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A GDSS FOR RANKING A FIRM'S CORE CAPABILITY STRATEGIES

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ABSTRACT

Strategic management is a key activity for organizations' ability to sustain competitive advantages in the long-term. It is crucial for enterprises to optimize their strategies in order to build unique competencies. However, the complex and uncertain environment of modern organizations create difficulties in the evaluation of relevant factors while formulating strategies. In addition, most firms lack cognition and consensus in developing their core capabilities which are vital to attaining competitive advantage. Hence, it is necessary to find more efficient ways by leveraging information technology. Specifically, these problems can be solved by implementing IT-based group decision support systems (GDSS), which are rarely explored. Therefore, the study develops a group decision support system in which the cluster analysis, genetic algorithms, and Analytic Hierarchy Process are used to help managers make key decisions. The system provides a flexible and user-friendly environment to help top management and other relevant staff to evaluate all relevant factors in formulating development policies for core capabilities. Furthermore, in the case study of the GDSS, the participating managers view it as a useful and user-friendly approach to facilitate this task.

Keywords: Core capability, Strategic business unit, Strategic business area, Value chain, Analytic hierarchy process, Genetic algorithm.

INTRODUCTION

Developing core capabilities is the process of determining appropriate courses of action for firms striving to formalize a strategy in order to create and sustain competitive advantage [1,12,50,53]. A firm's core capabilities encompass the concept of core competence [19], and as Ansoff and McDonnel [5] argued, it is clear that the firm's ability to move into new business areas depends on its capability to perform successfully in these areas. Furthermore, strategy and capability have a "chicken and egg" relationship and must support each other.

Furthermore, highlights of strategic management focus on understanding sources of sustained competitiveness [8,49]. Firm's policymakers invariably search for the factors of competitive advantage in the strategic planning process. The critical factors of sustained competitiveness include the relative capability development of a firm [26] and a firm's ability to differentiate its products [26,59]. Thus it can be seen that core capabilities not only guide the firm's strategic direction but also highly influences the firm's growth and competitive advantage.

There are several studies exploring the importance of capability in the firm, in which knowledge management capability [9,37], technological capability [39,44,46,51], innovative capability [56], dynamic capability [38,55], and core capability [65] are examined. The collection of these studies emphasize capability, embodied in multiple domains, as a dominant effect on business performance.

When a capability is valuable, rare, imperfectly imitable, and with no strategically equivalent substitutes, it is said to have strategic potential, thus becoming a core capability with potential for creating competitive advantage [7,15]. Hence, the firm's core capabilities surpass other capabilities and possess a critical role within strategic management. The scope of core capability extends from the hidden strengths of the firm as far as the customer's perception [47]. How a company leverages its resources depends on the company's capabilities that allow it to exploit its resources [25]. However, in reality, not every firm can make the best use of its resources. Even though a firm may have an excellent level of resources, weakness in the firm's capability detracts from its ability to exploit such resources. Thus, the effect of core capability has a comprehensive level and determinant factor on a firm's performance.

A firm's differentiation strategy is usually focused on developing core capabilities. Core capabilities are "capabilities that differentiate a company strategically, fostering greater benefit in competitive firms" [33]. Furthermore, capabilities refer to a company's skills at coordinating its resources and putting them to productive use [21]. Ansoff and McDonnell [5] advanced a theory that there are two types of capability: functional (marketing, production, research and development, etc.) and general management capability (management of growth, diversification, and acquisition). The building blocks of functional capability are the same: skills, technology, facilities, equipment, shared knowledge and know-how. Three general management capability attributes are climate, competence, and capacity [5]. In sum, it takes capability to administer a company and core capability is in widespread use of any functional department of a firm. Thus, managers usually are confronted with the challenge to identify, develop, protect, and deploy resources and capabilities in ways that create sustainable competitive advantage [2].

As Hafeez et al. [18] point out, "by fully exploiting its core competencies the firm can establish competitive advantage in the marketplace. In our view the process of core competence identification is to start with the key capability analysis." The first and foremost step for firms is to mine and identify their core capabilities in order to develop their strategy. The increasing challenges of a highly turbulent environment especially pose difficulty for firms to allocate their resources optimally; these trials can inhibit development of the necessary capabilities to pursue a good strategic position.

In turbulent environments consisting of dynamic markets, complex organizational structures, and chaotic technology in-

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novation, information technology (IT) has become an essential tool for firms to attain better competitive positions [14,41] and a driver of business strategy [52]. Andreu and Ciborra's [4] research shows how IT can contribute to core capability formation in a firm and thus become an active part of the firm's competitive advantage. In general, IT is valuable to offer potential benefits ranging from quality improvement to cost reduction [40], and IT investments can contribute positively to the productivity growth [23]. IT can also provide information across functional levels and improve the firm's performance [6]. Among IT tools, decision support systems (DSS) are suitable for capability formation in a firm's strategic information systems planning.

A DSS has the properties of being an interactive, flexible, and adaptable computer-based information system, and it is specially developed for improving decision-making in solving unstructured management problems. The greatest advantage of DSS is to utilize data effectively and to provide an easy-to-use interface to allow for the decision-maker's own insights [62]. However, most DSS studies have focused on the fields of organizational knowledge acquisition [32], research and development project selection [60], portfolio selection [11,34,35], negotiation [57], marketing [16,67] and computer literacy training [58]. But the problem of how to apply DSS to core capability formation in support of top management is seldom discussed.

Given the importance of capabilities for a firm's strategy development, it is urgent to create user-friendly, efficient, and effective tools that allow firms to further explore and develop core capabilities. The aim of the paper is to provide a system for a firm's core capability development by using existing decision algorithms and IT software systems. This paper particularly focuses on the question of how firms can actually identify core capabilities and thus develop their strategies.

An integrated framework for core capability formation is proposed by taking advantages of the characteristics of some existing methods, which include cluster analysis, electronic focus group, and Analytic Hierarchy Process based on Genetic Algorithm (GA-AHP). Based on Turban's key concepts of DSS [62], a system for core capability formulation is developed in this paper to help managers systematically and scientifically make decisions for strategic formulation.

The paper is organized as follows. In section 2, relevant concepts and techniques include the strategic business unit (SBU) and strategic business area (SBA) concept, cluster analysis, electronic focus group, value chain, GA-AHP, and strategic information systems planning are introduced. Section 3 proposes a GDSS architecture for the selection of core capability development plan. In section 4, GDSS is presented to illustrate the proposed integrated approach. In section 5, the field test for the system is demonstrated. In section 6, a case study is employed as an example to illustrate the proposed integrated approach. Finally, section 7 concludes the paper.

RELEVANT CONCEPTS AND TECHNIQUES

The strategic business unit (SBU) and strategic business area (SBA)

Generally, most research in strategic management regards SBU as the study unit [22,27,29]. However, the idea of SBU usually only separates in products and markets. According to Ansoff and McDonnell [5], "The strategic decision made by these new SBUs were 'crosswalked' for implementation to the departments. To avoid such duality of strategic responsibility, the General Electric Company used a different solution. It undertook the difficult task of matching existing operating units to the firm's SBAs, thus making their SBUs responsible not only for strategy planning and implementation, but also for subsequent profit making." Based on Ansoff and McDonnell's concepts of SBU and SBA, in strategic planning it is desirable to reorganize a firm according to SBAs. Furthermore, the SBAs should be identified and analyzed without any reference to the firm's structure or its current products. The outcome of such analysis is the set of growth, profitability, turbulence, and technology prospects which the SBA will offer to any future competitor of competence [5]. Hence, this study will focus employing a firm's SBAs to develop strategy and further, employ cluster analysis to group the SBAs.

Cluster analysis

Cluster analysis has been widely used in business, social science, genetics, biology, and education to separate elements into groups by implementing different concepts or algorithms. For example, Wallace et al. [64] performed cluster analysis to identify the aspects of low, medium, and high risk projects by using the *k*-means algorithm. Additionally, Kuo et al. [30] applied neural networks and genetic algorithms in cluster analysis to analyze the browsing preferences of customers in electronic commerce. According to the data pattern and similarity, there are various kinds of cluster analysis that can be used. The existing popular methods could be divided into the following four: Partition Clustering, Hierarchical Clustering, Density-based Clustering, and Grid-based Clustering [3,20]. Among these methods, the partitioning around medoids (PAM) algorithms can handle various attribute types and works satisfactorily for small data sets [28,43]. In this study the characteristics of cluster decision incorporate multiple attributes and few data sets. Hence, we will adopt PAM algorithms to cluster the SBA in a firm.

Electronic focus group

Focus groups are relatively small, moderated discussion groups that concentrate on a particular topic [13]. However, traditional focus groups suffer from some limitations. Thus, new techniques such as electronic support not only help to reduce these limitations but also lower costs and increase quality. For example, the World Wide Web has allowed the participants to convene and discuss topics of interest regardless of geographic location. Our GDSS is designed using a web-based framework in order to leverage the Internet to conduct focus groups that help determine a firm's core capabilities worthy of development.

Value chain

A value chain [48] is a model for depicting the value-added activities in an organizational process [10]. This model is a systematic means of examining all the activities a firm performs. In addition how the activities interact provides keys to analyze the firm's sources of competitive advantage. It is therefore useful to examine the value chain when determining a firm's core capabilities. Hence, in the GDSS framework, the value chain is introduced to map core capabilities onto each activity.

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Analytic Hierarchy Process based on genetic algorithm (GA-AHP)

The Analytic Hierarchy Process (AHP) is a powerful approach to the process of group decision-making, particularly when applied to help people set priorities and make the best decision when both qualitative and quantitative aspects of a decision need to be considered [54]. AHP has been utilized successfully to solve economic, political, social, and technological problems in the group decision-making process [63]. It is a useful tool for business research, as shown by Hafeez et al. [18] who used AHP to determine the key capabilities of a firm. Besides, Tsai et al. [61] performed AHP to assess the relative importance weights of Enterprise Resource Planning systems performance measurement. Further evidence comes from Liu and Shih [36], who applied AHP to determine the relative weights of recency, frequency, and monetary variables in evaluating customer lifetime value or loyalty.

However, AHP has been criticized since synthesis weight may not reach a consensus. Thus, Yeh et al. [66] proposed a consensus approach to provide necessary information generated by the genetic algorithm to help decision-makers adjust their judgment. This study will utilize GA-AHP to solve multicriteria decision-making problems.

The following is a detailed description of the steps of GA-AHP [66]:

Step 1: Carry out pairwise comparisons

Step 2: Assess the consistency of pairwise judgments

Step 3: Compute the relative weights
Obtain a solution set (w_{ri}, $r = 1, 2 \cdots, n$) of the synthesis weights by GA using the following mathematical programming.

$$\text{Min} \quad \sum_{i=1}^{n} d(w, w_i') = \sum_{i=1}^{n} \sqrt{\sum_{r=1}^{R} (w_i' - w_{ri})^2} \qquad (1)$$

Subject to

$$CI_i < 0.1 \qquad i = 1,2,\cdots,n \qquad (2)$$

$$w_{ri} = \left(\prod_{j=1}^{n} a_{ijr} \right)^{1/n} \Big/ \sum_{i=1}^{n} \left(\prod_{j=1}^{n} a_{ijr} \right)^{1/n} \qquad (3)$$

The objective function, (1), is used to find a set of new weights (w'_i, $r = 1, 2 \cdots, n$), which are the nearest values to the original weights directly derived from the comparison matrix completed by decision makers. The total distance between the original and synthesised weights is measured by taking the square root of the total square deviation between them. The first constraint, inequality (2), hinders the original weights (w_i) of the inconsistent comparison matrix being taken into the objective function. The second constraint, equality (3), is the relationship between the weights (w_i) and the element (a_{ij}) in the comparison matrix. Using the GA, the above mathematical programming yields many approximately-optimal solutions; the selective options in the synthesis process will refer to these solutions.

Step 4: Implement the genetic algorithm

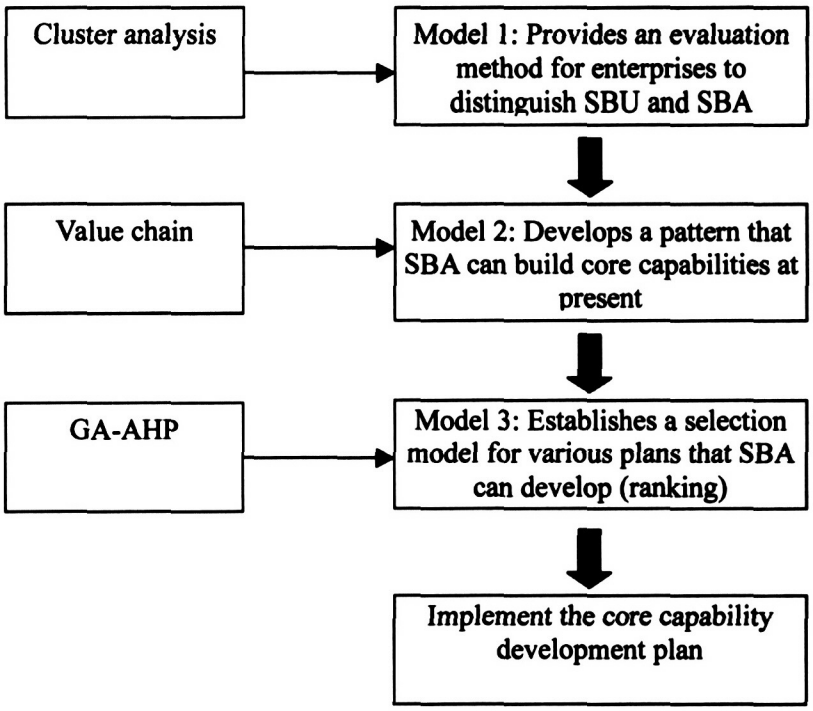

Figure 1. A conceptual framework of this research

Strategic information systems planning

Strategic information systems planning (SISP) is a process of determining a portfolio of computer-based applications to help an organization accomplish its business objectives [31]. Firms always search for new ways to utilize information, knowledge, and IT in supporting strategic goals and business competitiveness. Accordingly, SISP has been shown to be a good way for firms to develop their overall strategies and procedures for integrating, coordinating, controlling, and implementing the IT resources they need to succeed in today's highly competitive environment [17,42,45].

CONCEPTUAL FRAMEWORK

The decision-making problem studied in this paper concerns the determination of a core capability development plan from an SBA viewpoint. A group decision support system (GDSS) is proposed to facilitate firms' identification of core capabilities (see Figure 1). Conceptually, our approach for core capability selection in the GDSS consists of a three-phase process: (1) cluster analysis to segment SBU and SBA, (2) identification process for the core capabilities which are determined via an electronic focus group, (3) establishment of a prioritized list of core capabilities by using the GA-AHP algorithm.

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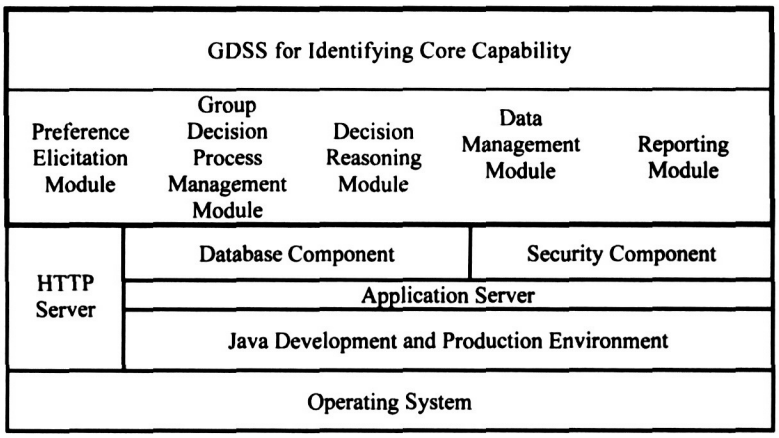
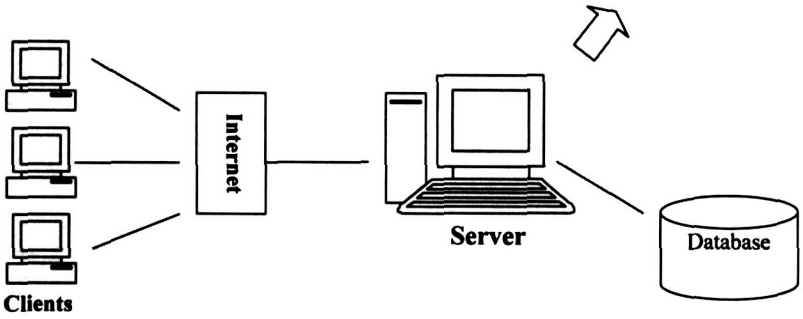


Figure 2. System Architecture



GROUP DECISION SUPPORT SYSTEM DESIGN

The IEEE Guide to Software Design Descriptions [24] recommends that a software design be described from four views. The Decomposition View describes how a system is decomposed into modules or components. The Dependency View describes the hierarchy and interaction between modules or components. The Interface View describes the user interface and system interface, as well as related protocols. The Detailed Design View describes how each module or component works. The description of the GDSS design in this study will follow the IEEE guideline.

Decomposition View

A decomposition view is highlighted with a system architecture. The GDSS system architecture is shown in Figure 2.

The GDSS will be Web-based client-server system that consists of the following components:

Operating system: To support multi-tasking initiated by decision-making participants. Must be equipped with a Web-browser to support a unified user interface.

HTTP server: To support data transfer between clients and servers on the Internet.

Database server: To support database management and answer to user or application requests.

Model base server: To support model base management and to answer application requests. Models included in the model base are highlighted in Table 1 through Table 3.

Application server: To coordinate application processes and to answer user requests.

Preference elicitation module: To collect preferences from the decision-making participants.

Group decision process management module: To monitor system states and coordinate other modules' operation.

Reporting module: To output inference or analysis results produced by other modules.

Data Management Module: To store and manage data relevant to the decision-making process, including participants' background information.

Decision Reasoning Module: Perform the model base functions such as data analysis and inference, provide explanation about the inference process, and provide suggestions on alternatives.

Dependency View

The interdependency of system components is shown in Figure 3, which is self-explanatory.

One function of the group decision process management module is to collect the off-line information for subsequent modules. The other function of the module is to offer a GDSS facilitator access to make orders to preference elicitation module, decision reasoning module, data management module, and reporting module. In order to provide users with a flexible application system, the proposed core capability selection prototype is designed to be user-expandable through an application interface. The actors include top management, electronic focus group facilitators, and GDSS facilitators. Building upon the information collected by the group decision process management module, the preference elicitation module can then offer top management a set of user-friendly interfaces. Each manager inputs data by interacting with the preference elicitation module interface. The data is then transferred to the data management module.

The decision reasoning module has three functions: (1) segmenting the firm's environment into SBAs by using cluster

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TABLE 1
Highlight of Model I

Objective	To separate the SBU and SBA of business
Input data	[1]*Step 1*: Measurement of the SBA variable in the main dimensions: growth, profitability, turbulence, and technology [2]*Step 3*: The score evaluation for each SBU according to each sub-item (such as demand stage)
Output data	[3]*Step 1*: The sub-item of four SBA variables in the main dimensions: demand stage, buying power, competitive structure, and distribution system [4]*Step 5*: The result of cluster analysis and the best fitting clusters of SBA [5]*Step 6*: The list of the SBAs
Participant	1. Electronic focus group facilitator 2. GDSS facilitator 3. Top management
Method	1. Electronic focus group 2. Cluster analysis

Note: the numbers appeared in Table 1 are corresponding to which were showed in Figure 4.

TABLE 2
Highlight of Model II

Objective	To identify the core capabilities being developed at present for the SBA unit
Input data	[6]*Step 1*: The result of cluster analysis in Model I [7]*Step 2*: Porter's value chain [8]*Step 3*: Core capability value chain
Output data	[9]*Step 2*: The list of the core capabilities of the value chain [10]*Step 3*: The result of electronic focus group [11]*Step 4*: The list of core capabilities being developed at present such as information technology, marketing, and human resources
Participant	1. Electronic focus group facilitator 2. GDSS facilitator
Method	1. Electronic focus group 2.Porter's Value Chain [48]

Note: the numbers appeared in Table 2 are corresponding to which were showed in Figure 6.

TABLE 3
Highlight of Model III

Objective	To identify the importance ranking of core capabilities being developed at present for the SBA unit
Input data	[12]*Step 1*: Core capabilities being developed at present such as information technology, marketing, and human resources (the result of model II) [13]*Step 4*: Importance evaluation (score evaluation) for core capabilities being developed at present based on the evaluation items such as differentiation, competitive advantage, opportunity creation, and control
Output data	[14]*Step 2*: The list of evaluation items for core capabilities [15]*Step 6*: The result of GA-AHP [16]*Step 7*: The list of the importance ranking of core capabilities being developed at present for SBAs
Participant	1. GDSS facilitator 2. Top management
Method	GA-AHP

Note: the numbers appeared in Table 3 are corresponding to which were showed in Figure 8.

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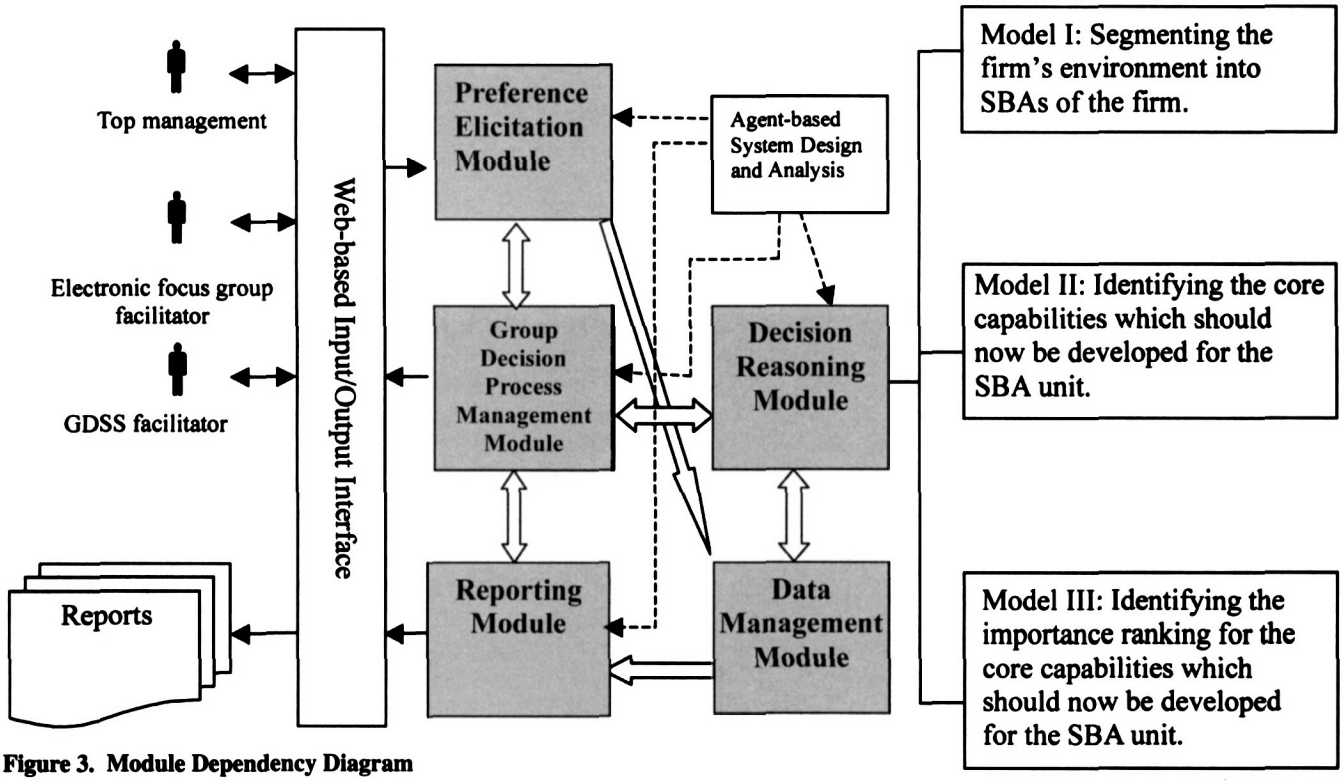

Figure 3. Module Dependency Diagram

analysis in model I (for example, see Table 4), (2) identifying the core capabilities which should be developed for the SBA unit by using an electronic focus group in model II (for example, see Table 5), (3) identifying the priorities for the core capabilities which should be developed for the SBA unit by using GA-AHP in model III. The decision reasoning module performs the model base functions to provide suggestions on alternatives and the data management module stores and manages relevant data. Through the group decision process management module, the GDSS facilitator makes orders to the reporting module for managing the report generation and distribution process. The reporting module provides several types of results, which include scatter plot and table formats.

Interface View

The interface view is described in terms of actors and interface mechanism:

(1) The actors

Electronic focus group facilitator: The GDSS calls upon firm experts to generate ideas and suggestions, to record attitudes and perceptions, to identify sub-items of a construct for analysis, and to strengthen the assessment capability of the system for external environmental analysis.

Top management: Their primary function is to rank preferences on the analysis results of the Preference Elicitation Module.

GDSS facilitator: The facilitator controls the schedule and progress of the group decision making process as well as assures the security and integrity of the data inputted to the system.

(2) The man-machine interfaces

The man-machine interface is Web-based and interactive. Intelligent agent (IA) techniques are used to facilitate the interaction between the DSS and the users, and to reduce redundant data entry. An IA is a software program that helps a user to complete certain tasks. It has the features of independency, non-obtrusiveness, single-mindedness, capability to learn, and interactivity. An IA supports users in information browsing and extraction, decision support, and employee empowerment; it also handles repetitive or routine work, information search, retrieval, selection, dissemination, and expert tasks.

Detailed Design View

In this section, the interactions between the actors, models, modules, and algorithms will be described in detail.

The process enacted by Model I

The main task of Model I is to cluster the SBAs and SBUs of a firm (see Figure 4).

TABLE 4
Example of SBA and SBU

Which SBU	Cluster of SBA	Clustering factors
SBU1	SBA1 SBA2 SBA3	Based on the factors of growth, profitability, turbulence, and technology.
SBU2	SBA4 SBA5	

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TABLE 5
Example of the core capabilities mapped onto each activity of value chain

Activity of Value Chain	Description of relevant core capability	Relevant core capability
Inbound Logistics	Core capabilities associated with receiving, storing, and disseminating inputs to the product.	● Relationship with suppliers ● Logistics management system ● Materials management system ● Automation of warehouse
Operations	Core capabilities associated with transforming inputs into the final product form.	● Equipment ● Quality management ● Integrated ERP
Outbound Logistics	Core capabilities associated with collecting, storing, and physically distributing the product to buyers.	● Logistics management system ● Automation of order process
Marketing and Sales	Core capabilities associated with providing a means by which buyers can purchase the product and encouraging them to do so.	● Marketing strategy ● Brand loyalty ● E-commerce ● Sales capability ● Price competitiveness
Service	Core capabilities associated with providing service to enhance or maintain the value of the product.	● Customer management system ● Service quality

In step 1, the factors of growth, profitability, turbulence, and technology proposed by Ansoff and McDonnell are used as constructs to conduct cluster analysis. The electronic focus group facilitators direct a discussion for determining the SBA measurement variables. In step 2, the GDSS facilitators input the subitem names by the interactive discussion of experts. In step 3, the Preference Elicitation Module helps top management rank preferences on evaluation items for each SBU. In step 4, the GDSS facilitators ensure that all top managers have given their preference scores on the evaluation items in their respective lists. The Group Decision Process Management Module is exercised to support the session activities. In step 5, the Decision Reasoning Module will be activated to process the data, using cluster analysis. In step 6, top management confirms the result of cluster analysis and denominates various clusters as SBA1, SBA2, etc. The result is then reported back to the actors through the Reporting Module (see Figure 5).

The process enacted by Model II

Model II is used to identify core capabilities which should be developed by the firm (see Figure 6).

In step 1, the inputs are the respective SBAs from the result of Model I. In step 2, the GDSS facilitators use Porter's value chain [48] to map the core capability for each activity in the value chain, storing the results in the Data Management Module. In step 3, the electronic focus group facilitators preside over an interactive discussion with all experts for core capabilities to be developed; following, the Decision Reasoning Module is activated to process the lists of results. In step 4, the electronic focus group facilitators input the results of the interactive discussion with experts and the Group Decision Process Management Module is exercised to support the process. The result is then reported back to the actors through the Reporting Module (see Figure 7).

The process enacted by Model III

Model III is used to identify the importance of core capability which should be developed for the firm (see Figure 8).

In step 1, the inputs are the list of core capabilities which are generated in Model II. In step 2, top management is gathered to interactively discuss evaluation of items and the results are stored in the Data Management Module for further processing. In step 3, the GDSS facilitators confirm the available evaluation items which are used to evaluate core capability. The Group Decision Process Management Module is exercised to support the activity. In step 4, top management gives preference scores on the evaluation items of core capability. The Preference Elicitation Module helps each top manager to determine the preference scores in this step (see Figure 9).

In step 5, the GDSS facilitators ensure that all top managers have given their preference scores, and the prioritized lists are stored in the Data Management Module for further processing. In step 6, the Decision Reasoning Module will be activated to process the preference scores offered by top management to produce one single prioritized list of core capability, which is derived by using the GA-AHP algorithm. In step 7, the GDSS facilitators confirm the results. The results are then reported back to the top management through the Reporting Module (see Figure 10).

FIELD TEST FOR THE SYSTEM

The proposed integrated approach has been discussed with the top management of two firms in southern Taiwan. First we show the fundamental concept framework and system architecture, then we detail the procedural flows to demonstrate how it functions. Finally, graduate students act as the managers to execute the system based on a scenario. The top management of these two firms expressed the usefulness of the system in facilitating the complex processes. However, they suggested the need for

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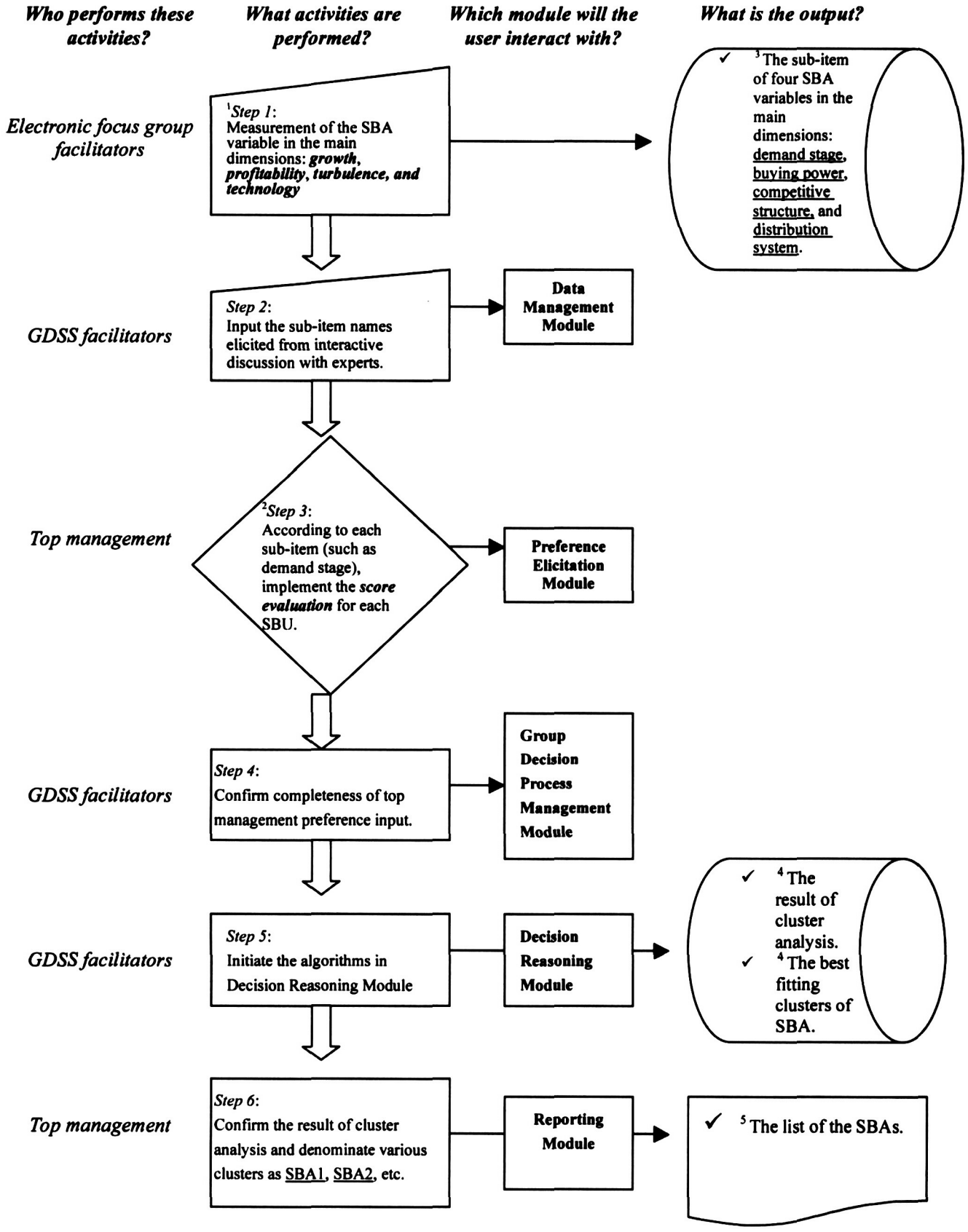

Figure 4. Proceedure of Model I

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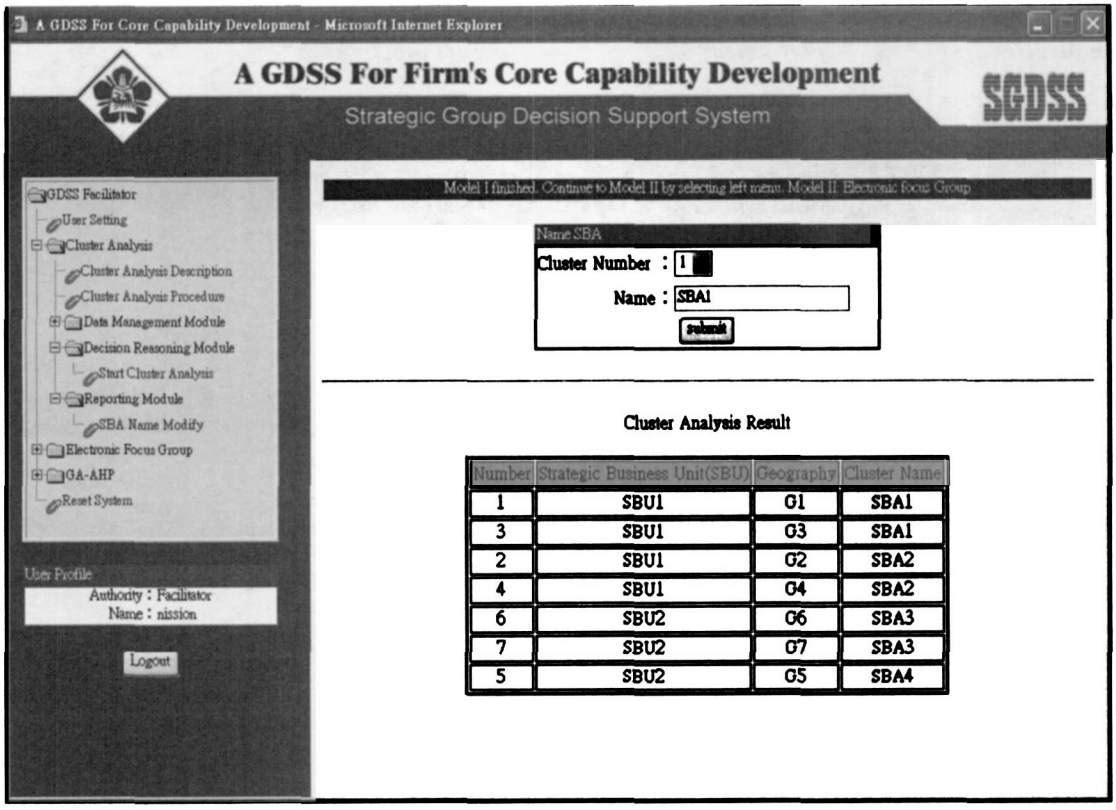

Figure 5. The result of cluster analysis

TABLE 6
Three top management executives' assessment

Evaluator	General manager							R&D manager							Marketing manager						
SBU	SBU1			SBU2				SBU1			SBU2				SBU1			SBU2			
Region	G1	G2	G3	G4	G5	G6	G7	G1	G2	G3	G4	G5	G6	G7	G1	G2	G3	G4	G5	G6	G7
Demand stage	5	4	6	4	6	6	4	4	5	6	4	7	3	4	4	5	6	3	6	3	4
Market size	5	4	4	3	5	5	5	3	6	6	5	5	3	3	5	6	6	4	6	4	4
Buying power	4	2	5	4	5	5	4	4	4	5	4	5	4	4	4	6	5	3	7	4	5
Buying behavior	5	2	5	5	6	6	4	4	4	5	5	6	4	3	4	7	4	5	6	3	4
Competitive structure	4	4	5	4	4	4	5	4	3	6	4	6	3	4	5	5	6	4	5	4	4
Competition intensity	5	4	4	3	6	3	4	4	5	6	4	7	5	4	4	4	7	4	4	6	5
Economic	5	4	6	5	6	4	4	4	7	4	4	5	2	5	3	5	6	3	4	5	4
Technological	6	3	5	5	5	3	5	2	7	5	5	5	6	4	4	3	4	4	6	5	4
Innovative capability	7	5	7	4	5	4	6	4	6	6	6	4	5	4	5	6	3	3	5	6	5
R & D rate	5	4	7	4	4	3	7	4	6	5	4	6	4	2	4	6	6	5	6	3	7

1-worst, 2-worse, 3-bad, 4-average, 5-good, 6-better, 7-best

more detailed contents in the menus for alternatives of strategy, domain of value chain activities, and criteria used in separating the business units; specifically, they suggested that these options should be provided based on the specialty of the firms. Based on the comments, we expanded the menu contents and created a new function that allows an actor to select or add items to the menus. The improved flexibility of the system, thus, provides a more customized solution to match the specialty of the firms.

CASE STUDY

In order to evaluate the applicability of the proposed approach, the revised system was taken to a software company for a real test. The case firm likes to find appropriate core capabilities and develop them. Thus, the proposed integrated approach was used to assist the determination of core capabilities. The implementation procedure contained three phases and involved an evaluation team. The evaluation team included the case firm's three top management executives; a general manager, an R&D manager, and a marketing manager. Two experts from the case firm organized electronic focus group facilitators, and one information director acted as the GDSS facilitator. The functions of the GDSS facilitator in the implementation procedure include data-input and data collection, management of the group process, and promotion of effective task behaviors. The following are the implementation tasks for each phase.

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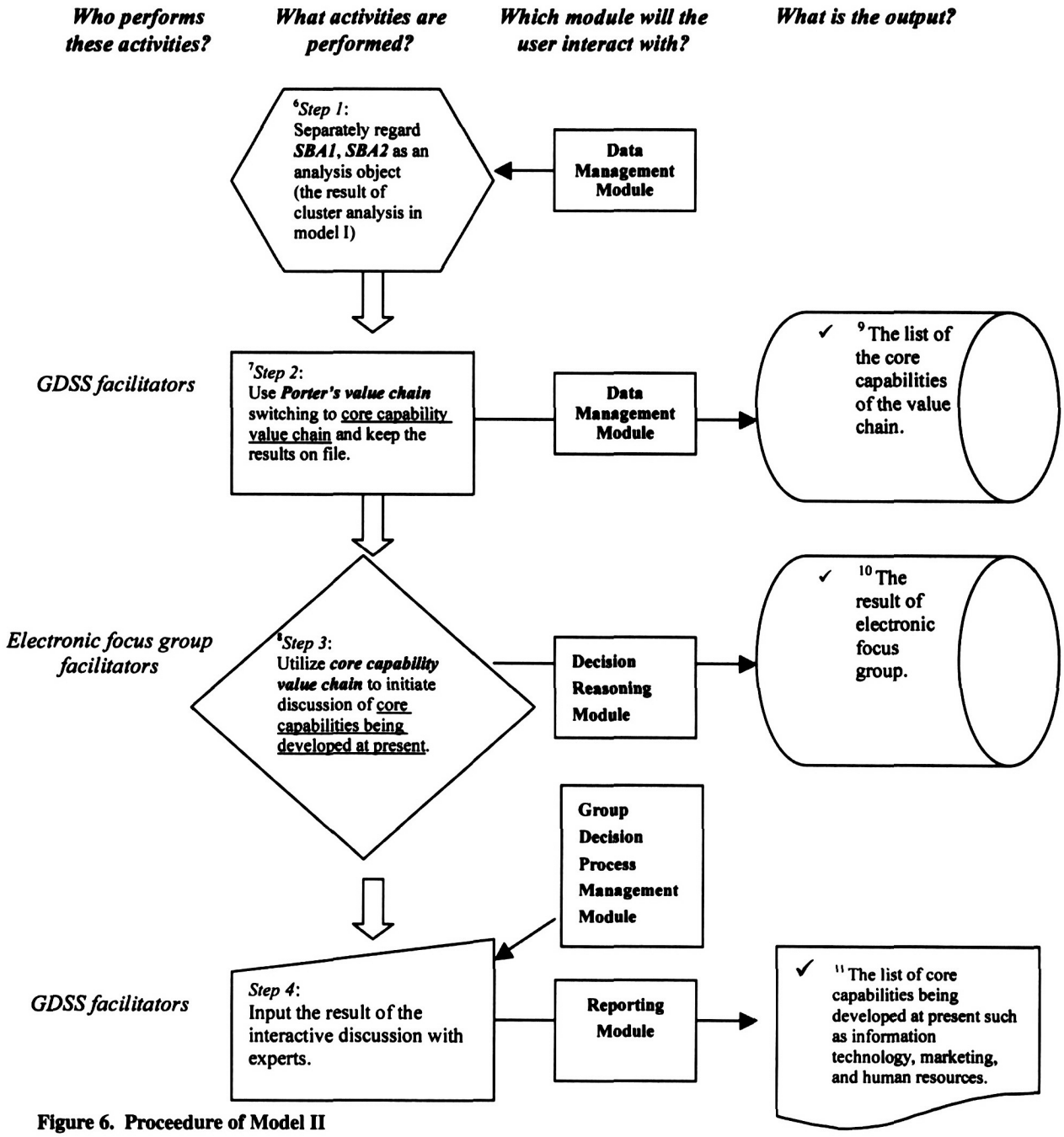

Figure 6. Proceedure of Model II

Phase 1

The case firm runs two strategic business units: SBU1 and SBU2. Among them, SBU1 has three geographic regions: G1, G2, G3, and SBU2 has four geographic regions: G4, G5, G6, G7.

Step 1: Firstly, the electronic focus group facilitators set the main dimensions for evaluating SBA; they are growth, profitability, turbulence, and technology. Then, they decide sub-items from the main dimensions. In growth, the sub-items are demand stage, market size, and buying power. In profitability, the sub-items are buying behavior, competitive structure, and competition intensity. In turbulence, the sub-items are economic and technological. In technology, the sub-items are innovative capability and R&D rate.

Step 2: Firstly, the GDSS facilitator chooses SBU1 and SBU2 for cluster analysis. Secondly, he selects the business geographic regions of SBU1 and SBU2 and, thirdly, he selects top management for evaluation. Fourthly, he inputs the main dimensions and the sub-item names elicited from an interactive discussion with experts. Lastly, a cluster analysis evaluation table was developed (see Figure 11).

Step 3: According to every SBU's business geographic region in each assessing item, including demand stage, market size, buying power, buying behavior, competitive structure, competition intensity, economic, technological, innovative capability, and

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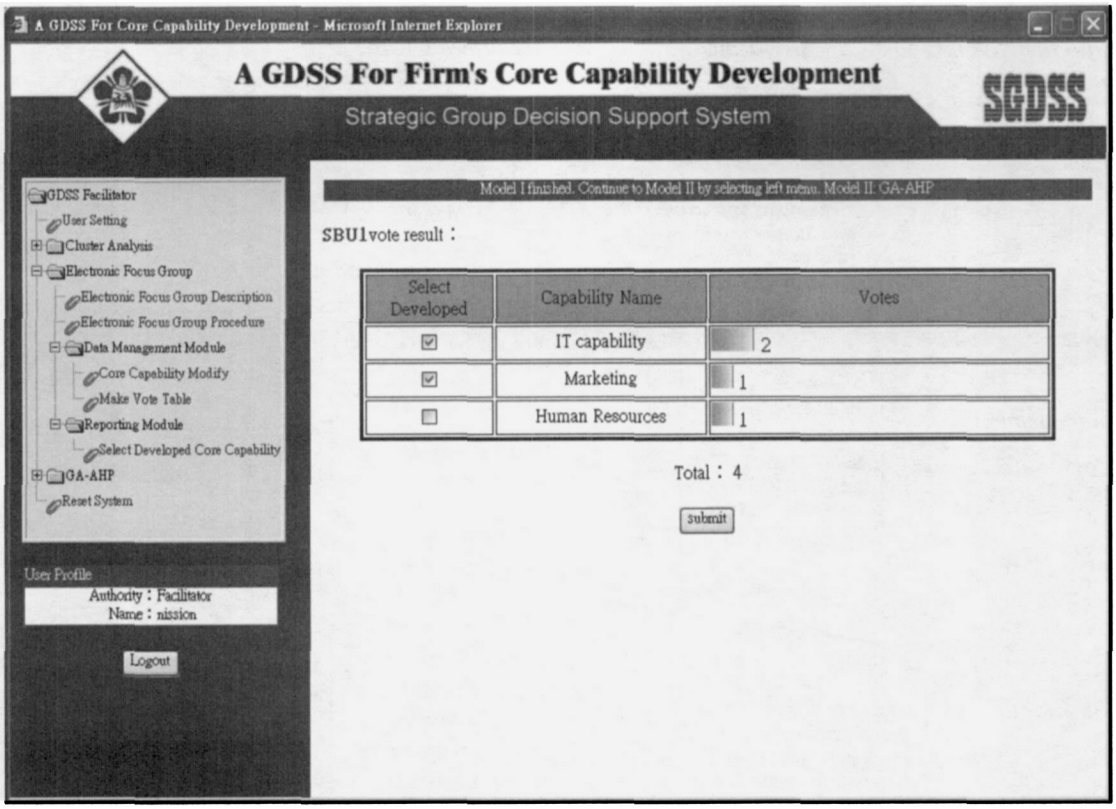

Figure 7. The result of electronic focus group

R&D rate, top management takes part in the assessment according to their level of importance (see Figure 12). The three top management executives' assessment is shown in Table 6.

Step 4: The GDSS facilitator confirms completeness of top management preference input.

Step 5: The GDSS facilitator starts cluster analysis.

Step 6: Top management confirms the result of the cluster analysis and denominates various clusters. Among them, SBU1's G1, G2 was divided into SBA1, SBU1's G3 was divided into SBA2, SBU2's G4 was divided into SBA3, SBU2's G5 was divided into SBA4, SBU2's G6, G7 was divided into SBA5. The result is shown in Table 7.

Phase 2

Step 1: Separately regard SBA1~SBA5 as an analysis object (the result of cluster analysis in phase 1)

Step 2: The GDSS facilitator uses Porter's value chain switching to core capability value chain and keeps the results on file: information technology capability, marketing, human resources, quality management, brand loyalty, sales capability, and integrated ERP (see Figure 13).

Step 3: According to every SBA's internal and external business environment, electronic focus group facilitators conduct an interactive discussion and then use voting in every SBA to discover the potential core capabilities and decide which core capability is worth developing. In SBA1, potential core capabilities are information technology capability, marketing, and human resources. In SBA2, potential core capabilities are quality management, brand royalty, sales capability, and integrated ERP. In SBA3, potential core capabilities are information technology capability, marketing, and human resources. In SBA4, potential core capabilities are information technology capability, brand royalty, and sales capability. In SBA5, potential core capabilities are information technology capability, marketing, and human resources.

Step 4: The GDSS facilitator inputs the result of the interactive discussion with the experts (see Table 8).

Phase 3

Step 1: Top management confirms the potential core capabilities being developed from the interactive discussion with the experts (the result of phase 2).

Step 2: The three top management executives discuss and decide each assessing item of measuring core capabilities' importance according to the case firm's business environment. After the discussion, top management decides diversity, strength, organization unique, and opportunity of assessing items.

Step 3: The GDSS facilitator confirms the result of the discussion of top management.

Step 4: Each top management executive has to make a comparison matrix of the measuring items. Top management will evaluate the relative importance of assessing items according to the case firm's internal and external business environment. This includes the relative importance of diversity to strength, organization unique, and opportunity; the relative importance of strength to diversity, organization unique, and opportunity; the relative importance of organization unique to diversity, strength, and opportunity; and the relative importance of opportunity to diversity, strength, and organization unique (see Figure 14).

Each top management executive must make a comparison ma-

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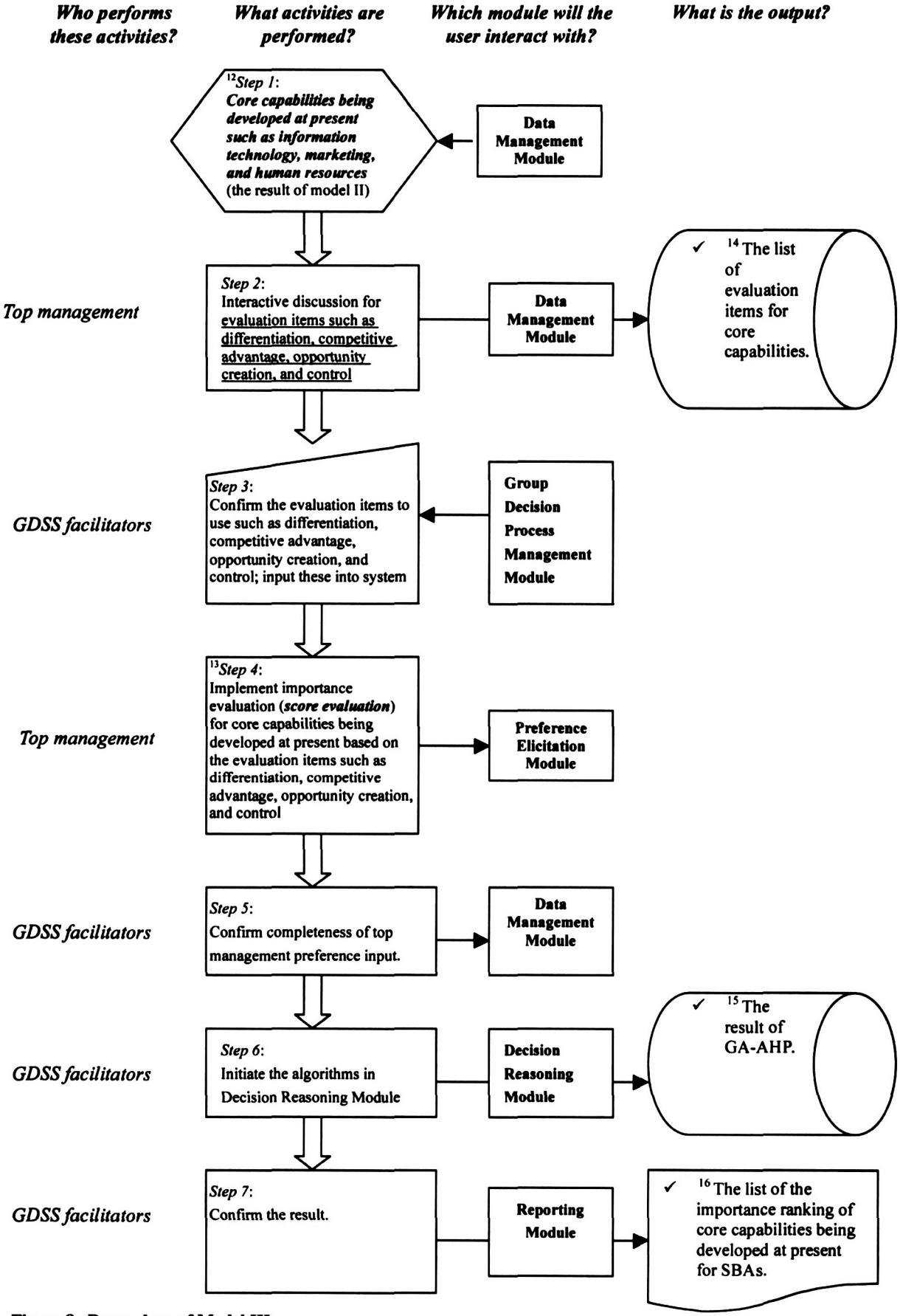

Figure 8. Proceedure of Model III

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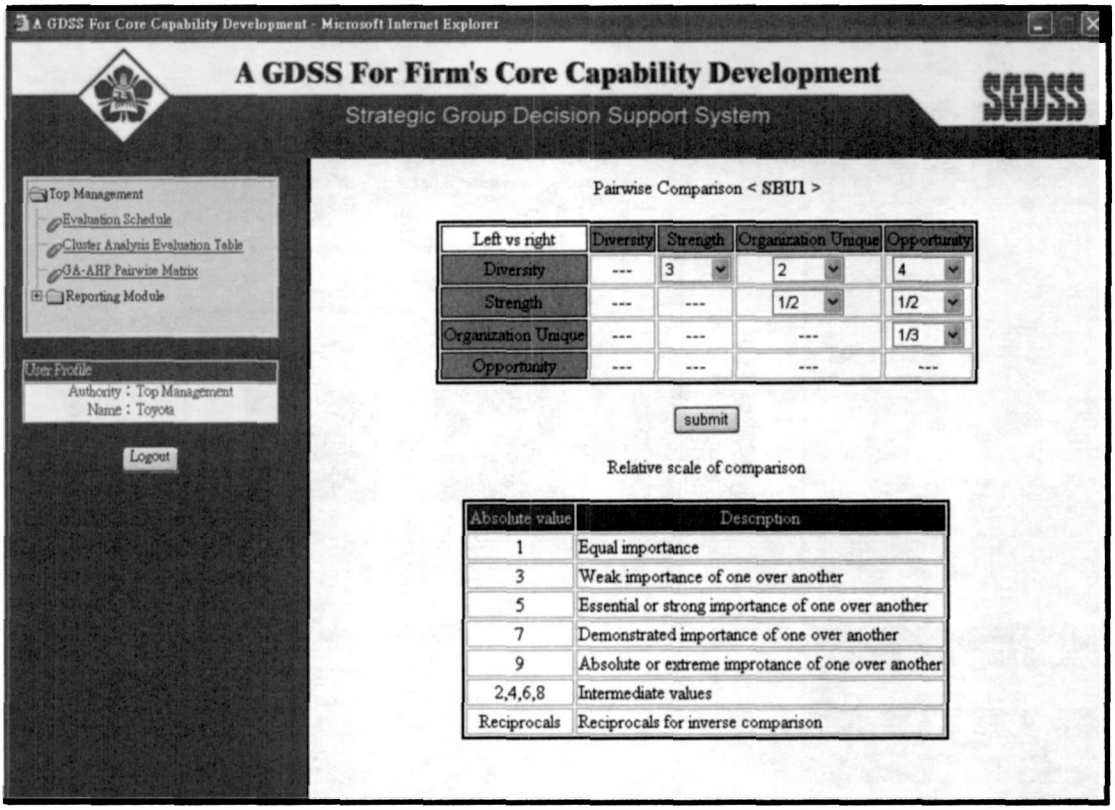

Figure 9. The evaluation of preference scores

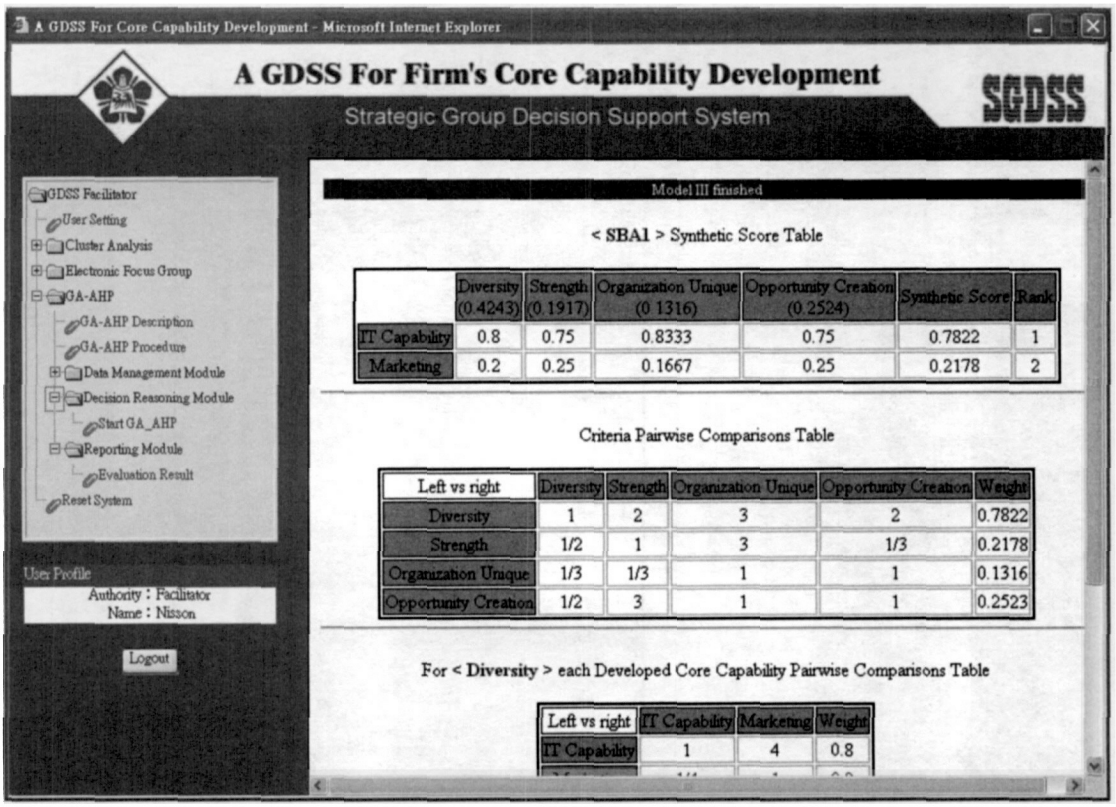

Figure 10. The result of GA-AHP

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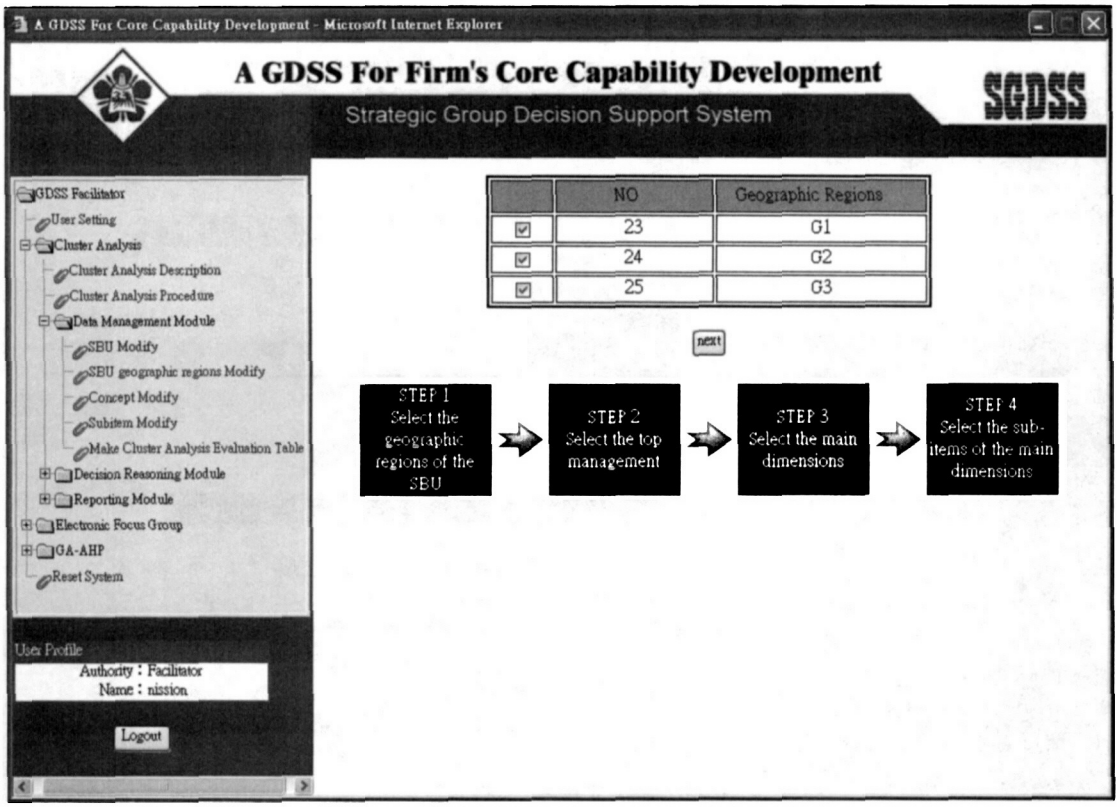

Figure 11. GDSS facilitator inputs the relevant data

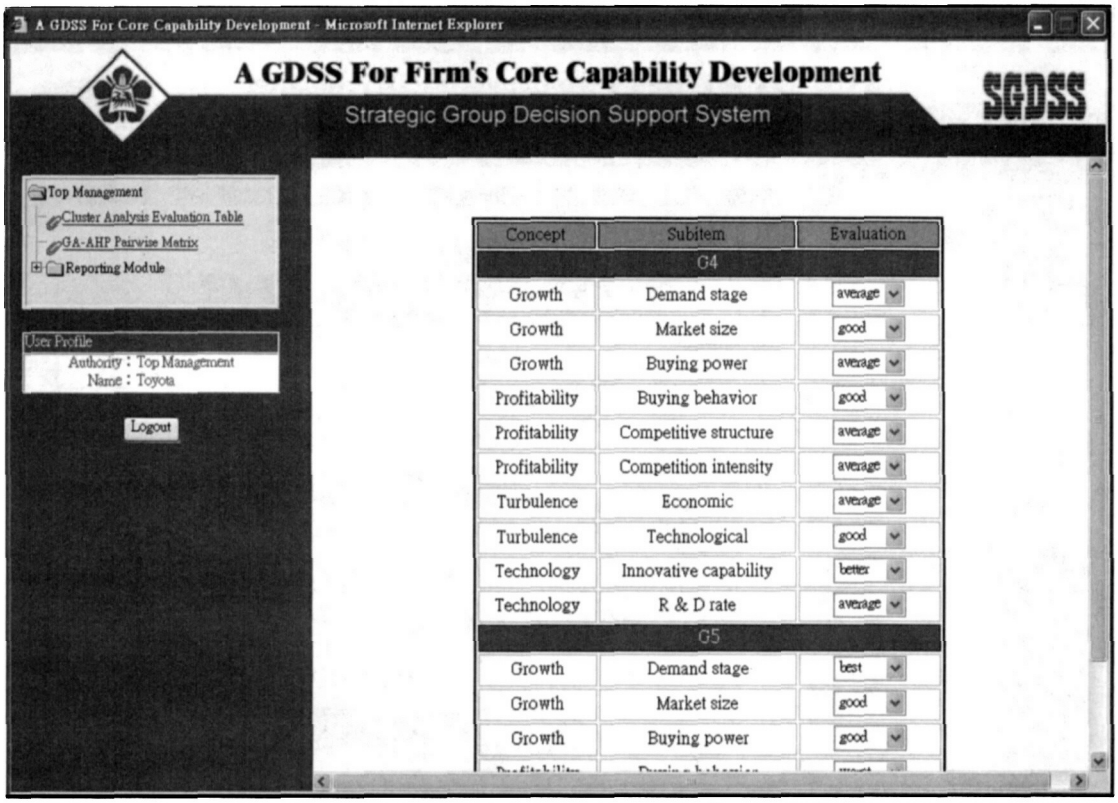

Figure 12. Top management assessment in cluster analysis

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TABLE 7
The result of cluster analysis

Strategic business unit	Geographic region	Cluster name
SBU1	G1 G2	SBA1
	G3	SBA2
SBU2	G4	SBA3
	G5	SBA4
	G6 G7	SBA5

TABLE 8
The result of core capability being developed

Strategic business area	Core capability being developed at present
SBA1	Information technology capability Marketing Human resources
SBA2	Quality management Brand loyalty Sales capability Integrated ERP
SBA3	Information technology capability Marketing Human resources
SBA4	Information technology capability Brand loyalty Sales capability
SBA5	Information technology capability Marketing Human resources

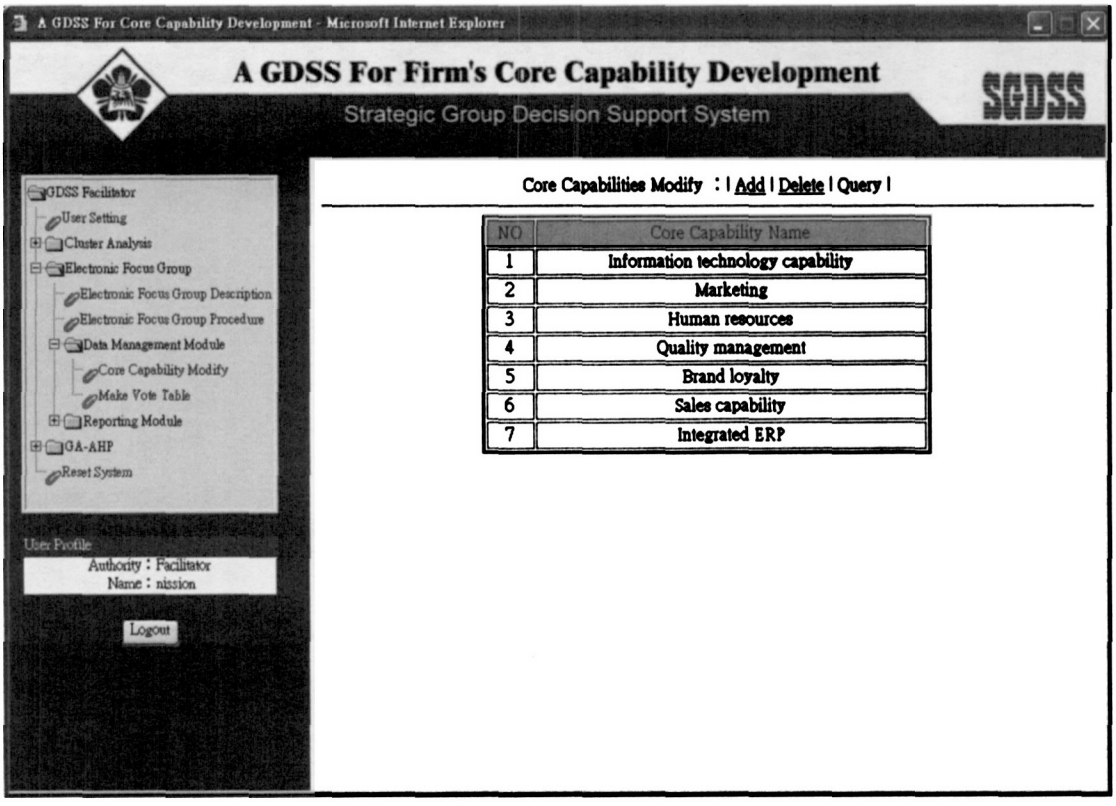

Figure 13. Core capabilities in electronic focus group

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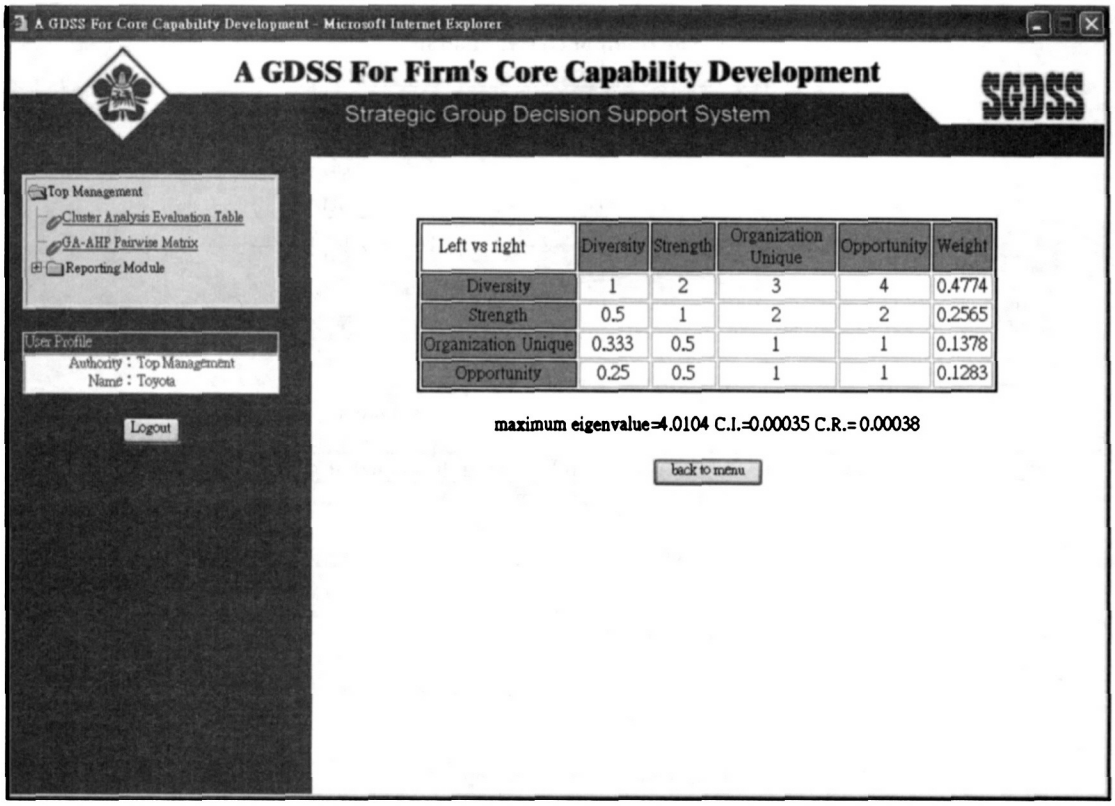

Figure 14. Comparison matrix of the measuring items

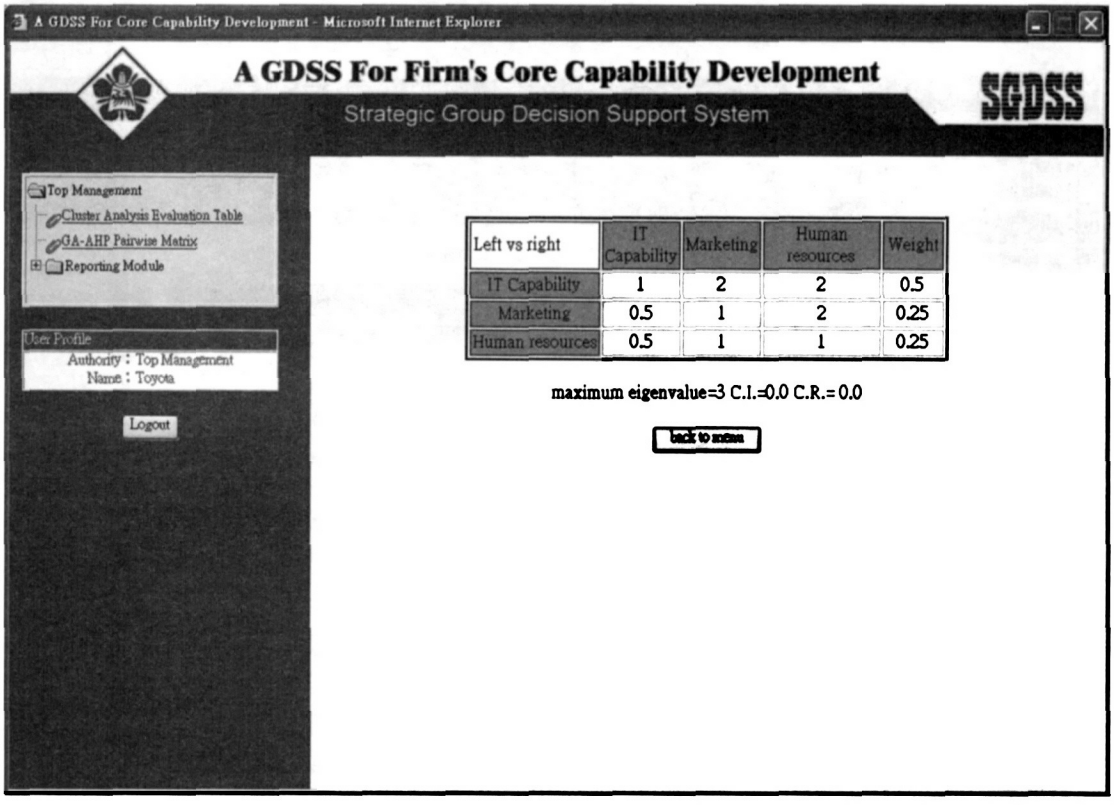

Figure 15. Comparison matrix of the core capabilities

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trix of the core capabilities. According to every SBA's internal and external business environment, top management assesses the relative importance of the core capabilities. For example, in SBA1, they evaluate the relative importance of IT capability to marketing and human resources, the relative importance of marketing to IT capability and human resources, and the relative importance of human resources to IT capability and marketing (see Figure 15).

Step5: The GDSS facilitator confirms completeness of top management preference input.

Step6: The GDSS facilitator then starts GA-AHP (see Figure16)

Step 7: The GDSS facilitator confirms the final result. He obtains the final result from the input of top management and calculates it using GA- AHP. In SBA1, the ranking of importance of core capabilities are human resources, IT capability, and marketing. In SBA2, the ranking of importance of core capabilities are brand royalty, sales capability, quality management, and integrated ERP. In SBA3, the ranking of importance of core capabilities are IT capability, marketing, and human resources. In SBA4, the

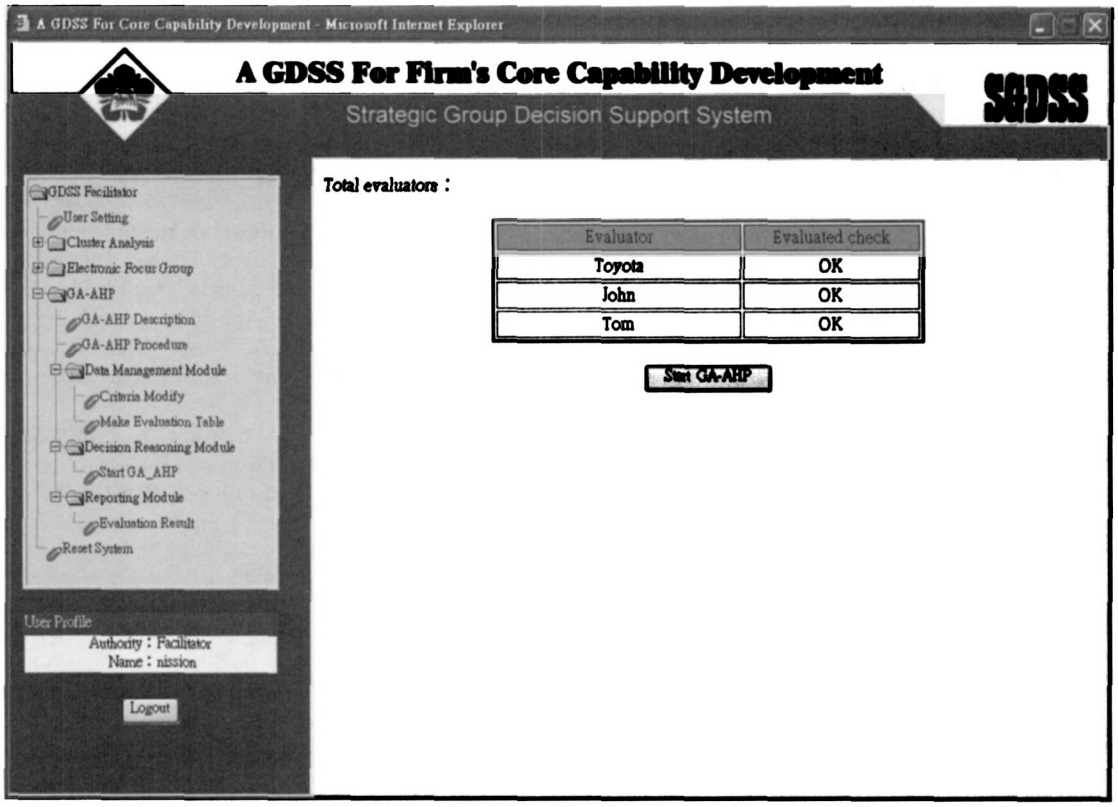

Figure 16. GDSS facilitator starts GA-AHP

TABLE 9
Ranking of core capability being developed

Strategic business area	Ranking of core capability being developed at present
SBA1	1. Human resources
	2. Information technology capability
	3. Marketing
SBA2	1. Brand loyalty
	2. Sales capability
	3. Quality management
	4. Integrated ERP
SBA3	1. Information technology capability
	2. Marketing
	3. Human resources
SBA4	1. Brand loyalty
	2. Information technology capability
	3. Sales capability
SBA5	1. Information technology capability
	2. Human resources
	3. Marketing

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ranking of importance of core capabilities are brand royalty, IT capability, and sales capability. In SBA5, the ranking of importance of core capabilities are IT capability, human resources, and marketing (see Table 9). Therefore, top management can select and develop the most important core capability according to the ranking of importance of core capabilities being developed for the SBA unit.

The implementation proves that this system can help a manager to select and rank the priority of the core capabilities without spending a large amount of time in discussion and meetings.

From interviews with the top management, the advantages of this system are as follows:

(1) The system is an expandable and easy-to-use core capabilities ranking tool.
(2) The system provides a computer-aided evaluation environment to reduce meeting time and offers the evaluators the freedom of doing the evaluations in their own offices at any time.
(3) The system can effectively divide enterprise's SBUs into different SBAs.
(4) When deciding the importance of different core capabilities, the system can effectively deal with strategic disagreements in order to reach a consensus.

After using the proposed system, the top management stated that they were comfortable with the system design and felt confident with the evaluation results. Hence, the top management executives were pleased and thought that the proposed system satisfies, or even exceeds their expectations.

(Note: the case descriptions deleted confidential data of the firm)

CONCLUSION

This paper presented a system to support top management in selecting the firm's development strategy for core capabilities. It is a flexible and expandable system offering several advantages. The holistic approach is a complete procedure for top management to determine core capability development strategy by appropriately combining both strategy planning and information technology. Quantitative algorithms were proposed to combine qualitative issues for top management to set priorities and to select the best plan. Furthermore, several concepts or framework of strategical management were systematically connected with decision algorithms and information system, and thus a user-friendly decision support system was provided for the practitioners. Readers may access the Chinese version of the system at http://140.116.96.186/capability_gdss/.

ACKNOWLEDGMENT

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