimension by using GIS; 2) Discussing the benefits of integrating GIS in such analysis. Specifically, the overview and problems with current BCG matrix analysis are examined in Section 2. Then the role of GIS in extending BCG matrix analysis to spatial dimension is discussed in Section 3. A case study on automobile sales is presented in Section 4 to demonstrate the role of GIS. Finally, conclusions and some issues for the future are listed (Section 5).

2. BOSTON CONSULTING GROUP MATRIX AND ITS MAIN PROBLEMS

As a currently used strategic planning tool, both positive and downside of this tool are found.

2.1 BCG Matrix Analysis and Its Significance in Marketing Planning

The BCG matrix (Figure 1) classifies products from the perspective of a single company and its particular products or SBUs (Strategic Business Unit). The BCG matrix measures market attractiveness by market growth rate in vertical axis, and it assesses the firm’s ability to compete by its relative market share in horizontal axis. Each axis is delineated in ‘High’ and ‘Low’ categories.

In Figure 1, four distinct products (or market situation) are identified and given by a metaphorical name, suggesting the implications that each holds for a firm’s marketing strategy: cash cows (to be milked), stars (to sustain their ascendancy), problem children (to treat with caution), and dogs (to avoid) [2].

In the real world practice, BCG matrix methods are judged to be successful by those who use them. Haspeslagh [8] found that almost all respondents believed that their use of formal portfolio planning methods had a positive impact, in a survey of Fortune 1000 companies [3, 8]. Therefore, in the positive side, portfolio models provide a systematic method for resource allocation decisions [2].

2.2 Problems with current BCG matrix analysis

At the same time, it is noted a real problem is attached with BCG matrix analysis, i.e. easy to be misleading [9]. It is noted few limitations lead to this misleading. Specifically, the limitations can be summarized from the following perspectives: 1) the distinction between high and low is highly subjective; 2) the use of BCG analysis can’t help managers take into account synergies that may possibly exist among the various SBUs within the product portfolio; 3) the assumed causal relationship between market share and profitability may not truly exist.

Given the focus of this paper is to further develop BCG analysis from a methodology perspective, subjectivity becomes the major concern of this research. The problems of subjective classification and their impact on strategic planning can be found from few perspectives, which are shown in Figure 2.

From previous researches, it is found managers often neglect to use a rational economic approach. Instead, they use unstructured judgmental processes, which is based on their decisions on power or emotional factors [10]). As a result, two different managers can recommend two different resource allocation strategies given the same scenario. Under this situation, BCG matrix, may lead managers to make decisions that are less rational than those they make without the aid of BCG analysis.

Alternatively, the distinction between ‘High’ and ‘Low’ may need to be established with the consensus. Undoubtedly, the exploratory is needed to determine the proper/logic classification.

Figure 2 Problems and solutions of subjective classification of BCG extension in spatial dimension

Therefore, from a methodology perspective, there is a need to improve the subjective classification from broadly three aspects: 1) systematic classification rule; 2) customized classification scenario analysis for logic classification searching;
3) interaction-based exploratory analysis tool to achieve the consensus among different managers. Also, the extension BCG into spatial dimension, it will relate to the issues with spatial data manipulation and database management. Therefore, the comprehensive geo-referenced data management system is needed.

Under this situation GIS is introduced and integrated for implementing BCG matrix analysis in each small geographical area (e.g. postcode). To illustrate the benefits of integrating GIS with BCG matrix analysis, firstly the background knowledge of GIS is examined. Then a case study on automobile car market analysis is conducted to elaborate the related functions and benefits of integrating GIS in marketing.

3. THE NEEDS OF GIS IN SMALL AREA BASED BCG ANALYSIS

3.1 Overview of GIS in Marketing

GIS is a system for capturing, storing, checking, manipulating, analysing and displaying data which are spatially referenced to the earth [11]. It has been used to help solving problems in the environment field since 1960’s. Well-developed GIS functionalities have been found in rich GIS literature [12]. Recently, the value of GIS is being recognised by more and more researchers and practitioners in marketing. Beaumont [1] has demonstrated the role of GIS in supporting decision-making within an organization and provided a useful list of some of the questions that need to be answered by marketing management in Figure 3. And more empirical studies of GIS in marketing have been explored [13-15]. In spite of this, there is still a lack of examination about the role of GIS on BCG matrix analysis.

3.2 The Role of GIS in BCG Product-Portfolio Analysis

As it is shown in Figure 2, to extend BCG matrix analysis into spatial dimension and reduce the subjectivity attached to BCG matrix analysis, the flexible classification tools and interactive based exploratory tools are needed. The model-based systematic classification and the customize classification tool can provide various possible options for classification based on the intrinsic data distribution nature or the gut feeling about data or managerial efficiency. Concurrently, the interactive based exploratory tool helps decision maker to obtain meaningful classification based on the possible classification scheme at a very low cost. Consequently, improve the inter-subjectivity on the measurement of the area type for strategic planning. Undoubtedly, during this process (i.e. extending BCG matrix analysis into spatial dimension), the issues related to spatial data manipulation and analysis will be involved. In this paper, GIS is introduced and integrated with BCG matrix analysis. And the role of GIS can be identified as: 1) data and database management tool; 2) model-based classification tool; 3) interactive based exploratory tool. The detail information will be illustrated in the following paragraphs.

Data and database management tool

In order to extend BCG matrix analysis into spatial dimension, the product performance in both firm and industry level needs to be counted on a nominated geographical level. Although the product performance (e.g. the number/frequency

---

**Figure 1 Boston Consulting Group (BCG) Matrix**

- **Star**
  - High Industry Growth Rate
  - High Relative Market Share
  - Build
  - Maintain

- **Problem Child**
  - Low Industry Growth Rate
  - Low Relative Market Share
  - Build
  - Niche
  - Divest

- **Cash Cow**
  - High Industry Growth Rate
  - Low Relative Market Share
  - Harvest
  - Maintain

- **Dog**
  - Low Industry Growth Rate
  - High Relative Market Share
  - Maintain
  - Niche
  - Divest

*After [2] p 47*
of sales) in each geographical area (e.g. postcode) can be derived based on geographic information attached with sales data, this aggregation of product performance is very limited. Only when the geographical information explicitly appears in the data, the aggregation can be done. For instance, with automobile sales data, only when the postcode or suburb of customer’s car registration address is kept, the aggregation of car sales in each postcode or suburb can be derived by counting the numbers of sales in each postcode or suburb. The product performance in a customized geographical boundary (e.g. trading area) can’t be calculated easily without the spatial data analysis and database management tools.

However, the Geocoding function provides a more practical solution to aggregate the sales data in any customized geographical boundary, which enable BCG matrix analysis can be conducted at different geographical levels. Geocoding is a process of adding geographic information to a file or database so that its objects (e.g. sales customer) can be displayed on a map. Once customer registration address is located on a map, the product performance in the each area can be calculated by using spatial analysis and manipulation functions such as buffering, point-in-polygon analysis. In other words, the product performance can be calculated by counting the number/frequency of dots (the representation of sales customers in a map) in the nominated geographical areas (i.e. postcodes).

When BCG matrix analysis is extended to the spatial dimension, the evaluation of the area type in terms of product market potential is more difficult and almost impossible to be done on manual base, which is same as the situation for

**Figure 3 Questions need to be and could be answered aiding by GIS**

![Figure 3 Questions need to be and could be answered aiding by GIS](image)

(Source: after [1], p 140)

the trading area based BCG matrix analysis. This is because the information integration and evaluation process will involve large amount repetitive data manipulation and calculation job. But this problem can be solved by using database integration tool. In GIS, the information in different data sources/sets can be linked/joined together (into a table) by matching the common column. For instance, to evaluate the product market potential in each small area, it needs to integrate the firm’s product performance information in each postcode (from firm’s internal database) and the industry growth rate (from industry authority’s database). As postcode appears in both databases GIS data integration tools can combine these two databases together by matching two tables based on this common column, i.e. the number of postcode. Then GIS database management tools - SQL (Structured Query Language) can be used to pick up the records (i.e. a set of postcodes) belonging to same type based on the value of product performance and industry growth rate in each record (postcode). Next, the selected records (postcodes) will be updated with a new column as the identity (or metaphoric name) of each type by using Database Update function in GIS.

**Model-based classification tool**

As it is discussed above, BCG has the limitation with the irrational/subjective definition on the classification label. The functions in GIS offer series alternative model-based classifications, which help to develop an appropriate classification for strategic planning and the consensus among different managers. Maybe it is hard and almost impossible to develop
an objective classification for BCG matrix analysis. Also, it may not necessary for this kind of objective classification from a managerial perspective. Thus, the problem with the subjectivity of classification becomes the issue to improve inters-subjectivity (i.e. the consensus among the managers) on classification. Under this situation, the various model-based classification methods based on the real data distribution nature will help to reveal the hidden pattern in the data. Specifically, the following six methods related to classification can be found with the typical GIS softwares (e.g. MapInfo) [16].

- **Equal Count**: Each range contains approximately the same number of records. If the number of records is not evenly divisible by the number of ranges, MapInfo places the remaining records into the most appropriate ranges.
- **Equal Ranges**: The difference between the top and bottom values in each range is the same.
- **Natural Break**: The range breaks are determined according to an algorithm such that the difference between the data values and the average of the data values is minimized on a per range basis. This reduces error and enables you to obtain a truer representation of your data.
- **Standard Deviation**: The middle range breaks at the mean of your data values, and the ranges above and below the middle range are one standard deviation above or below the mean.
- **Quantile**: Determines the distribution of a variable across a segment of your data (e.g. population). When you choose Quantile, a Quantiling box appears at the bottom of the dialog. Choose the field or an expression you want to perform the quantiling operation on from the drop-down list.
- **Custom**: Indicates that the ranges are user-defined. When you choose Custom, a Custom Ranges box appears at the bottom of the dialog. Highlight the range you want to change from the list in the middle of the dialog, and edit the minimum and maximum values in the Custom Ranges box.

**Interactive exploratory tool**

Within GIS software, geographical mapping is one of the most important components for geo-referenced data analysis. The key feature of presentation mapping is the ability to display attribute data on a map. The display of data against a map leaves the user with impressionistic information that has to be interpreted by the human brain [15]. Maps always have the capability to make the complicated decision-making much simpler and efficient by collecting and compiling the relevant information and then presenting it based on human intelligence’s logic to facilitate the decision-making. Also, it is noted by Andrienko and Andrienko [17], interactive analysis of spatial data cannot be automated, but an analysis toolkit can make the researcher’s job easier by providing an intuitive interface to the data. As a result, the interactive mapping gives user the ability to customize the utility to their specific analytic needs simply and at relatively low cost in terms of resources and complexity. However it should be noted, this kind of analysis is limited by the exploratory nature of the analysis it permits. [18]

### 3.3 The Benefits of Using GIS in BCG Matrix Analysis

Based on the above discussion, the following benefits of using GIS in BCG matrix analysis could be found in the marketing practice:

- Extending the product-portfolio analysis to the spatial dimension within the smaller geographical resolution. This can help marketing practitioners examining the market performance more closely. Consequently, improve the effectiveness of marketing strategy and the accuracy of decision-making on marketing strategy.
- Improving the flexibility in classifying, describing, and differentiating the market potential features within each small area, when evaluating the local market potential. The classification of the market performance won’t be merely differentiated by ‘low’ and ‘high’; it can be defined and classified at any scheme. And this flexible classification process can be conducted quickly. Thus, it is easier to coordinate and reconcile different managers’ opinion in evaluation. Consequently, improve the inter-subjectivity in decision-making.
- The interactive visualisation helps marketers selecting the appropriate classification scheme in closely examining the market potential.

### 4 CASE STUDY

In this case study, to demonstrate the benefits of integrating GIS in BCG analysis, firstly, the spatial distribution of Brand X market share (an automobile brand in Australian market) and industry growth rate are examined by using two different classification schemes. The demonstration of using two different classification schemes reveals the flexibility of GIS in differentiating small geographical areas in terms of the level of Brand X market share. Then product market potential is examined and evaluated by integrating the information on both product relative market share and industry growth rate. This enables the product-portfolio analysis to be extended to the spatial dimension, consequently, helps marketers closely examining the market potential.
4.1 GIS provides an interactive exploring and flexible classifying tool for marketing spatial distribution analysis

Given the strategic planning is operated on postcode-base, firstly the product market share and industry (i.e. product-category level) growth rate are examined respectively. Two different classification schemes are used in this case study: 1) the product market share is classified into 3-ranges (high, medium and low) with ‘Equal Count’ classification approach. 2) The statistics are classified into 2-ranges (high and low). In Figure 4.1, 3-ranges classification is used. Specifically, “High” means market share of Brand X is over 2.1% and mapped in solid dark; “Medium” means market share between 1.0% and 2.1% mapped in oblique line; and “Low” means market share less than 1.0% mapped with dots. In Figure 4.2, 2-ranges classification is used. “High” means market share is over 2.0% and mapped in solid dark; and “Low” means market share less than 2.0% mapped with dots. Based these two maps, it is found: 3-ranges classification (in Figure 4.1,) offers more accurate measurement of Brand X market share than 2-ranges classification (in Figure 4.2). This is because 3-ranges classification can provide more detailed classification information and make it easier to see the difference of product performance across the study areas. Likewise, it is found 3-ranges classification provides more detail information about industry growth rate by comparing Figure 4.3 (with 3-ranges classification) to Figure 4.4 (with 2-ranges classification). Also, it is noted the use of customized classification schemes provides a flexible tool in exploring the spatial distribution of Brand X market share.

Then based on the information on relative market share and industry growth, the thematic maps based on the measurement of area product market potential in each postcode are calculated by integrating the information on both perspectives. This extends BCG analysis into spatial dimension.

4.2 GIS extends BCG analysis in spatial dimension

By integrating the information on both product relative market share and industry growth rate, the market potential information is extended and displayed across the spatial dimension, which is shown in Figure 4.5. The ‘Fill-pattern’ within each small area (i.e. postcode) indicates the level of market potential. Thus, by extending BCG analysis in spatial dimension, the local market potential (within each small area) can be identified and differentiated. Consequently, based on this 'zoomed-in' information, marketers can closely and precisely examine the market potential and workout the most appropriate marketing strategy to target the local markets.

5. CONCLUSION / FUTURE RESEARCH

Although the use of GIS can’t solve all the problems with BCG, the significant data and database management system, the flexible classification mechanism and the efficient interactive based exploration tool ensure the elimination of the uncertainty rising from arbitrary classification and improve the inter-subjectivity between decision makers. Furthermore, the significance of using GIS in BCG matrix analysis extends BCG analysis in spatial dimension and reveals the spatial heterogeneity of market potential across the geographical areas.

But the more sophisticated exploration about the role of GIS in extending BCG analysis into spatial dimension is needed. Especially, the exploratory study on causal relationship between the studied variables and how to taking into account synergies that may possibly exist among the various SBUs with the product.

REFERENCE


Figure 4.1 Market share distribution based on 3-ranges

Figure 4.2 Market share distribution based on 2-ranges
Figure 4.3 Growth rate distribution based on 3-ranges

Figure 4.4 Growth rate distribution based on 2-ranges

Figure 4.5 Market potential evaluation based on 4-ranges