韓國地形空間情報學會論文集 第12卷 第1號 2004年 3月 pp. 3-10

연구논문

Strategic deployment of GIS for fashion Industries
GIS의 패션 산업에의 전략적 전개에 대한 고찰

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Abstract

These days GIS have rapidly deployed as input and solutions to marketing decision making problems and corresponding decision support systems in many countries including Korea. Its powerful spatial analysis tools along with data integration and graphic display capabilities let many retailers and manufacturers in fashion industry to accept GIS as a useful mean for their decision making systems. At this moment, this paper presents many facets of discussions on how GIS be applied to fashion marketing decision making problems. From provoking several questions on current fashion marketing decision making system to explaining multiattribute decision making and multiobjective decision making as tools for decision making analysis and discussing some implementation issues, this paper revealed many aspects of GIS and fashion marketing decision support system from integration point of view.

Keywords : fashion marketing, decision support system, MADM, MODM

要 旨

최근 GIS는 국내에서 뿐 아니라 외국에서도 마케팅의 의사결정문제와 그에 따른 의사결정지원시스템에 적용이 시도되고 있다. GIS는 강력한 공간분석 기능과 함께 자료의 통합과 그래픽 기능 등을 갖추고 있으며 이와 같은 기능으로 인해 많은 소매 운영자와 생산자들로 구성되는 패션 산업에 있어서 의사결정을 지원하는 하나의 좋은 수단으로서 점차 인식이 확산되고 있다. 이러한 시점에 본 논문에서는 GIS를 패션마케팅에 적용함에 있어서 몇가지 주요한 요소들을 고찰하여 보았다. 이를 위해 현재의 패션마케팅 의사결정문제에 있어서의 주요 이슈에 대한 문제제기에서 출발하여 다속성 의사결정과 다목적 의사결정의 프레임이 어떻게 패션마케팅 의사결정지원에 이용될 수 있는가를 알아보고 이를 실제로 구현하는데 있어서의 한계점 역시 아울러 고찰하여 보았다. 논의의 주안점은 주로 현재의 패션마케팅 의사결정시스템과 GIS 기능의 통합에 두었다.

핵심용어 : 패션마케팅, 의사결정지원시스템, 다속성의사결정, 다목적의사결정

1. Introduction

Fashion is a complex multibillion-dollar industry that includes the many functions of design, production, and distribution of fashion product. Fashion affects the clothing and accessories we wear, the environment in our homes and offices, the cars we drive, the food we eat, and the entertainment we enjoy. The fashion business includes all of the industries necessary to produce and market fashion goods to the consumer.

Fashion goods include apparel and accessary item for men, women, and children as well as home furnishing[1)].

Because fashion is a product of change, predicting its movement is important at all levels of the fashion industry. To successfully merchandise fashion, one must have a sense of timing and follow the movement of consumer preferences. Producers and retailers of fashion goods use several methods to forecast or predict fashion trends. Information system is a critical tool on which decision makers can rely. Examining current activities of consumers enables projections of fashion trends. Such productions based on data of consumer information are important so that fashion goods can be produced in large quantities in advance of when consumers will make merchandise purchases.

2004년 2월 4일 접수, 2004년 2월 28일 채택

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Information system is also important to manufacturers and retailers. Overstoring and increased competition are causing retailers to adjust their merchandising strategies to compete more effectively from predicting demands to allocating manufacturing place, and to networking among distribution centers.

The purpose of this study is to introduce how to apply GIS into fashion businesses. As GIS is an emerging area and its useful application is rare in fashion business, the conceptual employment of GIS is meaningful to fashion industries. Indeed, this may provide useful implications to the technical concerns, providing user friendly program and industry specific program. The discussion starts from the concept of marketing information system, a generally accepted decision support system in businesses. As GIS is also a kind of information system, understanding marketing information system may contribute to identifying application of GIS in fashion businesses which, in turn, may lead a way to the idea how to incorporate and implement it.

In order to help more realistic understanding, two cases are presented. The cases shows how the GIS problem solving power can be used in managing current fashion marketing needs. To be specific, two methods are introduced, multiobjective decision making and multiattribute decision making methods. These are to address the very specific requirements to facilitate a decision support system for fashion marketing applications. Finally, some issues are raised, regarding implementation of the system in practice. This study is to show how GIS capabilities can be used to leverage a competitive decision making task of the marketing information systems. Further, this study may guide a way, how the multicriteria decision analysis is used to accomplish such a goal, which has many implications for future extending of researches on this subjects.

2. MIS, GIS, and Fashion marketing

As we review the concept of marketing information system as a general tool for fashion marketing management, its origin goes back to the 1960s at which several new data processing techniques were applied to decision making that formed basis on understanding and setting up valuable marketing strategies. Since then, concepts of marketing information system have asserted it may fundamentally alter the way of decision making resulting cost savings as well as increased effectiveness. To some extent, such an idea has been come up true as the history explained. However, as Stone and Good(1989)[2] and Stone(2001)[3] indicated, there are still lacks of specific techniques for constructing the system to meet current market's needs considering its inherent potential.

From such understanding, Geographic Information System(GIS) can be used to boost its functionalities[4]. The GIS can be viewed as a sort of decision support systems(DSS) generator to meet particular decision making needs[5].

Fashion marketing is dynamic and challenging area requiring a breadth of decision makings to manage satisfactory customer relationship as well as accredited development of the industry. By the help of increasing marketing researche and enhanced computing capabilities, the domain of area is ever-deeply involving with DSS. Due to their share of common discipline, deployment of the fashion marketing information system is parallelled with the marketing information system.

For our understanding of a DSS, Kotler's(1997)[1] framework of the marketing information system is illustrated in Figure 1. As the illustration explains, decision making is done based on information collected in internal reports and marketing intelligence domain. Combining with assessing information needs and distributing information, the DSS build up the marketing information system.

From Kotler's definition, there are two types of practical systems, specific DSS and ad-hoc DSS. While a specific DSS provides support for repetitive decision making needs, an ad-hoc DSS provides support for short-term and non-repetitive decision making needs. Whatever it is, one apparent fact is that no system satisfies decision maker's commitment to achieve successful strategy as it might. According to Lee et al.(2001)[6], a longitudinal analysis of the marketing information system for 1980s, 1990s, and 2000s showed that less companies use the system even though the decision makers consistently increase use of the power of computing. This outcome brings in questions on

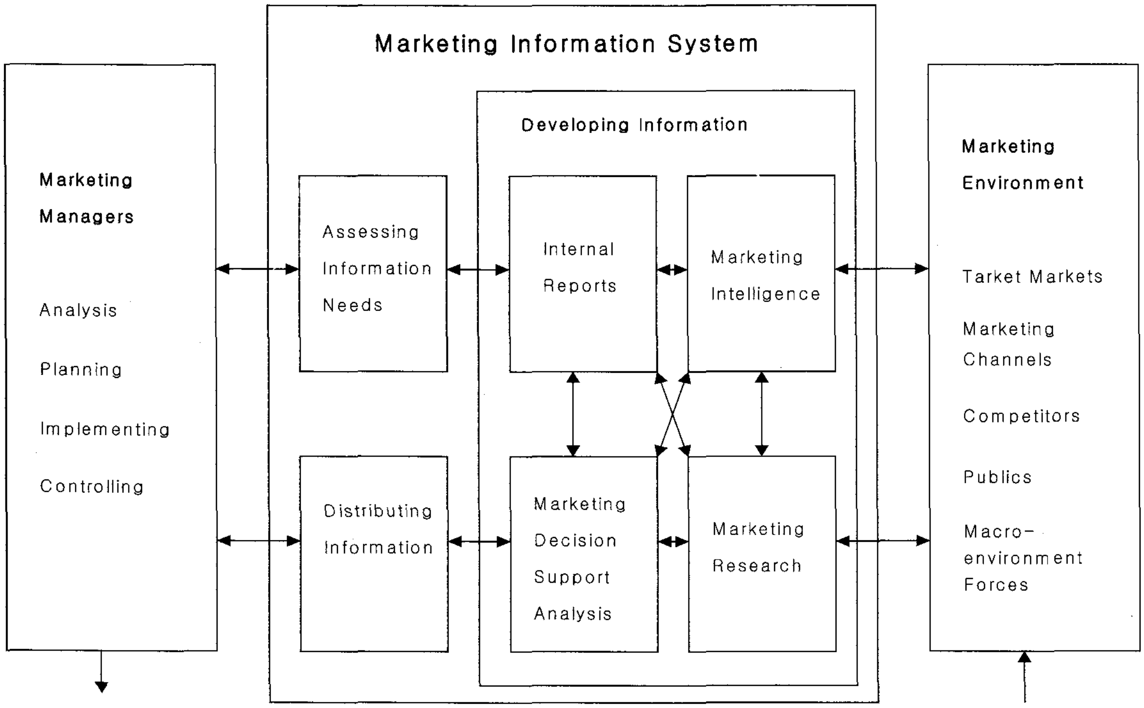

Figure 1. Marketing Information System as a General Discipline of Fashion Marketing Information System (Kotler, 1997; Burns and Bush, 2000).

effectiveness of the system.

Among several distinct components that comprising the system, an assembly of components, gathering information and analyzing, places in heart of such accusation. At the same time, by closer thorough check of the system architecture, it is easily understood that gathering information and analyzing critically influence to decision making. Then, a question arises how to address such an issue, of which answer can be found in next section.

3. GIS potentials in problem solving

GIS, at one hand, enhances our ability to understand and analyze the world[7]. On the other hand it plays a key role for achieving better decision to meet many consumer-led market needs. Thus, it could be viewed as a DSS.

Figure 2 illustrates how GIS be placed as a fashion marketing DSS. From a general perspective of marketing DSS, GIS deals with input data that are collected from internal report and marketing intelligence domain. Based upon four different stages of process, GIS handle the data to lead peoples to a correct decision making. Here, space is the principal organizing factor through which input data is aggregated and manipulated.

By applying particular fashion industry user requirements as a shell of system environment, this system can be easily adapted to solve fashion marketing decision problems.

Application case a)

A typical fashion marketing application of GIS might be involved with allocation of fashion resources (e.g. fashion product including clothes, shoes, and accessories)[8]. Usually, fashion store chains have divided up a city into blocks of consumer areas considering factors including accessibility and preferences. Based on such division, managers of stores put short-term and long-term strategy of resource allocations in their marketing decision.

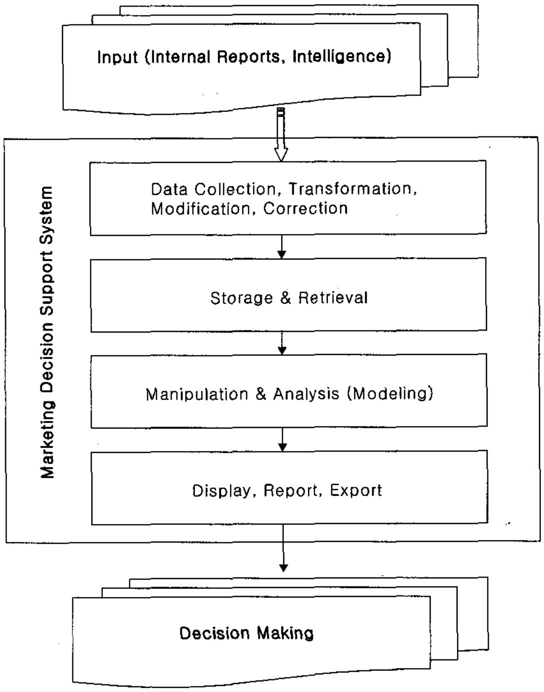

Figure 2. GIS Functionalities as a Fashion Marketing Decision Support System.

Such a case requires aggregation of spatial and aspatial information on consumer's preferences and accessibility. From a wider spatial coverage to a small area level this information is necessary. In database point of view, internal reports as well as marketing intelligence comprising consumer's preferences are to be georeferenced under a certain planimetric coordinate system. Geocoding, or address matching, is applied to link the preference information with digital maps, in which the preference information sheet is in tabular form and each commercial event is registered chronologically as a point object. This special form of sheet is called a event table, which usually be well organized by and acquired from a commercial market data consultancy. This means spatial query-led pop-up displays the event table full of events ordered along items, such as identification(ID) number and corresponding attributes of a particular commercial behavior of a consumer(Figure 3). Another tabular form of information being comprised of other items related with products (so called product attribute table) is in linkage with the event table through unique product codes that are common in both the table. Hence, both the tables are to be in relational structure. Where, socio-economic characteristics of their existing consumers are closely matched with the event table, in which census data is assumed to be available.

Potential of GIS is not limited to linkage and display of heterogeneous information but extends to support multicriteria decision making under various state of market environment. So, many issues involving decision analysis, such as generating criterion maps, comparing decision alternatives, applying decision rules, analyzing sensitivity of the results are dealt with in tight-couple or loose-couple manner to lead a correct decision making.

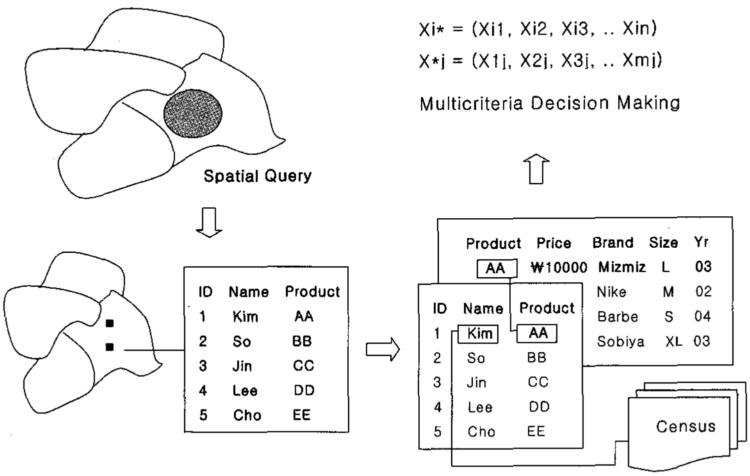

Figure 3. Process of Decision Making from Spatial Query.

Application case b)

For many retailers of fashion product distribution is a critical factor of their business. Usually, a set of distinct store units make up closely related distribution chain or network. Department stores, small shops, wholesaler, franchise, outlets, or even supermarkets belong to this unit. Products are delivered to the consumer through this network.

Throughout 1970s, 1980s, and even early 1990s expansion of the network has been largely accepted as a right trend and thus investment in the network was understood as a mean to provoke considerable margin. This trend had been paralled with battle that major retailers had done against the competitors for increasing market shares(Kay, 1987)[9]. Such trend, however, is no more at mainstream in marketing industry due to the retrogressive perspective to expansion strategy Rather, trend is shifted to seek for greater returns from the network without expanding the chain. Thus, the importance is in evaluation of the existing network from effectiveness and efficiency point of view. In addition, many questions including what is going on, what would happen, and what to do need to be answered.

GIS, as a solution tool(Burke, 2003)[10] must being put forward to these needs as it provides flexible decision support environment. By serving for analyzing efficiency and effectiveness of the supply chain network, and thus results in multiple logistic strategies, it allows good decisions to best suit the requirements of local customers(Kang et al., 2003)[11]. Traditional network analysis specialized toward the fashion marketing schema(e.g. demand-and-supply chain, just-on-time, CRM) can be developed.

4. Multicriteria decision analysis

So far, potential of GIS as a fashion marketing decision support system is evaluated and explained by two practical case applications, fashion resource allocations and distribution network analysis. Among many factors influencing setting up a robust DSS the internal decision mechanism places at the heart of the system.

Throughout literature, a series of approaches to structure and explain the mechanism to multiple decision making problems have been proposed. Because many criteria are involved with the solution schema in general it is usually called multicriteria decision making(MCDM) problems. To settle MCDM problems needs understanding six components; goals, decision makers, evaluation criteria, decision alternatives, states of nature(environment), and sets of outcomes (Malczewski, 1999)[7]. Here, the evaluation criteria consists of objectives and/or attributes, and the

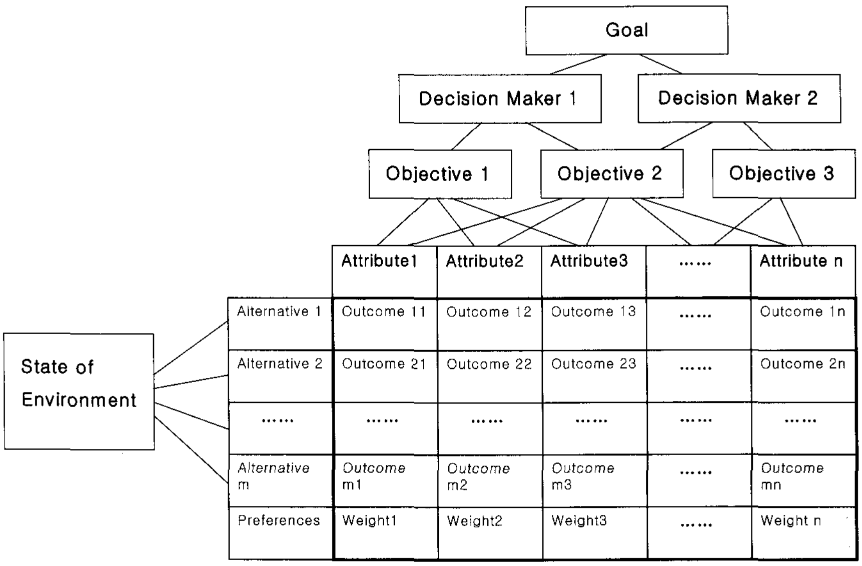

Figure 4. Framework of Multicriteria Decision Analysis (Malczewski, 1999).

states of nature indicate uncontrollable variables(e.g. economic inflation, natural disaster) working out of the framework(Figure 4).

In this framework, the key element is a decision matrix consisting of multiple alternatives(row) and attributes(column). Each value in this matrix indicates a particular outcome to a given evaluation criteria. As the hierarchical structure implies, a objective can be involved with one or many attributes and a decision maker can be involved with one objective or many objectives, which at the highest level constitute a goal.

From fashion marketing perspectives, the goal is to be a desired end state of industry generating the highest profits within existing systems. Retailers, managers, or manufacturers as decision makers may adopt several objectives, such as least stock-out, just-in-time supplies, efficient delivery logistics, or locating a new store unit. To come up with a good decision, multiple alternatives are to be exposed and evaluated.

One important thing significantly affecting this framework is the states of nature. Due to its unpredictable nature this element reflects the level of uncertainty inherent in the decision outcomes. For example, if there is an action of a competitor that is unexpected, then a new outcome should be set up to cope with it. This implies there can be multiple outcomes to given criteria.

MCDM problem can be classified into two, multiobjective decision making(MODM) and multiattribute decision making(MADM), along their major components by which decision analysis is done. In case of MODM, decision is based on how well the one or many objectives are satisfied. Thus, only attributes corresponding to the objective(s) are considered. Whereas, in MADM, all the attribute is considered and evaluated for each alternative with respect to a given set of evaluation criteria. In fashion marketing terminology, the alternatives may be geographic locations of store units, policies or strategies regarding customer management, delivery logistics, or allocation of local customers to a certain store unit. Thus, MCDM as a heart of fashion marketing tool can be thought of as a procedure that aggregate, transform, classify, or simulate spatial and aspatial data to acquire resultant decision achievement. It transforms multidimensional digital map along with geocoded marketing data into unidimensional values of outcomes, where decision maker's preferences may be involved in the form of decision rules. Here, as we already explained, event tables and product attribute tables may be geocoded against the digital map, which are linked with census data as well.

MADM approach

Provided a set of attributes corresponding to each alternative is explicitly specified, an alternative X is defined by attributes or decision variables as follows (Malczewski, 1999):

$$X = [x_{i*} \mid i = 1, 2, 3, \ldots, m]$$

where, i indicates location of the alternative(Table 1). As we put a criterion outcome x_{ij}, which means an outcome corresponding to <u>*ith*</u> alternative and <u>*jth*</u> attribute, an alternative i and attribute j can be expressed as vectors,

$$x_{i*} = (x_{i1}, x_{i2}, x_{i3}, \ldots, x_{in})$$
for i = 1,2,3,...,m

$$x_{*j} = (x_{1j}, x_{2j}, x_{3j}, \ldots, x_{mj})$$
for j = 1,2,3,...,n

The decision matrix for MADM is expressed in Table 1 of which dimension is $m \times n$. This table, sometimes is called impact matrix, shows relationships between alternatives and attributes with respect to evaluation criteria.

As in other statistical analysis, dependency between alternatives is assumed to be zero. Based upon such decision matrix, decision can be made using the

Table 1. Matrix of the Attribute- Alternative Relation for a MADM problem (Malczewski, 1999)

	Attribute 1	*Attribute 2*	...	*Attribute n*
Alternative 1	x_{11}	x_{12}	...	x_{1n}
Alternative 2	x_{21}	x_{22}	...	x_{2n}
...	...	...	...	...
Alternative m	xm_1	xm_2	...	x_{mn}

following rule:

$$[x_{i1}, x_{i2}, x_{i3}, \ldots, x_{\in} | x_{i*} \in X, i = 1, 2, 3, \ldots, m]$$

This means applications of a certain decision rule to each alternative and corresponding attributes gives the most appropriate conclusion(i.e. alternative) as an output. As for rules to be applied several methods, such as simple additive weighting method, value/utility function method, analytic hierarchy process, ideal point method, concordance method, fuzzy aggregation method may be possible.

MODM approach

Compare to the MADM, this approach considers one-to-one, one-to-many, and many-to-many matching between objective(s) and attribute(s). Attributes are appeared as sources for decisions to actualize the objectives. Thus, distinction between attributes as decision variables and decision criteria is required.

If we put an objective as $k(k = 1,2,3,\ldots,q)$ it is involved with one or multiple corresponding attributes $k(k \in \{1,2,3,\ldots,n\}$. By setting the attribute-objective relationship as f_{ij}, then corresponding vectors are as follows(Malczewski, 1999):

$$f_{i*} = (f_{i1}, f_{i2}, f_{i3}, \ldots, f_{iq})$$

for i = 1,2,3,...,m

$$f_{*j} = (f_{1j}, f_{2j}, f_{3j}, \ldots, f_{mj})$$

for j = 1,2,3,...,q

where, i indicates location of the alternative. From this equation, each alternative is evaluated for selected objectives, where each objective is related with one or multiple attributes. Tabular form of the objective-alternative relation is expressed in Table 2.

Table 2. Matrix of the Objective-Alternative Relation for a MODM Problem (Malczewski, 1999).

	Objective 1	*Objective 2*	...	*Objective q*
Alternative 1	f_{11}	f_{12}	...	f_{1q}
Alternative 2	f_{21}	f_{22}	...	f_{2q}
...	...	...	...	...
Alternative m	f_{m1}	f_{m2}	...	f_{mq}

Like the MADM, in this matrix we need to evaluate each alternative considering linked objectives. Thus, the formal decision rule is as follow:

$$[f_{i1}, f_{i2}, f_{i3}, \ldots, f_{iq} | x_{i*} \in X, i = 1, 2, 3, \ldots, m]$$

Similar to the MADM, several different kinds of multiobjective decision rules can be applied to get correct decision, such as value/utility function method, goal programming, interactive programming, comprise programming, data envelopment analysis.

5. Implementation issues

One of the most challenging aspects in implementing the DSS based on GIS is the integration of heterogeneous form of spatial and aspatial data from different sources(Oh, 2002)12). In addition, system interoperability problem makes the situation even worse. Considering the diversity of data from marketing consultancy or sometimes by second party providers(i.e. proprietary format of internal reports and marketing intelligence) as well as system architecture based on it, it seems not easy to accomplish a fully integrated system. It may require many facets of technological supports including data warehousing.

A a general step, loose-coupling between the fashion marketing DSS and GIS may be realistic in practice. Simply speaking, reinforcing user interface by allowing easier data mining, displaying, and transforming would be the tool that is meaningful in this step. In the long run, however, the two systems would be fully integrated and work in complete functionalities as they might. For the time being customizing, i.e. user-friendly programming features, may play a key role for augmenting the coupling between systems.

6. Conclusions

Throughout this paper, we have tried to reveal how GIS capabilities be applied to fashion marketing decision making problems. From provoking several questions on current fashion marketing DSS to explaining MADM and MODM as tools for decision making analysis and discussing some implementation issues, this paper revealed many facets of GIS and fashion marketing DSS from integration point of view. We would like wrap up this paper by highlighting some implications based on our discussions so far.

First of all, it should be fully recognized among fashion marketing decision makers that traditional DSS can be reinforced by introducing geographic dimension into the marketing information. It allows ever-expanded perspective analysis on customer as spatial interaction with marketing events is revealed and systematically analyzed. Powerful data integration and mining along with display and simulation capabilities that are provided by GIS enhance such trend.

Next, there need continued researches on applications of MCDM framework to fashion marketing decision schema. Especially, MODM and MADM approaches are required to be elaborated to fit the six components into fashion marketing decision schema; goals, decision makers, evaluation criteria, decision alternatives, states of nature(environment), and sets of outcomes.

Lastly, standardization effort to enhance sharing heterogeneous marketing data of proprietary format needs to be continued. For example, during geocoding, address of customers and marketing events are matched against digital maps based on coordinates or postal codes. To increase efficiency and matching accuracy standardized format of address coding is required among marketing vendors.

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