Artificial intelligence-based systems applied in industrial marketing: An historical overview, current and future insights

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ABSTRACT

Intelligent systems have particular potentialities and strengths to support decisional situations faced by companies, especially those of a strategic nature, where good strategic intelligence is necessary. In this paper, we carry out an historical literature review of artificial intelligence-based systems applied to marketing, covering a time period of several decades (from the 1970s to the present day), with special focus on applications to industrial marketing. A detailed review is presented, along with conclusions and some future insights. Then, we briefly introduce the set of papers in this special issue.

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1. Introduction

The artificial intelligence (AI) core focuses on the development of valuable, automated solutions (i.e. intelligent agents/systems) to problems which would require the intervention of intelligence if done by humans (Negnevitsky, 2004). In a business context, there are problems to be tackled that require this particular characteristic, which need human judgement and analysis to assess and solve these problems with guarantees of success. These decisional situations frequently relate to strategic issues in firms, where problems are far from being well-structured. Developing and applying ad-hoc intelligent systems, due to their particular strengths, to process data and provide valuable information either with a data-driven or, especially, with a knowledge-driven approach, might be of interest to managers in their decision-making (see Casillas, Martínez-López, & Corchado, 2012; Martínez-López & Casillas, 2009).

However, in spite of their potentialities to contribute to companies' strategic intelligence (i.e. business intelligence + competitive intelligence + knowledge management) (see Liebowitz, 2006), this research theme has received scarce attention in journals that primarily deal with business and management issues. A basic search in Scopus[1]

(i.e. article title, abstract and keywords) reveals that the total number of papers published on both business and AI/intelligent systems in business/management-focused journals is less than 150.

With this special issue, we have aimed to promote, stimulate and publish high-quality contributions on applied-intelligent systems to support the management of any marketing issue among businesses. The particular and interesting areas of applications within the industrial/ business marketing framework are numerous. Some of them might be, but are not limited to, the following:

- Segmenting and targeting business markets.
- Managing customers' relationships.
- Marketing channel relationships.
- Organizational buying and supply chain management processes.
- Business intelligence and knowledge management.
- Managing personal selling.
- B2B communications decisions.
- B2B pricing strategies.
- Product development, innovation and creativity.
- Services management in business markets.
- Web intelligence and B2B e-commerce applications.

Although some of these areas have been covered in the set of papers accepted for publication, as a whole they represent a good starting point and, maybe, a seminal reference for future research efforts and proposals that can build on this topic. The remainder of this paper is as follows. First, we present the results of a literature review for the general topic of intelligent systems applied to marketing and, more specifically, for industrial marketing. Obviously, greater

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  [1] Search results are not static, so figures reported here on the number of papers after Scopus searches will vary over time.

attention has been paid to the latter, which contains a detailed description of each paper that matched the search criteria we set: basically, a paper which applies an intelligent system proposal to an industrial marketing issue. To our knowledge, this is the first review on this specific topic. Its interest lies not only in its novelty but also in the overall view that it offers regarding what has been done to date. Then, there is a brief overview of the set of papers in this special issue. Finally, the paper ends with some acknowledgements.

2. Background

2.1. Artificial intelligent-based solutions applied to marketing: a brief overview

In a basic search in Scopus for the terms *marketing* and *AI*/*intelligent systems* in business/management-related journals, the number of papers found is below 50. In Wierenga (2010), some reflections are made on the motives that might explain the limited materialization of such potentialities; e.g., the hegemony of Operations Research and econometrics-based methods as the traditional techniques used by managers to support decision-making on quantitative problems, or the insufficient attention paid to marketing applications in the AI field, among others. In this regard, the overall number of published articles, also considering more technical-oriented subjects (e.g., Computer Science, Decision Sciences, or Engineering, among others) treating issues on AI/intelligent systems applied to marketing, is below 300 (see Scopus). Fig. 1 shows the historical evolution (1972–2011) of published papers, from any source (e.g., journals, conferences, research book chapters, etc.) and source subject (e.g., business, economics, computer science, etc.), on AI and/or intelligent systems applied to marketing, based on the results of a basic search in Scopus.

Likewise, there is a lack of advanced research books with a clear focus on AI methods and applications for marketing, although there are some notable introductory books (e.g., Berry & Linoff, 1997; Matsatsinis & Siskos, 2002). By contrast, though specific books on the subject are scarce, there are books whose general scope touches on AI applications for management/business that contain chapters on marketing (e.g., Aliev, Fazlollahi, & Aliev, 2004; Bidgoli, 1998; Carlsson, Fedrizzi, & Fuller, 2003; Prasad, 2008). Recently, we edited a book volume titled "Marketing Intelligent Systems using Soft Computing: Managerial and Research Applications" (Casillas and Martínez-López, 2010), containing reflections of various renowned marketing and management scholars on the potentialities of AI-based methods for marketing, as well as a collection of advanced research works devoted to a variety of marketing issues.

We concluded that (see, also: Casillas & Martínez-López, 2009) the AI discipline offers real opportunities for advancing the analytical methods and systems used by firms to manage a variety of marketing issues. Furthermore, well-conceived and designed intelligent systems are expected to outperform statistical-based supporting tools in complex, qualitative and/or difficult-to-program marketing problems and decisional scenarios; secondly, these opportunities still need to be truly materialized by researchers and practitioners. More interdisciplinary and applied contributions are necessary for this promising research stream to really take off.

2.2. Intelligent systems applications for industrial marketing issues

This section focuses on analysing the current background on the specific topic of this special issue, i.e., intelligent systems applied to industrial marketing issues, and we have selected 10 representative papers for this purpose. Indeed, the literature is quite scarce, but we assume that the positive synergy of the two fields that make up this interdisciplinary topic and its great potential is a good omen for this emerging discipline.

We defined several fields for the analysis, with a business or a technical focus. The business-related fields are three: first, the topic of the article within the industrial marketing framework. We mostly based our analysis on the categorization that emerged in the extensive literature review on industrial marketing published in *Industrial Marketing Management* done by Laplaca (1997), though we added the new category of "e-commerce"; second, a description of the objectives/aims of the article's research; and third, a résumé of its main conclusions. The technical-related fields are three: a brief explanation of the researchers' motivations for using AI-based methods; information on whether the methods used were ad-hoc developed, already existing (e.g., a software package) or both; and, finally, a description of the typology of intelligent systems applied in such research.

In addition to the detailed description of each paper for this set of fields, which is shown in the Appendix, some conclusive ideas reached are that:

- The application of intelligent systems to manage industrial marketing issues has been scarce and mostly concentrated in the last decade.
- A consequence of the above question is that some industrial marketing topics are as yet unexplored, as a primary focus of attention in terms of ad-hoc applied intelligent systems; e.g., promotion.
- Topics of management and pricing account for about half the intelligent systems applications.

Fig. 1. Published papers (1972–2011) on artificial intelligence/intelligent systems applied to marketing (Source: Scopus, May 2012).

- About a 70% of the revised papers have proposed and applied ad-hoc intelligent systems, though the others have opted to use existing software (e.g., iThink, LINDO or NEXPERT).
- The ad-hoc developed systems are based on a diversity of AI approaches, applied on their own or hybridized, like fuzzy logic, neural networks, dynamic programming, and optimization algorithms, among others.

3. Contributions in this special issue

This special issue presents a collection of original, rigorous and significant contributions on AI-based solutions to aid the management of particular business marketing issues. All have solid empirical applications and discuss the implications of their proposals for marketing practitioners.

Tsafarakis et al. (this issue) propose a new and original method for optimizing a company's line of products which is based on both discrete and continuous attributes. For this to happen, a Particle Swarm Optimization algorithm is designed to deal with these kinds of attributes within the Business-to-Business context. The novelty of this method yields two advantages: 1) unlike most product line optimization methods, usually developed for firms oriented to consumer markets, the proposed method has been designed taking into account typical industrial settings; and 2) this method, apart from its ability to deal with discrete variables, can also process variables set on a continuous range. When compared with previous methods of product line optimization, this method's particularities allow manufacturers to increase the customization degree, and hence the added-value, of their product lines.

To overcome the usual weaknesses linked to standard supplier segmentation methods, Rezaei and Ortt (this issue) propose a new fuzzy rules-based system method. Fuzzy rules-based systems in segmentation are expected to perform better than traditional methods that do not work with fuzzy variables, especially when dealing with the interdependencies of segmentation variables and their eventual vagueness. The proposed method is based on two supplier characteristics: *capabilities* or set of skills and know-how accumulated over time; and *willingness*, or predisposition to engage in a long-term relationship with a buyer (i.e. customer). It is applied and tested to a real broiler company. The results are proven to be helpful in improving the company's strategies to manage its relationships with suppliers. Besides this, the authors suggest using this method's output to better connect supplier selection, supplier relationship management and supplier development.

Liang-Tu Chen (this issue) uses dynamic programming to improve the buyer–supplier coordination in a supply chain for deteriorating goods. From the diversity of approaches that can be used to manage and coordinate complex, dynamic supply and demand networks all along the distribution channel (i.e. from consumers to manufacturers and suppliers, passing through retailers), the author considers a scenario of vendor-managed inventory (VMI) systems with consignment contracts to ameliorate decision-making processes in retailer-centric business-to-business traditional markets and electronic markets. A profit-maximization problem is designed using dynamic programming for a single-retailer and single-supplier channel under cooperative and non-cooperative game settings over a multi-period planning range. One of the main concluding ideas is that a cooperative setting under the VMI with consignment contracts in the electronics market increases channel efficiency and profits for both supplier and retailer.

The article by D'Haen and Van den Poel (this issue) tackles the problem of customer acquisition and, specially, retention in the realm of business-to-business sales management. A model is proposed to assist sales staff in identifying the firms within the business market which are more likely to complete the whole cycle of the sales funnel (i.e. prospects–leads–customers), so finally becoming loyal, long-term customers. This information is useful for seller companies to save time, money and, ultimately, improve the efficiency and effectiveness of their customer relationships management (CRM) programs. In particular, this proposed tool is suitable for use in an analytical-oriented CRM, which basically applies data mining to customers' databases for strategic purposes. The analytical model presented here has three phases, during which diverse methods such as decision trees and neural networks are applied. Also, it has been tested by using a database of American companies with 166 variables and on 16 million observations. In sum, the authors' contribution can significantly modify the usual shape of the sales funnel in business markets.

Lee, Lee and Lee (this issue) propose an original and powerful multi-agent system to aid the marketing planning of companies operating within business-to-business territory. The authors explain the rationale of their contribution by emphasizing the importance of marketing planning for firms, but also the great complexity which is frequently associated with planning processes, and the lack of powerful methods to aid strategic planning. However, AI-based methods have been highlighted for their potential to effectively support the kind of challenges that managers face throughout the marketing planning process, but few contributions can be found in this regard. Here, the authors present a multi-agent system called MACOM which allows the integration of the diversity of managerial positions and views through the structure of areas within the organization, as it is able to capture interdependencies from among the variables of different functional managers through fuzzy cognitive maps. The proposed multi-agent system is tested by means of a simulator and applied to real strategic marketing planning in a global IT company.

Orriols-Puig et al. (this issue) present a method for decision-making support which is based on knowledge discovery in databases and soft computing methodologies. In particular, it is a genetic fuzzy system (called Fuzzy-CSar) applied to analyze attitudinal commitment in a manufacturer–distributor relationship. This particular distribution channel problem was originally approached by Gilliland and Bello (2002), whose study and database have been used within the experimentation part of this article. The proposed method can perform both supervised and unsupervised learning. These represent two performing modes, with different characteristics and benefits. Basically, the proposed method provides a set of descriptive fuzzy rules with quality metrics related to each, which interconnect the compounding variable of the database; the way that such a set of fuzzy rules is obtained is what makes the difference between the supervised and unsupervised modes. One of the interesting aspects of these rules is that information is provided in qualitative (linguistic) terms, which is in line with how humans (managers) reason.

To conclude, we hope that this special issue contributes to building up this incipient research topic and moving it forward. Our sincerest thanks go to the EIC of IMM, Peter Laplaca, for believing in our special issue project. His support and encouragement during its production have been very important for us. We would also like to acknowledge all the researchers for their time and submission of manuscripts, and, in particular, our thanks to those who have successfully passed the review process. Finally, our gratitude extends to the international team of referees who served on this special issue:

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Appendix A. Review of papers using intelligent systems applications for industrial marketing issues

Papers (in alphabetical order)	Main context within Industrial/ B2B marketing	Research aims	Conclusions/main results	Why are AI-based systems used?	Do they use an ad-hoc developed intelligent system or existing software?	What types of intelligent system are used?
Chan and Ip (2011)	Innovation/NPD	A decision support system is proposed to: 1) predict customer purchasing behavior given certain product-, customer-, and marketing-influencing factors; and 2) estimate the net customer lifetime value from purchasing behavior to toward a specific product.	This system has shown itself to be useful for decision-makers in order to: 1) Compare alternatives and select competitive products to launch on the market; 2) improve the understanding of customer behavior toward particular products, enabling the design of effective marketing strategies that increase customer loyalty and have a positive impact on generating higher profits in the long term; and 3) enhance confidence in new product development in terms of idea generation and product improvement.	The proposed system enables a more effective decision support by providing convincing and accurate solutions that could help companies develop competitive products and relationship marketing strategies. No comparisons with other approaches are made.	iThink (http://www.iseesystems.com/softwares/Business/ithinkSoftware.aspx)	A decision support system that consists of two models (one for customer purchasing behavior and another for net customer lifetime value) is proposed. These models are based on system dynamics, an analytical method for studying feedback systems using casual loop diagrams.
Chen and Chen (2008)	Buyer behavior	Production decision-making processes do not usually take marketing's dynamic nature into account; this is mostly due to the inherent weaknesses of the ERP system, e.g., the fixed and static parameter settings. To tackle these drawbacks, the authors propose two decision models that optimally solve the production lot-size/scheduling problem, considering the dynamic aspects of customer demand as well as the restriction of finite capacity in a plant.	Results show that the solution generated by the *shortages followed by inventory* (SFI) production style outperforms that by the *inventory followed by shortages* (IFS) in maximizing the net profit and other quantifiable measures such as minimizing inventory investment and storage capacity.	The advantage of the proposal is shown in an experimental study with an ideal, laboratory problem	Ad-hoc	A decision support system based on a dynamic programming model optimized by iterative search.
Laínez, Reklaitis, and Puigjaner (2010)	Management	Supply chain models incorporating business strategic decisions have to cover both supply chain and demand chain sides, so marketing activities must be coordinated with other corporate functional areas. This paper aims to build on the body of marketing science models by formulating a mathematical model, based on mixed integer nonlinear programming, which encompasses the main relevant business functionalities.	The holistic approach presented here, when compared with the traditional sequential decision approach, is demonstrated to be more beneficial. The potential of applying data mining techniques in this field is highlighted, as their use enables descriptive data-driven models to obtained for the marketing activities, which can be later used in an optimization scheme.	A synthetic supply chain design-planning problem is solved by both the proposal and traditional sequential approach. Empirical results prove the benefits of the former approach.	Ad-hoc	Mixed integer nonlinear programming
Li (2007)	e-Commerce	Development and experimental evaluation of an Internet-enabled	The AgentStra system is efficient and effective in terms of improving	The intelligent system helps reduce the cognitive loads to develop market	Ad-hoc	Multi-agent intelligent system.

Appendix A (*continued*)

Papers (in alphabetical order)	Main context within Industrial/ B2B marketing	Research aims	Conclusions/main results	Why are AI-based systems used?	Do they use an ad-hoc developed intelligent system or existing software?	What types of intelligent system are used?
		multi-agent prototype system, Agent-Stra, for developing marketing strategies, competitive strategies and associated IT/IS/e-commerce strategies.	strategy-making speed, improving confidence in strategy development, coupling strategic analysis with human judgment and creativity, helping strategic thinking, improving the quality of strategic decision making, etc.	strategies. The system is assessed in terms of efficiency and effectiveness compared to paper-based models through a questionnaire.		
Li (2000)	Management	Development of a hybrid intelligent system which supports the marketing strategy process. The particular purposes for this system are: 1) provide a logical process for strategic analysis; 2) support group assessment of strategic marketing factors; 3) facilitate a simultaneous consideration of strategic analysis with managerial intuition and judgment; 4) help managers to deal with uncertainty and fuzziness; and 5) produce intelligent advice on setting marketing strategy. Likewise, the proposed system aims to integrate the Porter's five forces model and the directional policy matrices to support strategic analyses.	The system was empirically assessed with marketing managers in five large British companies. Results showed that the hybrid system was useful and helpful in aiding the key aspects of marketing strategy development. The outputs generated by this system were reported to be mostly sound, surprisingly accurate, and clearly reflecting managerial judgment.	An artificial neural network is developed to analyze and forecast the market growth while the fuzzy rule-based system handles the inherent uncertainty of strategic criteria and implements reasoning for developing marketing strategy. Usefulness is evaluated through a questionnaire.	Ad-hoc	Hybrid intelligent system composed of artificial neural networks, decision support systems, expert systems and fuzzy logic.
Li and Li (2009)	Management	Hybridize human judgment, analytical hierarchy process, computer simulation, and fuzzy systems to deal with strategic uncertainties and support the process of marketing strategy and related Internet marketing strategies.	The proposed hybrid approach was efficient in improving the speed of strategy development and effective in coupling strategic analysis with human judgment. Findings were based on the assessment of six managers. This approach was beneficial for: 1) improving strategy-making performance; 2) helping in the understanding of strategic factors; 3) fostering strategic thinking; 4) Increasing strategy-making confidence; and 5) improving the output and quality of strategic decision-making.	Hybridization of different intelligent systems with a positive synergy to deal with the uncertainty and vagueness in strategic decision-making.	Expert Choice software (http:// expertchoice.com/) for AHP; ad-hoc for Monte Carlo simulation and fuzzy expert system	Hybrid intelligent system composed of fuzzy-based expert system to recommend strategies, Monte Carlo simulation to score individual factors and analytic hierarchy process to determine relative importance of individual factors.
Li and Li (2010)	Global and international marketing	Although computer-based systems have already been used for solving international marketing problems, most are usually restricted to the use of a single individual technique (usually traditional expert systems) and mainly deal with a particular problem of international marketing decision making. This research investigates the use of multi agent-based hybrid systems for international marketing decision-making. In particular, it proposes and tests a system called *Agents International*.	Conceptual framework, software architecture and evaluation findings are presented. The main benefits of the proposed multi-agent hybrid approach are: 1) to combine the strengths of intelligent software agents, knowledge bases, Monte Carlo simulation and fuzzy logic; 2) to couple human judgment with analytical models; 3) the system's functionality in assisting the three key stages of international marketing planning	The main advantage of this multi-agent hybrid approach is the ability to couple human judgment with analytical models; more effective decision-making processes are performed. Compared with their previous proposal (Li, 2007), the new system is designed to support the overall process of international marketing planning. No comparisons with other intelligent approaches are made. Usefulness evaluated by managers' responses to a close-ended questionnaire.	Ad-hoc	A multi-agent hybrid intelligent system is proposed. Monte Carlo simulation is used to represent and capture market changes and uncertainties. Fuzzy rules with certain degrees of confidence are considered to command the use of expertise to make decisions.

Appendix A (*continued*)

Papers (in alphabetical order)	Main context within Industrial/ B2B marketing	Research aims	Conclusions/main results	Why are AI-based systems used?	Do they use an ad-hoc developed intelligent system or existing software?	What types of intelligent system are used?
Lin, Wang, and Chin (2009)	Pricing	Prior studies have scarcely explored the simultaneous effects of warranty length and production rate on the setting of prices. Here the authors propose a model-driven Decision Support System where decisions for optimizing product pricing, production rate and warranty are simultaneously derived to maximize profit over the lifecycle of the product	Under most demand-function scenarios, price and warranty length should be altered in the same direction to establish optimal policies for all distributions, regardless of the production learning effect or unitary inventory cost.	Decision support systems help the user to achieve new insights into the complex interdependencies of the decision-making process.	LINDO software (http://www.lindo.com)	Decision support system is used to determine control paths for price, production rate and warranty length in product life distributions. Dynamic programming is applied to optimize these paths.
Metaxiotis, Psarras, and Askounis (2002)	Management	To develop an expert system that helps to schedule the production of SME in the most effective way, considering the prevailing conditions (e.g., production characteristics, constraints, performance criteria, etc.) in the industrial environment.	A rule-based expert system prototype called "GENESYS" is developed and tested. This software was successfully interconnected to an integrated management information system of enterprise resources, consisting of a number of subsystems (e.g., financial and sales management, monitoring of production cost accounting, resources scheduling, warehouse management, etc.).	Expert systems help organizations to increase automation, make more consistent decisions and improve production quality.	NEXPERT (http://www.dassault-developpement.fr/ndhome/)	A rule-based system refined by different combinatorial optimization algorithms is considered.
Moreno (2009)	Pricing	To develop a model that simulates the decision making process of the Colombian energy market's trading agents in two questions: 1) how they perceive, analyze and consider the market's signals; 2) how they learn from their experiences and modify their beliefs according to their risk profiles	Three main advantages are pointed out, when applying fuzzy logic and machine learning to support the trading agents' strategies: 1) it has a simple formulation, when just a few relevant variables are considered; 2) the synergies of combining fuzzy logic and machine learning to infer the market's evolution and improve trading agents' decisions; and 3) based on both simulation and real data, the proposed model enabled significant profit to be made.	A comparison with a passive contracting strategy in real and synthetic data shows that the proposed IA-based model performs better.	Ad-hoc	Fuzzy-rule based system optimized by a kind of reinforcement learning

References

Aliev, R. A., Fazlollahi, B., & Aliev, R. R. (2004). *Soft computing and its applications in business and economics (Studies in fuzziness and soft computing) (Hardcover)*. Springer.

Berry, M., & Linoff, G. (1997). *Data mining techniques: For marketing, sales and marketing support*. Wiley.

Bidgoli, H. (1998). *Intelligent management support systems (Hardcover)*. Quorum Books.

Carlsson, C., Fedrizzi, M., & Fuller, R. (2003). *Fuzzy logic in management (International series in operations research & management science)*. Springer.

Casillas, J., & Martínez-López, F. J. (2009). Mining uncertain data with multiobjective genetic fuzzy systems to be applied in consumer behaviour modeling. *Expert Systems with Applications*, 36(2, part 1), 1645–1659.

Casillas, J., & Martínez-López, F. J. (Eds.). (2010). *Marketing intelligent systems using soft computing: Managerial and research applications*. Springer.

Management intelligent systems. Casillas, J., Martínez-López, F. J., & Corchado, J. M. (Eds.). (2012). *First international symposium, vol. 171 of Advances in intelligent systems and computing*. Springer.

Chan, S. L., & Ip, W. H. (2011). A dynamic decision support system to predict the value of customer for new product development. *Decision Support Systems*, 52, 178–188.

Chen, L. -T., & Chen, J. -M. (2008). Collaborative marketing and production planning with IFS and SFI production styles in an ERP system. *Journal of the Chinese Institute of Industrial Engineers*, 25, 337–343.

Gilliland, D. I., & Bello, D. C. (2002). Two sides to attitudinal commitment: The effect of calculative and loyalty commitment on enforcement mechanisms in distribution channels. *Journal of the Academy of Marketing Science*, 30(1), 24–43.

Laínez, J. M., Reklaitis, G. B., & Puigjaner, L. (2010). Linking marketing and supply chain models for improved business strategic decision support. *Computers and Chemical Engineering*, 2107–2117.

Laplaca, P. J. (1997). Contributions to marketing theory and practice from *Industrial Marketing Management*. *Journal of Business Research*, 38, 179–198.

Li, S. (2000). Development of a hybrid intelligent system for developing marketing strategy. *Decision Support Systems*, 27, 395–409.

Li, S. (2007). AgentStra: An Internet-based multi-agent intelligent system for strategic decision making. *Expert Systems with Applications*, 33, 565–571.

Li, S., & Li, J. Z. (2009). Hybridising human judgment, AHP, simulation and a fuzzy expert system for strategy formulation under uncertainty. *Expert Systems with Applications*, 36, 5557–5564.

Li, S., & Li, J. Z. (2010). AgentsInternational: Integration of multiple agents, simulation, knowledge bases and fuzzy logic for international marketing decision making. *Expert Systems with Applications*, 37, 2580–2587.

Liebowitz, J. (2006). *Strategic intelligence: Business intelligence, competitive intelligence, and knowledge management*. : Taylor & Francis, Inc.

Lin, P. -C., Wang, J., & Chin, S. -S. (2009). Dynamic optimization of price, warranty length and production rate. *International Journal of Systems Science*, 40, 411–420.

Martínez-López, F. J., & Casillas, J. (2009). Marketing intelligent systems for consumer behaviour modelling by a descriptive induction approach based on genetic fuzzy systems. *Industrial Marketing Management*, 38(7), 714–731.

Matsatsinis, N. F., & Siskos, Y. (2002). *Intelligent support systems for marketing decisions (International series in operations research & management science)*. Springer.

Metaxiotis, K. S., Psarras, J. E., & Askounis, D. T. (2002). GENESYS: An expert system for production scheduling. *Industrial Management & Data Systems*, 102, 309–317.

Moreno, J. (2009). Trading strategies modeling in Colombian power market using artificial intelligence techniques. *Energy Policy, 37*, 836–843.

Negnevitsky, M. (2004). *Artificial intelligence: A guide to intelligent systems* (2nd ed.). Addison-Wesley.

Prasad, S. (Ed.). (2008). *Soft computing applications in business (Studies in fuzziness and soft computing) (Studies in fuzziness and soft Computing)*. Springer.

Wierenga, B. (2010). Marketing and artificial intelligence: Great opportunities, reluctant partners. In J. Casillas, & F. J. Martínez-López (Eds.), *Marketing intelligent systems using soft computing: Managerial and research applications* (pp. 1–8). Springer.

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