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Web & social media dynamics, and evolutionary and adaptive branding: theories and a hybrid intelligent model

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Abstract— Effective branding is pivotal to the success of most companies. In this paper, a hybrid intelligent model and associated supporting methods, techniques and technologies are proposed to represent, simulate and analyze the adaptation, evolution and growth of corporate and product brands in the contexts of World Wide Web and social media, through integrating the strengths of complex adaptive systems theory, environment-sensitive reasoning method, system dynamics, Web analytics, intelligent software agents, and expert systems. The rationale, modeling paradigm and decision support framework for branding in online social networks are presented and discussed. Hypotheses for further research on this topic are also formulated.

Keywords—social media dynamics; Web dynamics; adaptive branding; corporate & product brand building; complex adaptive systems theory; intelligent software agent; hybrid intelligent model; expert system; Web analytics; system

I. INTRODUCTION AND DEFINITIONS FOR WEB & SOCIAL MEDIA DYNAMICS, WEB ANALYTICS AND BRANDS

Tim Berners-Lee's invention of World Wide Web has brought significant cutting-edge revolution and great opportunities for businesses and human social networking across the world. World Wide Web, Web sites and business environments change dynamically. According to Oxford dictionary, dynamics are "the forces or properties which stimulate growth, development, or change within a system or process". In this paper, we define Web dynamics as the dynamic behavior of the complex Web system including online environmental changes, events, visitor/audience behavior, voice of customers, Web site usage and clickstreams, company behavior and maneuvers, competitor moves, and interactions of relevant players, participants,

users and audience on the World Wide Web and associated Web sites.

Social media and associated tools, such as Facebook and Twitter, are Web-based applications built upon Web 2.0 technologies. They enable and allow online interactions and communication amongst individuals and virtual communities for creating, co-creating, sharing, discussing, and amending user-produced contents [1, 2, 18]. We define social media dynamics as social media buzz, trends, growth, evolution, co-evolution, the dynamic behavior of social media contributors and users, and in particular, how they interact with each other, how they interact with online Web resources, what contents they generate, how they share information and knowledge, what they like, and what they dislike over time.

Web analytics is the study of reporting and analyzing what has happened and what is happening on Web sites, tracking user behavior on the Web, assessing Web site performance and improving its usage.

In order to compete, survive and succeed in the digital age, business people need to understand how Web & social media dynamics and relevant Web analytics affect and inform digital marketing decision-making and online branding activities. In this study, we focus on corporate and product branding.

"Brand" can be defined as the name, design (shapes, colors, sounds, etc.), logo, symbol, or any other characteristics or attributes that distinguishes one company's product or service from those of other companies [17, 25].

Product branding highlights and focuses on individual product's identity and value [17]. Corporate branding is concerned with establishing an image and name for a

company or organization [25]. They can be promoted separately or combined together and co-branded simultaneously.

Increasing brand awareness is pivotal to the survival and success of most businesses. Effective branding may lead to improved customer loyalty, larger number of orders, better sale volume, and higher revenue and profits.

There are diverse branding strategies including company names, individual branding, attitude branding, private labels and social media brands.

Pont [3] argues that social media brands may be the most evolved version of brand form for the reason that they focus on both the brands themselves and the consumers or users.

Brands need to evolve and adapt to dynamic competition, consumer expectations, and environmental changes. Marketing efforts and advertising campaigns should be made by companies to build positive perceptions for their corporate and product brands and thus to achieve better sales and profit margins than competitors. While World Wide Web and social media offer the great arena and avenue for branding in the digital age, there are also challenges to companies and managers' knowledge and skills.

Due to the uncertainty, disturbance, complexity and changing nature of social media, branding and brand building in this context bring difficulties to business managers and marketers. This paper aims to propose and discuss a novel hybrid intelligent model, paradigm and associated supporting methods and tools for representing, simulating and analyzing the evolution, adaptation and growth of product brands, through integrating the strengths of complex adaptive system theory, environment-sensitive reasoning method, system dynamics, Web analytics, expert systems and others.

II. A HYBRID MODEL FOR ADAPTIVE CORPORATE & PRODUCT BRANDING IN THE CONTEXTS OF WORLD WIDE WEB & SOCIAL MEDIA

Considering the reality that many managers lack knowledge and skills on branding in social media, and taking into account the bounded rationality of the human mind in decision making for complex situations [23], diverse methods, techniques and technologies should be employed to model, analyze and support effective branding through online social networks in the digital age. In this paper, we propose a hybrid modeling and decision support paradigm and model.

Within this paradigm, Peirce's abductive reasoning method [19] and the inductive reasoning approach are employed to detect the Web environments, make inference and find causes for relevant phenomena, events and changes.

The salient feature of contextual smart software agents are utilized to monitor, analyze and react to the audience mentions, buzz, events, competitor manoeuvres, through inductive and abductive reasoning. The context-sensitive

intelligent decision support systems approach [24] is also incorporated to support this.

Self-organized ant foraging systems [21] are extended and applied to detect and respond to digital trails, trends, and optimize the adaptive corporate and product branding processes [9]. Research on adaptive foraging in the field of ecology [22] can also bring new ideas to adaptive branding, and customer buzz hearing [9].

System dynamics is a methodology and modeling approach towards structuring and understanding the dynamic behavior of complex systems [6]. This method mainly utilizes differential and difference equations, combined with probabilities for some variables to describe a continuously changing system. A typical system dynamic diagram may contain feedback loops, causal loops, flow rates, flows and stocks, variables and influences.

The system dynamics approach is employed to describe and analyze brand evolution and associated interactions and relationships amongst participants and other variables in the Internet-enabled social networking environment.

Complex adaptive systems (CAS) theory [4] provides a solid foundation and remarkable capacities for modeling and analyzing the branding problem in social media. As stated by Holland [4], a CAS system has such characteristics and properties as self-organization; parallelism of agents interacting with each other and producing signals simultaneously; If-then conditional action depending the contexts and signals; modularity with building blocks for reacting to current situations and dealing with new circumstances by applying a set of organised rules; micro level of individual agent behaviour and interactions, and macro level of emergence that cannot be predefined or predicted precisely; and adaptation, evolution and co-evolution over time; implied fitness for measuring agent needs fulfilment and performance [4, 5, 7].

Specifications for relevant agents or subjects, relevant algorithms and the basic cycle for rule-based signal processing procedure can be found in Holland's work [4, 5]. In this study, John Holland's complex adaptive systems theory and the basic cycle [4] are extended to integrate with environment-sensitive detection and reaction [8], system dynamics simulation [6], intelligent software agents and fuzzy expert systems for adaptive branding in social media.

In a CAS, system components or agents interact through reacting to the environmental events, exchanging messages, inter-communicating, learning, co-operating and competing [7, 11, 13]. Because the interactions amongst relevant agents or subjects are non-linear, some mentions or buzz may exponentially cause significant emergence to arise from online social networks. Some emergence may help improve a corporate or product name. Some may damage a brand. A branding agent can learn, evolve, respond to changes and affect its social media environment. The brand, the company, competing brand, competitors, customers, online virtual communities interact with each other randomly in the contexts of social networking and its dynamics. Patterns may

emerge from these interactions. At the micro level, brands can be built up, shape themselves. Furthermore, brands and branding strategies may grow and evolve in a positive way and lead to occurrence on better reputation and a larger sphere of influence. At the macro level, emergence such as big name, image, reputation, popularity and good customer loyalty may happen and even become popular throughout the online social networks, conforming to the law and regulations for social media.

Within this model, Web and social media analytics tools such as Facebook Insights, Omniture, Google Display Planner, can be employed to measure and analyze the online Internet data about branding. Web analytics-oriented software agents can be created to watch and extract the key information such as traffic flows, mentions, likes, customer loyalty, dislikes and trends. This information can then be sent to a co-ordination software agent.

The analytic hierarchy process (AHP) [16] is used to perform pair-wise comparisons, and determine priorities for branding decision alternatives by evaluating them against relevant criteria or factors.

Fuzzy logic [14,15] is applied to model and cope with uncertainty and ambiguity in relation to the criteria and variables that affecting branding decisions. A fuzzy expert system can be developed to embody domain expert knowledge on branding in social media and produce intelligent advice on branding strategies and online advertising campaigns.

In this study, we use a hybrid method [10, 11, 12, 13] for modeling and analyzing the adaptive branding problem. On the basis of the CAS theory, all the above-mentioned agents and artifacts of the online social network in relation to corporate and product branding are modeled as intelligent software agents. A co-ordination software agent can be created to manage interactions and communications, and resolve conflicts. It can also be designed to connect and integrate various functional software agents and elements of the hybrid intelligent model. The powers of the above-mentioned systems modeling, artificial intelligence and decision support techniques, technologies and approaches are utilized to match the various properties and facets of the problem. The strengths of intelligent software agents are exploited to create flexibility and tailorability of smart modeling and evolutionary decision support for brand building, shaping, evolution and adaptation. It is worthy of note that managerial experience, judgment, intuition, creativity and intervention must be incorporated and included in the process of relevant branding strategy development and advertising campaign decision-making.

The overall paradigm is given in Table I. An illustration of the adaptive branding interactions and associated supporting methods, techniques and technologies are outlined in Fig. 1.

Table I. Modeling paradigm for adaptive branding in social media

Properties & facets	Modeling, simulation and decision support methods, techniques & technologies
Environmental change monitoring, signal-processing, and digital trail detection	Inductive and abductive reasoning methods; artificial ant intelligence; intelligent software agents; CAS theory and signal processing algorithms; fuzzy logic
Uncertainty and ambiguity	Fuzzy logic; CAS theory
User traffic flow, trends, mentions, buzz, likes, dislikes, consumer loyalty, etc.	Social media & Web analytics tools such as Facebook Insights, Omniture, Google Display Planner; expert system; intelligent software agents
Web & social media dynamics, parallelism of interactions amongst the brand, competing brands, the company, competitors, customers, and online virtual communities	CAS theory and algorithms; intelligent software agents; system dynamics; fuzzy expert system; self-surviving adaptive foraging ideas
Modularity, emergence	CAS theory and algorithms; intelligent software agents
Brand growth, adaptation, learning, evolution and co-evolution over time; risk reduction for brand damaging	CAS theory and algorithms; system dynamics; graphical displays; self-surviving adaptive foraging ideas; intelligent software agents; expert system
Branding strategies, and advertising campaign decision-making	The analytic hierarchy process; fuzzy logic; expert system; self-surviving adaptive foraging ideas; intelligent software agents; and hybrid decision support; human judgment, intuition, creativity and personal vision.

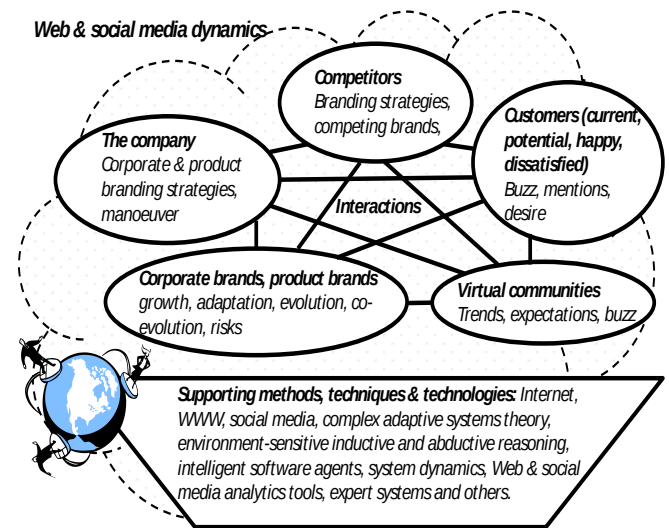


Fig.1. A hybrid model for adaptive corporate & product branding in social media

III. HYPOTHESES FOR FURTHER RESEARCH

On the basis of the work discussed in the previous sections, the authors' own reflection and synthesis of the literature, the following hypotheses are formulated for further research on this topic.

Hypothesis 1. Users of the hybrid model for simulation and analysis of adaptive corporate & product branding will achieve better understanding of Web & social media dynamics, and branding than non-users.

Hypothesis 2. Users of the hybrid model will attain better understanding of the interactions and relationships amongst the brand, the company, competing brands, competitors and consumers than non-users.

Hypothesis 3. Users of the hybrid model will obtain better insights about how a brand evolves, grows and adapts in social media contexts than non-users.

Hypothesis 4. Users of the hybrid model will be able to acquire more knowledge about how a brand evolves, grows and adapts in social media contexts than non-users.

Hypothesis 5. Users of the hybrid model will know more about how social media atmosphere and buzz affect a brand than non-users

Hypothesis 6. Users of the hybrid model will have more chance to estimate and "observe" the unpredicted emergence of brand evolution in social media contexts than non-users.

Hypothesis 7. Users of the hybrid model will have more chance to reduce the risks for brand damaging in social media contexts than non-users.

Hypothesis 8. Users of the hybrid model will obtain a better understanding of how consumer loyalty for a brand is affected by various factors in the social media contexts than non-users.

Hypothesis 9. Users of the hybrid model will get more information about the consequences and associated risks of potential damages to their product brands than non-users.

Hypothesis 10. Users of the hybrid model will be able to simulate and explore more strategic alternatives or options for branding in social media contexts than non-users

Hypothesis 11. Users of the hybrid model will attain better coupling of analysis with human judgment and

intuition in the process of branding decision-making than non-users

Hypothesis 12. In comparison to non-users, users of the hybrid model will be able to do more experiments on what would happen if they adapt their branding strategies to the changing social media environment

Hypothesis 13. Users of the hybrid model will be able to make better improvements on their brand identity and image than non-users

Hypothesis 14. Users of the hybrid model will be able to understand and establish more consumer confidence about their brands than non-users

Hypothesis 15. Users of the hybrid model will know more about consumer desire for specific functional, physical and psychological properties of a brand than non-users

Hypothesis 16. Users of the hybrid model will produce higher quality of branding decisions than non-users

Hypothesis 17. Users of the hybrid model will be able to establish more customer loyalty for their brands than non-users

Hypothesis 18. Users of the hybrid model will be more confident (have higher level of confidence) about their branding decisions than non-users

Hypothesis 19. Users of the hybrid model will learn more about branding in social media than non-users

IV. CONCLUDING REMARKS

The aim of this paper has been to develop and propose a new paradigm and hybrid model for adaptive corporate & product branding in the contexts of World Wide Web & social media. A novel hybrid intelligent model has been presented, with relevant supporting methods, techniques and technologies recommended.

In order to effectively represent, simulate and analyze brand adaptation, evolution, growth, emergence and associated risks in the dynamic Web & social media environments, our model has been designed to link and combine the powers and benefits of complex adaptive systems theory, environment-sensitive monitoring and reasoning method, system dynamics, Web analytics, fuzzy expert systems, and the analytic hierarchy process. Human inputs and managerial intervention to the model was also highlighted.

Further research work is being undertaken by the authors to create a hybrid multi-agent-based software system that realizes and implements the proposed model. Model

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validation and system evaluation will also be a priority for the next stage of this research project.

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