

# Development of Management Science from 1991 to 2021: Review of Publications Indexed in WoS

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**Abstract:** Management is a discipline that has existed for as long as humans have, but its theoretical underpinnings are relatively new. There was already evidence of the creation and use of management ideas since 2900 BC, when Egypt was deploying over ten thousand people to build the pyramids. During the Middle Ages, the Greek, Roman, and Chinese empires all created their own versions of management theory. Modern management throughs were a 20th-century phenomenon, and management was only recognized as a formal study since the late 19th century. In this paper, the development background, thoughts and schools, existing problems, research methodology, discipline branches, and functions of management as a social science are systematically discussed and elaborated. A systematic review approach was used to summarize and analyze the 2,772,999 publications included in the Web of Science from 1991 to 2021 to find out the overall trend of publication, the published organization or institution, and the high-frequency research areas.

**Keywords:** Management science; Qualitative research; Literature review; Systematic review, Web of Science (WoS)

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## 1. Introduction

### 1.1. Industrial revolution and emergence of scientific management

The industrial revolution started in the middle of the 18th century which made great progress in social productivity and management thought. The functions of planning, organizing, and controlling came into being one after another. During this period, Adam Smith published his masterpiece “The Wealth of Nations,”<sup>[1]</sup> and the notion of division of labor served as a critical theoretical cornerstone for the development of the management science.

Social stratification, social interactions, and inter-personnel activities were all evolving into increasingly sophisticated forms in pre-industrial civilization. In capitalist countries, the contradiction between labor and capital was becoming more and more prominent, and the level of productivity was also increasing. As a result, finding a solution for enhancing factory and workshop management has become a pressing issue. A set of systematic management theories and scientific management techniques were urgently needed to adapt to it. At that time, Frederick W. Taylor continually believed that resolving the conflict between labor and capital was necessary, and he saw the pursuit of economic interests as one of humanity’s most fundamental necessities<sup>[2]</sup>. Henri Fayol, in the meanwhile, conducted a comprehensive study of the companies, methodically proposed 14 principles, defined 5 management roles, and developed the organization management theory<sup>[3]</sup>. This systematic, theoretical approach is what gives the management system structure. It takes ongoing management level improvement in the industrial economy

to adjust to the changing business environment due to the quick socialization of production, the rapid enhancement of productive forces, the constant market growth, and the harsher competitiveness of firms. As a result, a large number of management academics, sociologists, and psychologists are actively involved in management research, leading to the establishment of several new management theories and the emergence of a management theory jungle.

## **1.2. Socio-cultural shifts and revolution of management science**

The assumption of human nature in management has shifted from that of economic man, social man, and decision maker to that of complex man as a result of the global economy's fast shift from an industrial economy to an information economy. According to Maslow's hierarchy of needs hypothesis, the existence of personal purpose, preference, and interests mean that people will have a range of desires <sup>[4]</sup>. To satisfy the demands of each individual's self-development, self-realization, and self-improvement, these needs will create a range of motives and actions. Human nature has grown incredibly complicated as a result of cultural and moral evolution. Organizational efficiency cannot be significantly increased if managers fail to promptly analyze the situation, implement incentive mechanisms, and honestly collaborate with employees to satisfy their needs and fully realize their potential. The assumption of human nature in management will therefore overcome the assumptions of the economic man, social man, and decision-maker as the information economy period comes into being, sublimating to the complex human hypothesis.

## **2. Decisive concepts and problems of management science development**

### **2.1. Decisive concepts for management science**

Numerous management techniques have been developed since the advent of management philosophy, thanks to the contribution of hundreds of authors and practitioners. According to the major concepts and schools of management science, Koontz and Weihrich summarized the major contributions with corresponding management writers and practitioners which are considered decisive of management science <sup>[5]</sup>.

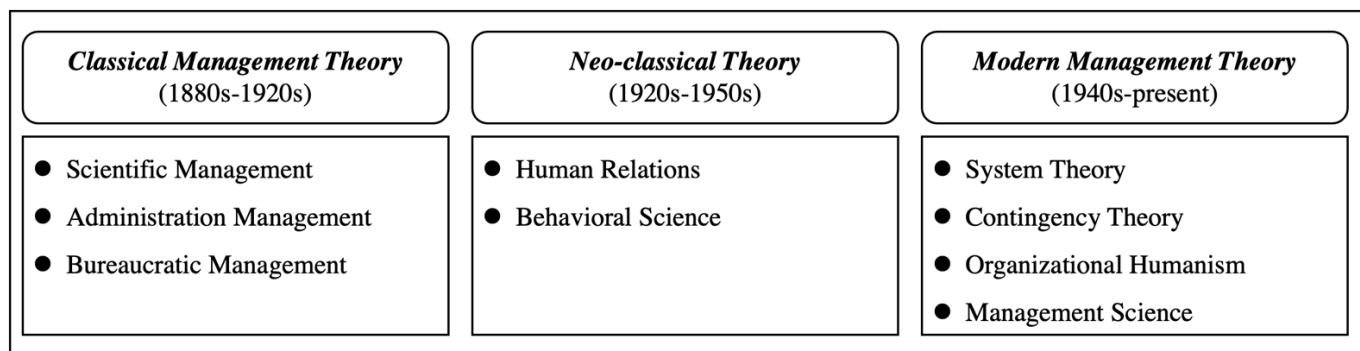
The formation stage of management is more or less controversial, but it normally has two ways of classifying, which are by time and by schools. Firstly, Hitt et al. divided management theories into three major categories according to the progression of time: classical management theory, neo-classical theory, and modern management theory <sup>[8]</sup>. The second is according to the classification of schools of management theory, among many scholars, Koontz's work was well recognized who classified the management theories into five schools, namely "Scientific Management," "Modern Operational Management Theory," "Behavior Science, Systems Theory, Modern Management Thought" <sup>[3]</sup>.

The three management theories listed by Hitt et al. <sup>[4]</sup> are currently popular and deemed sufficient to address this issue. As summarized in **Figure 1**, the "Classical Management Theory" evolved in the late 19th century and early 20th century that consists of a group of similar schools, as Scientific Management, Administration Management and Bureaucratic Management, on the management of organizations with the emphasis on managing workers and organizations more efficiently.

The "Classical Management Theory," which emphasized a more human-oriented approach and centered on the time needs, desires, behaviors, and attitudes of individuals, served as the foundation for the Neo-Classical Theory, which arose between the 1900s and 1950s. The main contributions for this classification were Human Relations School and Study of Behavior Science.

With the end of World War II, the modern management theory, the "Modern Management Theory" came on the stage. It drew attention to both the complexity of the organization and the variety of needs, drives, ambitions, and potentials among people. During this period of development, the most significant milestone was the beginning of use of mathematical and statistical methods for increasing quality of

managerial decision-markings. The contemporary management theory has made substantial contributions by extending the application of management expertise into fields other than business, including education, government, and health.



**Figure 1.** Management classifications by time (source: edited based on Hitt *et al.* [6])

As shown in **Table 1**, there are five general management thoughts or schools contributed to its original emergence and further development of management science. The main authors of “Scientific Management” were Frank and Lillian Gilbreth, Henry L. Gantt, and Frederick W. Taylor. Hugo Munsterberg, Max Weber, Vilfredo Pareto, Roethlisberger F. Jules, and William W. Dickson were the major behavioral science scholars; Chester Bernard made contributions to “System Theory”; Henri Fayol founded the “Modern Management Theory of Operation”; Peter F. Drucker and others were “Modern Management Thought” practitioners and scholars.

**Table 1.** The emergence of management thoughts (source: edited based on Koontz and Weihrich [5])

| Major contribution to management | Major contributors                             | Major works      |
|----------------------------------|--|------------------|
| Scientific management            | Frederick W. Taylor                            | [2]              |
|                                  | Henry L. Gantt                                 | [7]              |
|                                  | Frank and Lillian Gilbreth                     | According to [5] |
| Modern operational management    | Henri Fayol                                    | [3]              |
| Behavioral sciences              | Hugo Münsterberg                               | [8]              |
|                                  | Walter Dill Scott                              | [9]              |
|                                  | Max Weber                                      | [10]             |
|                                  | Vilfredo Pareto                                | [11]             |
|                                  | Roethlisberger F. Jules and William W. Dickson | [12]             |
| Systems theory                   | Chester Barnard                                | [13]             |
| Modern management thought        | Peter F. Drucker                               | [14]             |
|                                  | W. Edward Deming                               | [14]             |
|                                  | Peter Laurence and Raymond Hull                | [16]             |
|                                  | William Ouchi                                  | [17]             |
|                                  | Rober Waterman and Thomas Peters               | [18]             |

## 2.2. Problems in management science development

The phrase “the management theory jungle” accurately describes the turmoil brought on by the proliferation of management ideas [5]. There are two major problems of management sciences that are recognized by scholars in contemporary society, namely “Time Validity of Applied Theories,” and “Shortage of Coherent

Theoretical Concept of Its Own.”

Certain concepts and methods evolved in certain historical contexts. It is possible that similar circumstances still exist now. There are various ideas and methods of management, and each has advantages and disadvantages. There is therefore no perfect management theory. The management practices of today are both a reflection of and a response to earlier management philosophies [6].

A major obstacle to the creation of a coherent and integrated management theory is the inadequacy of idea generation. Since management is an applied discipline without its own cohesive theoretical notions, developing management concepts has proven to be challenging. Since the 1940s, the development of quantitative management theories started to involve other disciplines as statistics and mathematics, which made management theories symbiotic. In addition, management is more practical than theoretical in the field of psychological and philosophical research [19].

Other than the above-mentioned problems, in my opinion, the geographical effectiveness across countries and cultures is a serious problem. As mentioned previously, the so-called management theories and schools are mainly developed and examined by western scholars and industrial practitioners. The western management approaches' suitability for use in underdeveloped economies has been contested by academics [20], and many of them have called for investigation of the phenomenon in different contexts particularly in non-western countries [21].

### **3. Research methodologies in management science**

Management science is a social science; therefore, management science also adopts the research methods of social sciences, namely qualitative and quantitative research methods.

Günther summed up that qualitative research is frequently described as being the antithesis of quantitative research [24]. When collecting and analyzing data for qualitative research, words are prioritized above numbers, i.e., a non-mathematical approach is used [25]. The interpretivist or constructivist qualitative research, which primarily adopts the inductive technique, acknowledges that people create a constructed reality by interpreting their social environment [26]. Contrarily, quantitative research places a strong emphasis on quantification for data gathering and analysis, for example, its widespread use of statistical techniques. The primary goal of the deductive quantitative research approach is to test theories or hypotheses, and it makes the assumption that the universe is accessible to rational explanations [24].

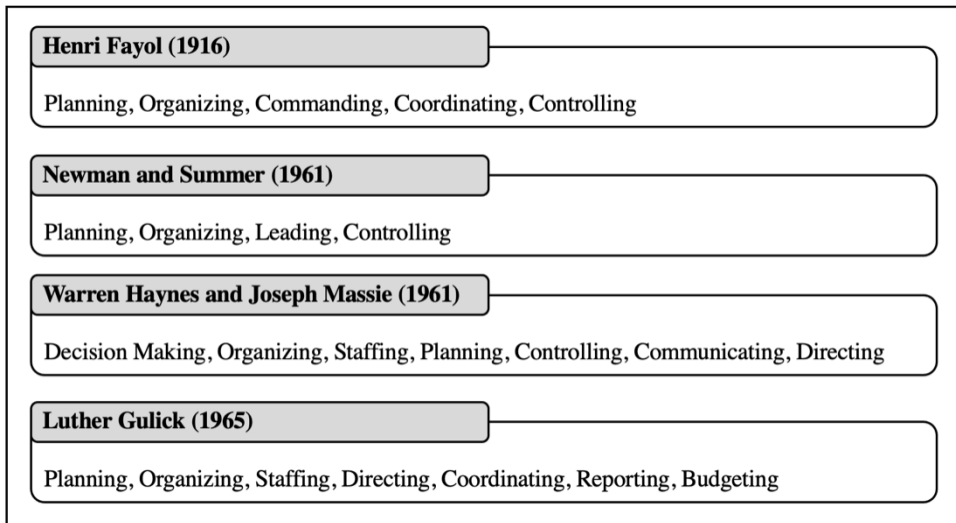
According to Lichtman, Johnson and Christensen, the items “criteria of research method” are used to distinguish the differences between the two described methods [25,26]. In contrast to quantitative research, which aims to test hypotheses to determine causes and effects for future predictions, qualitative research, for instance, aims to comprehend and analyze social interactions.

### **4. Branches and functions of management science**

Koontz and Weihrich pointed out that while the structured knowledge that underpins the practice is a science, managing the practice is an art [5]. Art should advance with science, just as the physical and biological sciences have. The science of management is undoubtedly imperfect and rudimentary since there are so many intricate factors that need to be controlled. However, managerial practice may undoubtedly be enhanced by such management expertise. Without the aid of management science, executives are forced to rely on chance, instinct, or prior experience.

Early management theories were more like specific behaviors or experiences than true ideas. Like in any other areas, practitioners have no other place to look for meaningful advice than the body of knowledge that underpins their work unless they want to learn by trial and error. As a social science, management has developed its own branches, most of which borrow and apply techniques or concepts from other disciplines, for example, statistics and mathematics [19]. The significant branches of management have been evolving

in a symbiotic relationship with relevant disciplines. Some examples of branches of management are operational management, financial management, human resource management, innovation and technology management, and more. Despite the variant branches of management, there have been various definitions and discussions of management functions since the beginning of the last century. Four most recognized definitions are summarized in **Figure 2**.



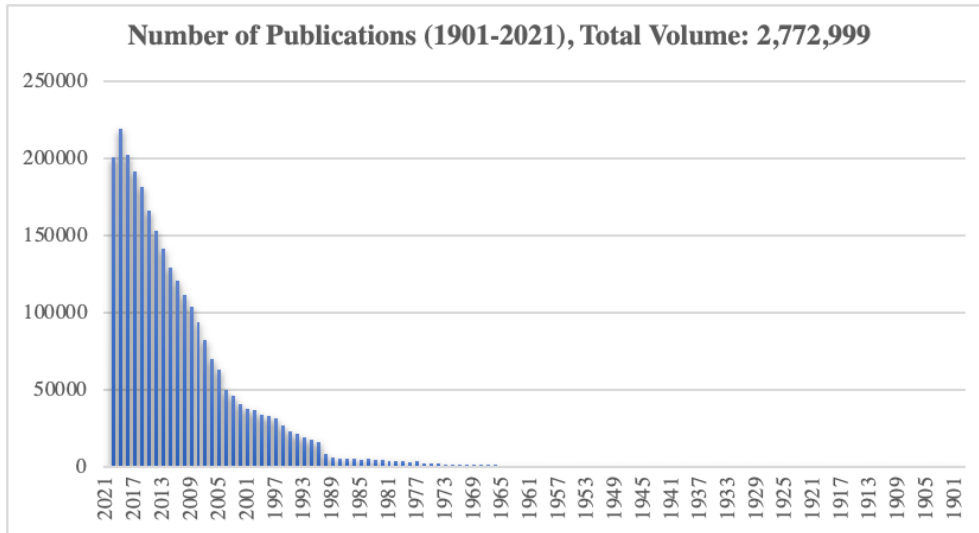
**Figure 2.** Functions of management

## 5. Systematic review of management-related publications indexed in Web of Science (WoS)

In order to have a deeper understanding of the development of management in different fields, provide research directions for subsequent researchers in related fields, a systematic review approach was applied to analyze the publications from 1991 to 2021 indexed in the Web of Science (WoS), through the aspects of the volume of publications, publications by organizations (or institutes), and top research areas.

### 5.1. Volume of publications

Taking one of the largest citation databases, Web of Science as an example, as of the twenty-second of December 2020, there have been 2,772,999 publications including books, scientific papers, conference proceedings, notes of literature, of management science across multiple disciplines. As shown in **Figure 3**, a significant increase in scientific publications related to management science. From 1989 to 2020, there was a spurt in the research on management-related fields. Surprisingly, the number of pre-accepted publications in 2021 has already reached 200,000.



**Figure 3.** Number of publications by year, management-related science (source: Web of Science, 22 December 2020)

### 5.2. Publications by organizations

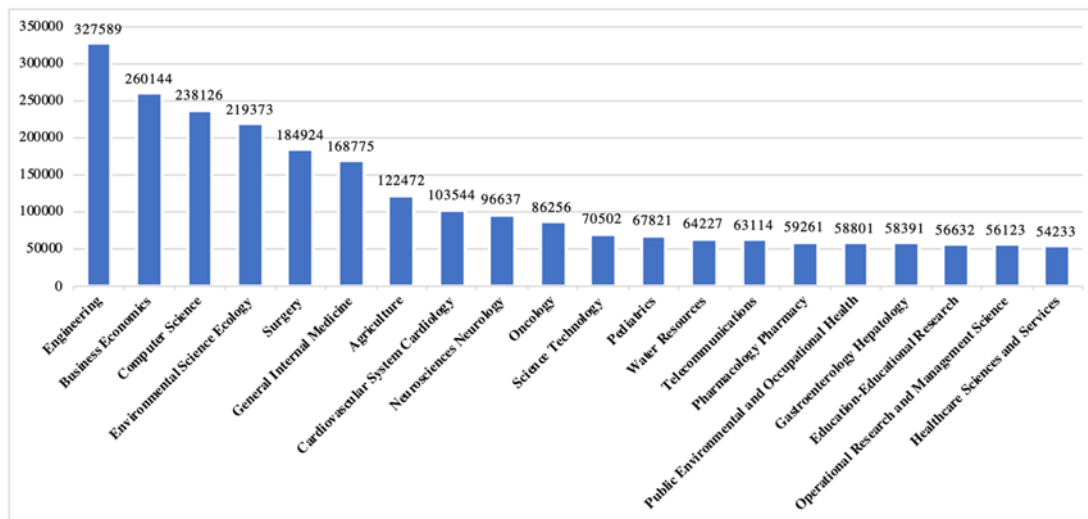
Among these 2,772,999 publications across multiple disciplines (see **Figure 4**), the University of California System owns 58,569 publications ranked the first among all other organizations (university, academy, etc.); followed by the University of London (42,541), Harvard University (39,686), and University of Texas System (31,095).



**Figure 4.** Organizations of publications related to management science (source: Web of Science, 22 December 2020)

### 5.3. Top research areas

As for applied sciences, management has been widely recognized and applied all over the world, including multiple disciplines, such as business management, engineering management, education management, and so on. Management provides a conceptual framework for scientific disciplines and industry standards. **Figure 5** provides the top 25 research areas related to management science that were stored in the Web of Science database. Interestingly, the field of engineering possesses the most publications (327,589) of management science; followed by the field of business economics (260,144), computer science (238,126), and environmental science ecology (219,373). The evidence reveals that management as an applied science is not only helpful in social science but also has a profound impact on other disciplines.



**Figure 5.** Top 25 research areas related to the management sciences (source: Web of Science, 22 December 2020)

## 6. Conclusions

The constant progress of society and the economy drives the development of theories in management science. As a social science applied to practice, management science is steadily updated and iterated with the development of time and the progress of the industry. As a scientific theoretical framework summarized from practices, it will also optimize its role in different areas. By analyzing the data from the Web of Science, we could also observe that the theoretical and conceptual outputs of management in engineering were more than the outputs in the business economy, and the volume of outputs in computer science was also very intensive and surprising. Therefore, more in-depth research and analysis in this field should be conducted using a systematic review approach or a bibliometric approach with more complex or integration of all databases, for example, Scopus and Google Scholar.

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## Disclosure statement

The author declares no conflict of interest.

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