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A Web-based hybrid system for blended electronic, mobile and social media marketing planning

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Abstract — A Web-based hybrid intelligent system, WebIntegrated (developed by the authors), for developing blended e-marketing, mobile marketing and social media marketing strategies is reported in this paper. The concepts, software system and associated elements or components are presented. A brief demonstration of the data entries and outputs are also provided.

Keywords - decision support system; fuzzy logic; knowledge automation expert system; marketing; e-marketing; mobile marketing; social media marketing

I. INTRODUCTION

The emergence and development of electronic, mobile and social media marketing are creating new opportunities and raising the issue of integration of marketing mix and strategies. The advance of ICT would make the combination and coordination of conventional, digital, mobile and social media marketing strategies and associated marketing mix into one holistic framework feasible. The powers of Web technologies, artificial intelligence, and decision support would enable decision-makers to fully exploit their potentials, make the right decisions and survive in the dynamic and uncertain market contexts. This paper reports a Web-based hybrid system in support of integrated marketing strategy formulation.

II. THE WEBINTEGRATED SYSTEM

On the basis of the concepts of systems and hybrid systems discussed by von Bertalanffy [15], Goonatilake and Khebbal [2], Hopgood [3], Li [6], Li & Li [7, 8, 9], we give the following definition for hybrid intelligent decision support systems on the Web or over the Internet:

“A Web-based or Internet-enabled system that is comprised of various interacting and interrelated functional elements and integrates the advantages or strengths of diverse techniques or technologies including one or more artificial intelligence techniques or technologies for the following

purposes: serving for specified objectives or functions; dealing with the different facets of a given problem; delivering analytical models; providing useful information; automating domain expertise; generating intelligent recommendations; and supporting human decision-making or problem-solving via the Internet, extranets or intranets.”

WebIntegrated is a hybrid intelligent system that was designed by the authors to focus on and specifically support the conventional, digital, mobile and social media marketing aspects and dimensions of strategy formulation. In particular, the system aims to support: 1) simulating and assessing variables influencing and determining integrated marketing strategies, and 2) performing approximate reasoning under uncertainty and advising blended conventional, electronic, mobile and social media marketing strategy alternatives or options.

WebIntegrated was constructed on the basis of the client-server structure, with server-side coding, scripting, programming and software creation. The following open-source tools were employed in this project: MySQL (a Web-based relational database management system), PHP (Hypertext Preprocessor), JSON (JavaScript Object Notation), and HTML (HyperText Markup Language).

Following the mathematical, computational and knowledge automation framework proposed by S. Li and J.Z. Li [10, 11], the WebIntegrated system hybridises the powers and benefits of Web technology, online computer simulation, fuzzy logic, Web-based expert system knowledge automation and Web databases to assist managers in the process of mixed marketing strategy formulation. It has been designed to deliver enhanced support by incorporating the state-of-the art decision support and artificial intelligence techniques and utilising various marketing models.

A Web-enabled *Monte Carlo simulation module* is developed to represent and simulate the uncertainties and

variations in relation to the marketing variables or factors. This utilizes triangular probability distributions and the inverse function of a cumulative distribution of the triangular probability distribution. *Fuzzy logic* is programmed to symbolise and implement pertinent variables, and compute the grades of certainty for digital marketing factors using trapezoidal membership/compatibility functions for the variables considered. A *knowledge base* is constructed to apply "if ... then ..." rules and fuzzy rules for representing relevant conventional, electronic, mobile and social media marketing models, and relevant domain knowledge obtained from the literature. An *inference element* is designed to carry out forward chaining under uncertainty to generate digital marketing strategy alternatives with various levels of confidence. A *Web-server database component* is developed to store simulation results, and saves and retrieves the user's judgemental inputs and data entries. The *Web-based user interface* is coded to aid the dialogue between the user and the WebIntegrated system.

The electronic/digital marketing strategy knowledge was collected and synthesized on the basis of the literature. McDonald [18]'s four-box marketing strategy development matrix and Watson and Zinkhan [17]'s Internet strategy grid were adapted and extended by the authors to cover electronic marketing dimensions including expertise and guidelines from Varadarajan and Yadav [16], Sultan and Rohm [14], and Gay, Harlesworth and Esen [1]. Expertise on e-marketing strategies for international markets was acquired from Sheth and Sharma [13]. Domain knowledge on mobile marketing strategies and mobile marketing mix was obtained from Leppaniemi and Karjaluo [5]. The social media marketing knowledge were acquired from Kaplan and Haenlein [4] and Mangold and Faulds [12]. The authors have also created and developed a four-cell strategic grid/matrix for mobile marketing strategies with a logical linkage to Leppaniemi and Karjaluo [5]'s guidelines.

III. A DEMONSTRATION OF DATA ENTRIES AND SYSTEM OUTPUTS

In this section, we demonstrate the data entries and WebIntegrated outputs using screen copies for the software execution.

Figures 1-5 illustrate data entry screens for the variables affecting market attractiveness, competitive strengths, the needs for mobile marketing, available level of budget, social media marketing factors.

An external analytic hierarchy process (AHP) tool [7] can be employed to perform pair-wise comparisons and help judge which factors or variable are less or more important to decisions than others, and help determine the weights of relevant factors or variables.

Figure 6 displays part of the blended conventional, digital, mobile and social media marketing strategies with fuzzy logic-based certainty level. Figure 7 shows part of the mobile marketing strategies with a fuzzy logic-based level of confidence. Figure 8 demonstrates partial output from the social media model.

| Factor | Pessimistic value | Most likely value | Optimistic value |
|---|-------------------|-------------------|------------------|
| Market size | 6 | 8 | 9 |
| Market growth rate | 5 | 7 | 8 |
| Market stability (or vulnerability) | 5 | 7.5 | 8.5 |
| Economic climate | 3 | 4 | 5 |
| Industry profitability | 5 | 6 | 7 |
| New technology (Web/Internet, digital TV, mobile, wireless, social media) | 8 | 9 | 10 |
| Customer empowerment and expectations | 7 | 8 | 9 |
| Other factors (social, political, and cultural factors, etc.) | 6 | 8 | 9 |

Figure 1. A screen copy of data entries for marketing attractiveness

| Factor | Pessimistic value | Most likely value | Optimistic value |
|--|-------------------|-------------------|------------------|
| Market share | 3 | 5 | 6 |
| Product quality | 7 | 8 | 9 |
| Product fit to customer requirements | 7 | 8 | 9 |
| Price competitiveness | 5 | 6 | 6.5 |
| General image and brands | 6 | 7 | 7.5 |
| Customer services | 7 | 8 | 9 |
| Size of the company | 6 | 7 | 8 |
| Customer focus and personalized marketing | 5 | 6 | 7 |
| Cost reduction driver | 7 | 8 | 9 |
| Financial performance (ROI, earnings, growth, budget, etc.) | 7 | 8 | 9 |
| Other factors (production capability, personnel, knowledge and skills on applying digital and mobile technologies for marketing, etc.) | 6 | 7 | 8 |

Figure 2. A screen snapshot for data inputs for competitive strengths

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First dimension of factors affecting mobile marketing decision-making and mix

The needs for mobile marketing
Enter a value for each factor between 0.0 and 10.0, and a corresponding weight between 0.0 and 1.0 for mobile marketing. Alternatively, you can restore previously saved or simulated inputs (if any) by clicking "restore/load".

Note that, as a guideline, the sum of all the weights should be equal to 1.0. If you would like to run a simulation to obtain inputs for below, please visit **Factors & Criteria simulation** before proceeding.

| Factor | Value | Weight | Sum of weights |
|--|-------|---------|---------------------------|
| The needs for reacting to competitors' moves/manoeuvres | 9 | 0.14286 | 1 (Sum guideline: 1.0) |
| The needs for customer retention | 8 | 0.14286 | |
| The needs for attracting potential customers | 10 | 0.14286 | |
| The number of customers having mobile phones and smartphones | 9 | 0.14286 | |
| The intended coverage of mobile marketing | 8 | 0.14286 | |
| The intended intensity of mobile marketing | 7 | 0.14286 | |
| Social, legal, regulatory and ethical issues | 7 | 0.14286 | |

default inputs | save values | restore/load

Figure 3. A screen example for data entries for mobile marketing variables

Second dimension of factors affecting mobile marketing decision-making and mix

Available level of budget
Enter a value for each factor between 0.0 and 10.0, and a corresponding weight between 0.0 and 1.0 for competitive strengths. Alternatively, you can restore previously saved or simulated inputs (if any) by clicking "restore/load".

Note that, as a guideline, the sum of all the weights should be equal to 1.0. If you would like to run a simulation to obtain inputs for below, please visit **Factors & Criteria simulation** before proceeding.

| Factor | Value | Weight | Sum of weights |
|--|-------|--------|---------------------------|
| Available budget level | 8 | 0.2 | 1 (Sum guideline: 1.0) |
| Financial position/resources | 7.5 | 0.2 | |
| Expected returns from mobile marketing spending | 6 | 0.2 | |
| Internet, Web and mobile technology development | 9 | 0.2 | |
| Staff experience, knowledge and skills on mobile marketing | 6.5 | 0.2 | |
| | | | |

default inputs | save values | restore/load

Figure 4. A screen shot for available level of budget

Social media marketing

Please specify which of the following values for the below variables are the most applicable to you...

| | |
|---|--|
| Self-presentation or self-disclosure | Social presence or media richness |
| Low <input type="radio"/> | <input type="radio"/> Low |
| High <input checked="" type="radio"/> | <input type="radio"/> Medium |
| | <input checked="" type="radio"/> High |

Please proceed to the **next section** to view the results for above choices.

Figure 5. A screen copy for making choice for the social media marketing

Results from McDonald's matrix adapted

Weighted inputs given were Market attractiveness(7.1875) and Competitive strength(7.1819). Click on the titles to view the advice.

Invest for growth

Level of confidence or degree of certainty is 1

Market Share: Maintain or increase dominance (McDonald, 1996). Compete more effectively and efficiently online; improve customer loyalty and retention.

Products: Differentiation - line expansion (McDonald, 1996). Adding value to existing products; providing more customized product design options and increase product range (Varadarajan & Yadav, 2009); developing digital products; direct and immediate delivery of digitizable through wireless services (e.g., maps, bill payment, and other information services).

Price: Lead - aggressive pricing for share (McDonald, 1996). Online price transparency and comparison; changing price levels randomly to create uncertainty for other competitors. (Varadarajan & Yadav, 2009)

Promotion: Aggressive marketing (McDonald, 1996). Short messaging service (SMS) (Sultan & Rohm, 2004). Extensive use of Web sites, e-mails, cookies and software agents for promotion.

Distribution: Broaden distribution (McDonald, 1996). Extensively use multi-channels including Web sites, wireless, and mobile phones to achieve higher customer retention rates, higher revenue and more frequent interaction with customers.

Search engine: Investment on search engine optimisation for digital marketing; Increase the position of the organisation and/or its product/services in search engine natural or organic results listings for selected keywords or phrases. (Chaffey et al., 2006)

Permission and personalisation online: Investment on e-CRM for acquisition and retention; extensive adoption of personalisation (contents, offers, etc.); use of personalisation strategies by spend, product and interest; delivering customised content for the individual through Web pages, e-mail or push technology. (Gay et al., 2007)

Web site: Investment on digital marketing Web sites; marketing-led Web site design for achieving customer acquisition, retention and communication of digital marketing messages (Chaffey et al., 2006). Web site performance metrics (Sultan & Rohm, 2004); Web analytics for segmentation and positioning strategies.

Mobile marketing communications: Maximise. Using mobile marketing as one of the key elements of the integrated marketing strategies; aggressive marketing. Mobile advertising (Web-based mobile search and portal, broadcast including mobile TV, narrowcast, physical browsing, in-game advertising and others); promotions (branded content, competitions, others including coupon/voucher); direct marketing (messaging including SMS, MMS, E-mail, etc.); mobile CRM (customer services, mobile commerce, market research, mobile community, etc.) (Leppaniemi & Karjalainen, 2008).

Social media: Maximise. Using social media as one of the key elements of the marketing mix. Social media tools: Virtual social worlds, virtual game world, social networking sites, content communities, blogs, video sharing sites, collaborative projects, and more (Kaplan & Haenlein, 2010; Mangold & Faulds, 2009).

Figure 6. An output screen shot for the extended McDonald strategy model

Maximise. Invest.

Optimise mobile marketing as one of the key blended elements of the integrated marketing strategy. Aggressive marketing, hybrid mix.

Level of confidence or degree of certainty is 1

MOBILE MARKETING COMMUNICATIONS MIX

Advertising
Web: Mobile Internet (e.g. banner ads); Mobile search; Mobile portal
Broadcast: Mobile TV, radio
Narrowcast: Mobilecasting; Bluecasting
Physical Browsing: Touching, pointing, scanning etc.; Hypertag, RFID, bar code
Other: Visual radio; In-game advertising; IDLE phone; Ringback tones

Direct Marketing
Messaging: Personalized permission-based messages, e.g. SMS, MMS, WAP push, E-mail, etc.

Promotions
Branded Content: Entertainment and infotainment, e.g. advertisements (advertising + games), ringtones, logos, wallpapers, news
Competitions: Interactive concepts, e.g. quiz, voting, text2win
Other: Coupon / voucher; Sample ordering; Requesting more information; Money off offer

Mobile Customer Relationships Management (CRM)
Customer Services: A number of solutions, e.g. alerts (e.g. appointment reminder), check-in services, mobile ticket, content catalogs for regular customers
Mobile Commerce: Banking and brokerage; Payment; Bidding; Betting and gambling
Market Research: Survey; Poll
Mobile Community: Mobile blog; Fan club solutions; Mobile magazine

IMPLEMENTATION ISSUES
Mobile Technologies: Mobile devices; Mobile network; Content types; Other infrastructure
Mobile Marketing Technologies: Mobile marketing platform; Content delivery platform / Web application platform
Mobile Operators: Gateways; Short numbers; Resaming; Billing
Aggregators: Operator connectivity and billing
Mobile Marketing Databases: Opt-in mobile numbers; Privacy concerns
Data Management: Information update; Campaign results; Statistics
(Mass) Media Advertising: TV, radio, press, Internet, etc.

(Source: Leppaniemi, M. & Karjalainen, H. (2008). "Mobile marketing: from marketing strategy to mobile marketing campaign implementation", International Journal of Mobile Marketing, Vol.3 No.1, pp.50-67.)

Figure 7. An output screen snapshot for the mobile marketing strategy model

Self-presentation or self-disclosure and Social presence or media richness are both high

Below advice is for your chosen options - you can change them by returning to the previous slide.

Virtual social worlds (e.g., Second Life)

Allows inhabitants to choose their behaviour more freely and essentially live a virtual life similar to their real life. As in virtual game worlds, virtual social world users appear in the form of avatars and interact in a three-dimensional virtual environment; however, in this realm, there are no rules restricting the range of possible interactions, except for basic physical laws such as gravity. This allows for an unlimited range of self presentation strategies, and it has been shown that with increasing usage intensity and consumption experience, users of virtual social worlds - or "residents", as they prefer to be called - show behavior that more and more closely mirrors the one observed in real life settings (Haenlein & Kaplan, 2009; Kaplan & Haenlein, 2009).

Arguably, the most prominent example of virtual social worlds is the Second Life application, founded and managed by the San Francisco-based company Linden Research Inc. Besides doing everything that is possible in real life (e.g., speaking to other avatars, taking a walk, enjoying the virtual sunshine), Second Life also allows users to create content (e.g., to design virtual clothing or furniture items) and to sell this content to others in exchange for Linden Dollars, a virtual currency traded against the U.S. Dollar on the Second Life Exchange. Some residents are so successful in this task that the virtual money earned that way complements their real life income. Virtual social worlds offer a multitude of opportunities for companies in marketing (advertising/communication, virtual product sales/Commerce, marketing research). (Source: Kaplan, A. M. & Haenlein, M. (2010). "Users of the world, unite! the challenges and opportunities of social media", Business Horizons, Vol.53, pp.59-68)

Mangold and Faulds (2009)'s advice on influencing and shaping the discussions:

Social media has amplified the power of consumer-to-consumer conversations in the marketplace by enabling one person to communicate with literally hundreds or thousands of other consumers quickly and with relatively little effort. Managers cannot directly control these conversations. However, they can use the methods delineated below to influence and shape the discussions:

- Provide networking platforms by creating communities of like-minded individuals sharing interests and values, through the provision of Facebook groups, blogs, etc.
- Use blogs and other social media tools such as social networking sites (MySpace, Facebook, etc.), creativity works sharing sites (e.g. YouTube), blogs, collaborative Web sites (e.g. Wikipedia), virtual worlds (e.g. second life), commerce communities (e.g. eBay, Amazon.com, etc.), to engage customers
- Use both traditional and Internet-based promotional tools (e.g. online games, online voting, YouTube, etc.) to engage customers
- Provide information about relevant products and the use of the products
- Provide exclusivity and make people feel special
- Design products with talking points and consumers' desired self images in mind
- Utilize the power of stories
- From one-way traffic to multiple avenues and consider social media to be a hybrid element of the promotion mix in that it combines some of the characteristics of traditional integrated marketing communication tools with a highly magnified form of word-of-mouth

(Source: Mangold, W. G. & Faulds, D. J. (2009). "Social media: the new hybrid element of the promotion mix", Business Horizons, Vol.52, pp.357-365)

Figure 8. An output screen copy for the social media marketing model

VI. CONCLUDING REMARKS

In this paper, we have introduced and described a Web-enabled hybrid intelligent system, called WebIntegrated, for integrated conventional, electronic, mobile and social media marketing strategy formulation. The concepts, system elements and an illustration of system execution have been presented in the paper. WebIntegrated has good potential in enhancing and improving the efficiency and effectiveness of the blended marketing strategy planning process. It can also be used as a smart software tool for training marketing managers and students.

To make progress on this project, further work is being undertaken to test and evaluate the overall value and impact of the WebIntegrated system with company directors and managers. The WebIntegrated system will also be extended to include more marketing strategy models and domain knowledge.

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