

THE AUGMENTING EFFECTS OF ARTIFICIAL INTELLIGENCE ON MARKETING
PERFORMANCE

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Dedication

I dedicate this work to my parents, my dissertation committees, my professors and my friends.
Thank you for all unconditional support, help, and encouragement you have provided through this
challenging and rewarding journey.

PREVIEW

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THE AUGMENTING EFFECTS OF ARTIFICIAL INTELLIGENCE ON MARKETING
PERFORMANCE

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Abstract

This study explores the antecedents and consequences of firm's artificial intelligence (AI) adoption. Based on technology-organization-environment (TOE) framework and institutional theory, I propose that technological opportunism, top management support, customer orientation, and normative pressure are the main antecedents lead to firm's AI adoption. According to firm's different strategic types, this study added that prospectors are most likely to adopt AI, followed that analyzers, defenders, and reactors. In addition, enlightened by dynamic capability theory, I further propose that the intensity of AI adoption will enhance firm's marketing performance through improved dynamic selling capability, dynamic pricing capability, dynamic new product development capability, dynamic advertising capability, and dynamic customer relationship management capability. Based on 250 valid respondents from marketing managers, product managers, and brand managers, I find support for the antecedents, consequences, and moderation effects of AI adoption.

Table of Contents

Dedication	iii
Acknowledgements	v
Abstract	vi
Table of Contents	vii
List of Tables	x
List of Figures	xi
Chapter 1: Introduction	1
1.1 Organization of the dissertation	4
Chapter 2: Artificial intelligence research in marketing: a systematic literature review based on bibliometric study, social network analysis, and main path analysis	5
2.1 Introduction	5
2.2 Literature review	6
2.3. Material and method	8
2.4. Results	8
2.4.1 Bibliometric result: Basic statistic	9
2.4.2 Bibliometric results: Leading authors, documents, universities, countries, and sources	11
2.4. 3 Social network analysis results	26
2.4.4 Main path analysis of milestone papers	33
2.5 Implications and conclusions	36
Chapter 3: Artificial intelligence in marketing: an acceptance model	38
3.1 Introduction	38
3.2 Literature review	39
3.3 Hypotheses development	41
3.3.1 The intensity of AI adoption	42
3.3.2 Technological opportunism	43
3.3.3 Top management support	44
3.3.4 Customer orientation	45
3.3.5 Normative pressure	46

3.3.6 Moderation effect: strategic types.....	47
Chapter 4: Augmenting effects of AI on marketing performance	49
4.1 Introduction.....	49
4.2 Literature review	50
4.3 Hypotheses development	52
4.3.1 Dynamic selling capability	53
4.3.2 Dynamic pricing capability.....	55
4.3.3 Dynamic new product development capability.....	57
4.3.4 Dynamic advertising capability	58
4.3.5 Dynamic customer relationship management capability	58
4.3.6 Marketing performance.....	59
Chapter 5: Methodology	61
5.1 Research design and method.....	61
5.2 Sample.....	61
5.3 Measures	62
5.3.1 Technological opportunism	62
5.3.2 Top management support.....	63
5.3.3 Customer Orientation.....	63
5.3.4 Normative pressure	64
5.3.5 Marketing performance.....	65
5.3.6 AI adoption intensity.....	65
5.3.7 Dynamic selling capability	66
5.3.8 Dynamic pricing capability.....	66
5.3.9 Dynamic new product development capability.....	66
5.3.10 Dynamic advertising capability	67
5.3.11 Dynamic customer relationship management capability	67
5.3.12 Mile-Snow Strategic types.....	67
5.4 Data cleaning	68
5.5 Data analysis and hypotheses testing.....	69
5.5.1 Stage I – Assumption test	69
5.5.2 Stage II – Descriptive Analysis.....	69
5.5.3 Stage III – Exploratory Factor Analysis	70

5.5.4 Stage IV – Confirmatory Factor Analysis	70
5.5.5 Stage V – Common method variance	70
5.5.6 Stage VI – Structural Equation Modeling (SEM).....	71
5.5.7 Stage VII – Moderated Effect- Multi-group -Structural Equation Modeling (SEM)	71
Chapter 6: Results	72
6.1 Descriptive Analysis Result.....	72
6.1.1 Response rate	72
6.1.2 Demographic Profile of Respondents	73
6.2 Exploratory Factor Analysis	73
6.3 Reliability test	77
6.4 Confirmatory Factor Analysis.....	77
6.5 Constructs Validity	80
6.5.1 Content validity.....	80
6.5.2 Convergent validity.....	80
6.5.3 Discriminant validity	80
6.6 Structural equation modeling -Main effects	81
6.6.1 Structural Model Estimation	82
6.7 Structural equation modeling-moderation effects.....	84
Chapter 7: Discussion	88
7.1 Implications.....	88
7.2 Limitation and future studies	90
References	91
Appendix.....	114
Scales and definition	114
Text output.....	119
IRB exempt letter for interview	157
IRB exempt letter for survey.....	159

List of Tables

Table 2.1: Descriptive statistic information.....	10
Table 2.2: Leading publishing authors.....	13
Table 2.3: Leading publishing authors' documents, and keywords.....	16
Table 2.4: most cited papers	20
Table 2.5: Leading institutions	22
Table 2.6: Most Cited Countries	23
Table 2.7: Most frequent sources.....	24
Table 6.1: Factor loading and items.....	75
Table 6.2: Revised factor loading and items.....	76
Table 6.3: Standardized Measurement Coefficients and t-Values Resulting from CFA.....	79
Table 6.4: Correlation matrix.....	81
Table 6.5: Hypotheses and structural path.....	84
Table 6.6: Moderation Hypotheses	87

List of Figures

Figure 2.1: Annual Scientific Production	11
Figure 2.2: Source growth.....	26
Figure 2.3: coupling network between countries	28
Figure 2.4: Coupling network between institutions	30
Figure 2.5: Coupling network between keywords	33
Figure 2.6: The Main Path Analysis	34
Figure 3.1: Conceptual Model	42
Figure 6.1: Strucutral Model	82
Figure 6.2: Structural model for moderation effect	85

PREVIEW

Chapter 1: Introduction

Consider the following scenarios:

When you post photos on Facebook, it can automatically recognize your friends' face and tag their names.

You talk directly to Siri through your iPhone to ask her what the weather will look like.

Amazon Alexa and Google Home work like your personal assistant to take care of your life, work, and home, e.g., set the room temperature, manage your schedules, control the lights, and so on.

Walt Disney Co. uses language processing to trigger an audio soundtrack as a parent reads a story to his/her child (Chow, 2017).

IBM Watson helps H&R block with tax preparation.

Salesforce Einstein utilizes predictive analysis, intelligence recommendations, image recognitions, sentiment analysis, and task automation to augment sales.

These artificial intelligence (AI) examples are already functioning in our daily lives. AI can be thought of as machines that exhibit aspects of human intelligence, it can be seen as “biopsychological potential to process information to solve problems or create products that are of value in a culture” (Gardner 1999, p.33-34). Scientifically, AI is not a new term. Early in 1955, the Dartmouth Research Project defined AI as “making a machine behave in ways that would be called intelligence if a human were so behaving” (McCarthy et al., 1955). Just as humans have different types and layers of intelligences, AI, based on the difficulty of the tasks it can accomplish, can be divided into two subclasses: narrow AI, and general AI.

For the purpose of my study, I will focus on narrow AI. Specifically, the AI in my context is defined as “a system’s ability to interpret external data correctly, to learn from such

data, and to use that learning to achieve specific goals and tasks through flexible adaption” (Kaplan & Haenlein 2019, p.16). These systems can be in the form of a robot, a platform, a smart machine, or even an application as long as it can exhibit the features characterized in this definition. Looking at the definition, one might ask how AI is different from similar terms related to the Internet of Things (IoT) and big data?

- The IoT can be regarded as devices and machines that collect and exchange data. The goal for them is to collect the input (that is data) for AI (Krotov, 2017; Saarikko, Westergren & Blomquist, 2017).
- Big data are data. They can be characterized as huge amounts (volume) of frequently updated data (velocity) coming from different sources (variety) in both numeric and nonnumeric formats, such as numbers, text, images, videos, and voices (Kaplan & Haenlein, 2019).

Today, AI is increasingly utilized in marketing and is regarded as a major source of innovation (Rust & Huang, 2014; Brynjolfsson, Rock, & Syverson, 2018; Schwab, 2017). Machine learning, deep learning, neural networks, supervised learning, semi-supervised learning, and unsupervised learning are the main techniques used in AI. They are the technological foundation in the development of AI (Carbonell, Michalski, & Mitchell, 1983). To successfully implement AI, it requires devices (IoTs) to get large amounts of data (big data) to train the system as well as high processing power to process those data under command algorithms. Owing to the substantial amount of buyer-seller transaction data, marketing provides a good foundation to test and apply AI innovations. Personalized tagging, text recognition, image and voice recognition all are commonly used AI applications. AI has brought disruptive changes to sales and marketing activities. For example, Node (a start-up company) uses artificial

intelligence to manage a large set of data and matches it with information from the web to create a prospect list for salespeople (Node, 2017). As an advanced new product innovation, Watson Analytics allows its customers to select the requirements or characteristics of products they want, while recommendation systems, enabled by the artificial intelligence, will automatically tailor options to meet their needs. Employing artificial intelligence in Azure Machine Learning Studio, automakers can more intelligently plan their manufacturing based on predicted customer demand.

These examples and technologies have made some people declare that we are in the fourth industrial revolution (Schwab, 2017). Recently, the US government challenged the United States to increase “AI administration investment” (Forbes, 2018). Accenture (2017) also showed that 85% of executives have plans to extensively invest in AI related technologies in the next 3 years. An early survey shows that 98% of marketing managers say that they can foresee the benefits of using AI; however, only 28% feel confident in using AI, with only 10% of the surveyed managers currently using it (Demandbase, 2016). Although AI is promising, it is still at the infancy stage, and it is reasonable to predict that marketers are not confident in using it. But why is this the case? Specifically, the research questions I am going to explore are:

- 1) What are the factors determining the acceptance and usage of AI? That is under what conditions will a company accept and use AI?
- 2) How will the usage of AI impact firm marketing related activities?

The purpose of this dissertation is to provide future researchers and practitioners a road map of the factors that impact company usage of AI, and how AI combined with human intelligence (HI) in impacting firm marketing performance. The dissertation aims to offer insights for managers to determine how to improve the adoption and usage of AI. Additionally,

the combination of HI and AI will allow managers to optimize the benefits of AI and to identify what they need to do to optimize those AI benefits.

1.1 Organization of the dissertation

The dissertation is organized as follows:

Chapter 2 introduces AI, different applications, key technological terms, and key academic trends. I utilize a bibliometric study, social network analysis, and main path analysis to provide a systematic review of AI in the marketing field.

Chapter 3 proposes AI acceptance model. To practitioners and scholars, AI is still a relatively new field. Before articulating how AI will impact firm performance, I first identify the factors that impact its acceptance and use. I utilize a quantitative survey to empirically examine the proposed model.

Chapter 4 systematically explores how AI impacts various kinds of marketing activities and their subsequent performances. I utilize a quantitative survey to empirically test the proposed model.

Chapter 5 uses survey design to collect data in testing the theoretical model proposed in Chapter 3 and 4. Chapter 6 discuss the results, provide the implications for researchers and practitioners, and point out the limitations and future directions.

Chapter 2: Artificial intelligence research in marketing: a systematic literature review based on bibliometric study, social network analysis, and main path analysis

AI, which refers to human intelligence exhibited by machines, can provide great value for marketing decision makers who constantly use the data, the knowledge, and the expertise to solve marketing problems. AI, machine learning, and robotics will undoubtedly accelerate the marketing decision making process. With AI and machine learning, customized marketing will be possible. What is the impact of AI, robotics, and machine learning on marketing academics? Due to the ever-increasing interest and importance of AI applications in our marketing field, a comprehensive review that precisely analyzes the complex AI-marketing (AIM) interface literature is imperative to gain a proper understanding of the AIM field (Siau & Yang, 2017). Such a review will help researchers understand the developing path of the field so that they can determine what was important, what is important, and what will be important. This will also facilitate the healthy growth of the AIM field by guiding researchers to focus on meaningful research questions.

2.1 Introduction

Introduced by Garfield in 1972 (Garfield, 1972), the bibliometric study explores, organizes, and analyzes a large amount of content in academic journals and the journal citation information to help improve strategic decision-making. One of the main goals of bibliographic analysis is analyzing a research area to identify its leading trend (Bonilla, Merigó, & Torres-Abad, 2015). Paper's authors, keywords, affiliations, and citations information are collected in bibliometric study.

Social network analysis, on the other hand, is a method to study and analyze social relations through monitoring the relationship of social ties among nodes. Social network studies

believe that ties among nodes transmit information. The main benefit of social network analysis is to acknowledge meaningful relationships within nodes (Stangor, 2015).

Hummon and Doreian (1989) first introduced the main path analysis to use citation information to trace the main ideas that flow in a scientific discipline. As an effort to better understand the current state of AI-related research, and motivated by the ever-increasing interest in AI and scarce review literature about it, this article aims to comprehensively review AIM through a bibliometric study, social network analysis, and main path analysis. The results will provide a comprehensive view about who is leading the journals, what are the main topic trends, and what are the main research clusters. The review will also provide information about the citation structure of the journals that published this topic, the most cited papers, the most influential authors, countries, sources, and keywords.

This study is apportioned as follows: Section 2 provides a literature review about previous studies related to AI in marketing. Section 3 presents the materials and methods used to extract the publications. Section 4 discusses results based on descriptive statistics (e.g., leading authors, leading authors' publications, most cited papers, leading countries, and leading sources), social network analysis on the field of research, and the milestone papers by means of main path analysis. Lastly, the discussion section summarizes major findings and identifies future research streams.

2.2 Literature review

Bibliometric analysis has been widely used in literature review on a broad range of topics in the business discipline, including marketing (Samiee & Chabowski, 2012), advertising (Kim & McMillan, 2008), sales management (Johnson, 2006), accounting (Zhong et al., 2016),

strategic management (Vogel & Güttel, 2013), supply chain management (Asgari et al., 2016), and so on.

Pieters et al., (1999) were the first to reveal importance and similarity in the evolving citation network of the international journal of research in marketing (IJRM) from 1981 to 1995. The findings show that the overall importance of IJRM in its network is growing.

Saeed and Brian (2012) used a multi-method bibliometric analysis to study the knowledge structure in international marketing (IM). The results indicate that the IM field is expanding and is more complex than ever before.

Leone et al., (2012) conducted a citation and profiling analysis of pricing research from 1980 to 2010. Based on these data, they identified individual articles, authors, and institutions that have contributed most to this research stream. Their results showed that pricing is an important topic in the marketing domain.

Kuntner and Teichert (2016) also conducted an informetric study about the scope of price promotion research. The authors demonstrated price promotions are an essential element of a company's marketing policy because they affect sales, profits, and firm performance.

Marketing bibliometric studies provide us a good foundation to understand studies in the marketing field. However, AI studies are still in the infancy stage, until now there is a limited number of publications talking about AI in marketing. A systematic bibliometric study of AIM is still missing. At the same time, a comparative and quantitative analysis of the AIM studies will provide more insight for scholars in both fields. Therefore, utilizing bibliometric analysis, social network analysis, and main path analysis, this study is in an attempt to fill this research gap.

2.3. Material and method

The unit of measure in this study is the individual articles published within the broad topic of artificial intelligence and marketing interface. To capture as many articles as possible, this study has used “artificial intelligence” or “machine learning” or robot as the topics to represent AI streams. To make sure that the proposed AI streams have captured enough marketing activities, this study has included “marketing” or “new product” or “customer relationship” or “selling” or “market planning” or sale or “marketing planning”, or brand, or “selling capability” or “new product development capability” or “customer relationship management capability” or “marketing planning capability” to represent marketing streams. Then, this study examines the interface of AI streams and marketing streams to generate the final list of articles studied in the bibliometric study.

This study includes only published articles. I did not include book reviews and comments to editors. After ruling out all the duplicates, the number of unique records totaled 628 from the year 1982 to 2019. Although this dataset did not cover every artificial intelligence article in marketing ever published, the rigorous data selection process helps to ensure that the dataset can reasonably represent the AI field. This study configured all 628 papers into the Web of Science (WOS) citation format and fed the data into R, and utilized the biblioshiny method to do the bibliometric analysis. The software systems utilized for network analysis and main path analysis were VOSviewer 1.6.5 (Appio et al., 2017) and Pajek 5.0.1 (Strozzi et al., 2017).

2.4. Results

This study will interpret the bibliometric study results, social network analysis results, and the main path analysis results, respectively.

2.4.1 Bibliometric result: Basic statistic

The 628 articles have generated 7951 cited references which correspond to an average of 12.66 citations per document. Furthermore, the statistics show that teams of researchers have explored the topics of artificial intelligence, machine learning, robot, and marketing in the world. The average research team corresponds to 3.36 authors per document and confirms an expected significance of social network in the studied research (Table 1). As a comparison, this study also did a similar search for AI-unemployment WOS search and AI-marketing-unemployment WOS search. This study chooses unemployment as another research interest for two reasons. First, recently there are many in the business presses and practitioners worry about the employee's replacement by AI (e.g., PwC, 2017). In marketing studies, one of the key research areas is to study the relationship and interaction among customers, salespeople, and firms. If the human replacement rumors keep on heating, there will be a disruptive impact on how future marketing activities will be conducted. Second, literature from other fields, such as economics, management, and strategy have each theoretically and empirically tested the impacts of technology, robots, and digital invasion on innovation, employment, and GDP (e.g., Autor & Salomons, 2017). To give us a more comprehensive view of AI research, it requires a comparison among these three streams. Specifically, the keywords this study have used to identify the unemployment stream are "human labor" or "human labour", or "unemployment", or "human replacement". It includes only published articles. Eventually, the AI-unemployment interface produces only 95 articles ranging from 1991 to 2019. Lastly, this study also did the AI-marketing-unemployment interface using the same keywords search, the total number of articles that meet this requirement is 720.

From table 2.1, we can see that the stream of AI-unemployment studies is less than AI-marketing. The first article talking about AI-unemployment is nine years later than AI-marketing's. Thus, the average citation and the number of co-authors are smaller than AI-marketing. Although it is new and small, AI-unemployment concerns and worries will add some new perspectives to marketing scholars who want to investigate academic frontiers.

The AI-marketing interface does provide good basic statistical information for us to know the AIM field. What drives further exploration is how AIM leads to marketing related performance? Theoretically, AI could be interpreted as a capability added to the firm's activities. In the marketing field, capabilities generation and building is a big stream of study. How does the current dynamic capabilities literature look like? A bibliometric study conducted by Albort-Morant et al., (2017) showed that from 1991 to 2015, there are 3852 study published in Web of Science contained "dynamic capabilities" topic. In the year 1991, it only had 2 publications, but it surged dramatically to 307 in 2015. The USA is leading the publications in this field. This extensive stream of studies shows us that capability-driven literature could be a promising theoretical link between AI and firms marketing performance. The bibliometric study also indicates that Strategic management journal is the top 1 journal there, it could provide us a good source to find references.

Table 2.1: Descriptive statistic information

	AI-marketing interface	AI-unemployment interface	AI-marketing- unemployment interface
Total Number of Articles	628	95	720
Period	1982-2019	1991-2019	1982-2019
Average citation per documents	12.66	8.52	12.16
Co-authors per document	3.36	2.99	3.33

Figure 1 shows the annual scientific production of the articles discussing those topics. It is evident that after the year 2012, the annual scientific production has increased dramatically. In the past 30 years (from 1982 to 2012), the number of annual production was below or around 25. But, six years later (at the year 2018), the number of annual production has increased to 125, which is almost five times over the past 30 years. From this figure, this study assumes that the rate will continue to grow. Artificial intelligence in marketing has been a hot topic. Scholars are showing great interest in the area as a researchable topic.

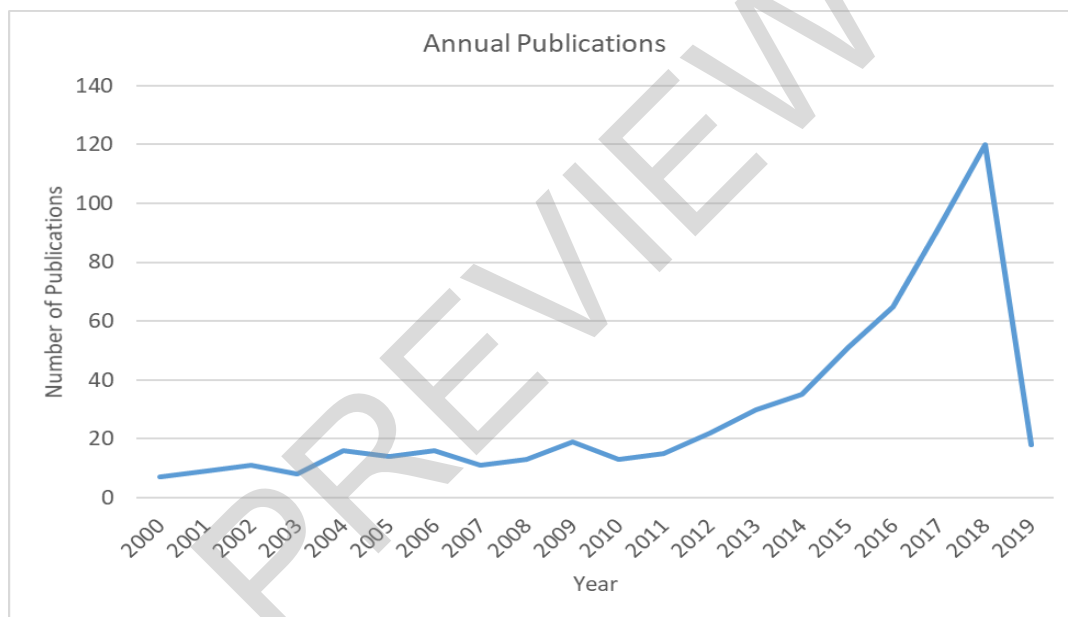


Figure 2.1: Annual Scientific Production

2.4.2 Bibliometric results: Leading authors, documents, universities, countries, and sources

Table 2.2 shows the top 10 leading authors. They are ranked by the number of documents published. Along with the number of publications, table 2 also shows the other metrics (such as h-index, g-index, m-index, total citations) for a comparison. Although different metrics show different ranks of the top authors, generally, they provide some information about the author's