

The Dilemma and Strategies to Realize Smart Manufacturing under the Concept of "Human-machine Collaboration + Short Video Communication" in Greater Bay Area

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ABSTRACT

The National Development and Reform Commission has mentioned the work vision of the manufacturing industry transformation in the Guangdong-Hong Kong-Macao Greater Bay Area many times in conferences, as well as initially completed the reform plan focusing on technology and patents as the key points of transformation. However, the back-end transformation with the concept of "service-oriented manufacturing" and "smile curve" is still in the planning stage and thus has its research value. From the perspective of creative culture, this study proposes a back-end transformation strategy of the manufacturing supply chain empowered by short video marketing, and discusses the cultural sensitivity issues that this international communication method is faced with. Secondly, based on the concept of artificial intelligence and human-machine collaboration, this study presents a method of utilizing a Data Visualization Platform as an auxiliary business strategy to solve the dilemma, and feasibility of this strategy is proved by the global village theory, product semantics, and manufacturing scenarios and applications. Furthermore, this study explains the specific content and framework of this strategy. With user experience design (UX) as the concept, the author uses Python programming, visual analysis software Gephi and design software Adobe Illustrator 2022 to perform prototype design on the proposed "Cultural Intelligence +" Data Visualization Analysis Platform. Last, the author systematically discusses the pioneering attributes of this brand-new manufacturing back-end transformation strategy and visions to implement it, and then puts forward some suggestions for future improvements.

Keywords: *Intelligent communication, Creative culture, Data visualization design, Human-machine collaboration, Cultural sensitivity, Guangdong-Hong Kong-Macao Greater Bay Area*

1. INTRODUCTION

Artificial intelligence and digital media are constantly blending into each other and becoming a part of the Creative cultural communication. As the carrier of collective wisdom and co-creation, digital media can achieve the ultimate market expansion for manufactured products, which is also an important means of realizing industrial transformation for the manufacturing industry in the Greater Bay Area. As a technological product of the new era, artificial intelligence can assist or replace a large amount of information processing work during the creation, production and circulation stages of communication by constructing a dynamic computing

environment to simulate the process of human cognition, thinking, and dialectical reflection [1]. Concerning the AI technology applications, just as AI is being applied in financial technology, autonomous driving and manufacturing, its value in the field of creative digital media is also continuously being tapped. Artificial intelligence and creative digital media have been closely connecting for long, from Netflix film and TV show recommendations, collaboration with AI-based Teammates in video games, to the analysis of public opinions on social media, and so forth. This study [2] will add to the list by focusing on the innovation of marketing strategies for the manufacturing industry in the Greater Bay Area based on human-machine collaboration.

We keep exploring to figure out what practical benefits can AI bring to the media industry through the continuous technological innovation? How could we break through the boundaries of disciplines and traditional thinking, respond to the calls for nation-building, and create a communication technology paradigm that can benefit the society? In this regard, starting from creative culture's empowering the transformation of manufacturing industry in the Greater Bay Area, this study adopts user experience design that combines both theoretical and practical values as a means to explore the opportunity for the effective integration between human-machine collaboration and new communication technologies. It provides many viewpoints to the integration-oriented, diverse and problem-solving communication science in the new era.

2. A NEW PATH FOR CREATIVE CULTURE TO EMPOWER THE MANUFACTURING INDUSTRY IN THE GREATER BAY AREA

In the era of using product manufacturing to provide food and clothing, manufacturing innovation is often associated with a lot of human and material resources, and there were certain risks [3]. After the 1970s, the new international division of labor led to the global aggregate realization of creative culture and brought huge wealth to the first group of developed countries [4].

Although the connection between creative culture and the manufacturing industry in the Greater Bay Area was form late, it has huge potential. In the early stage of reform and opening up, the Pearl River Delta region undertook industrial transfer from the international and Hong Kong and Macao regions by virtue of cheap labor, land and facility costs. The local government gradually came up with a local manufacturing mode with the characteristics of industrial cluster. For instance, Foshan built a strong ceramic industry, and Guangzhou has developed textile and machinery industries, etc. Dongguan, with the reputation of "one industry in each town", has created well-known economic industrial chains such as Houjie, the capital of furniture, and Humen, the capital of clothing. In 2008, Dongguan, the world's factory, went through a wave of bankruptcy, when it realized the seriousness of neglecting creative culture [5]. Since then, the government of the Greater Bay Area has begun to solve the root cause of the problem from the angle of product design, putting forward the vision of "Intelligent Manufacturing in the Bay Area", implementing policies such as the strategic cooperation with colleges of art and design, product research by "new engineering" design talents which achieved a great success[6][7].

"Deepen the supply-side structural reform, focus on cultivating and developing new industries, new business forms and new models, support the transformation and upgrading of traditional industries, and promote the

extension of the manufacturing industry from processing and production to R&D, design, branding, marketing, remanufacturing and other parts... "-Greater Bay Area Development Plan" [8].

Dr. Shi Zhenrong, founder of Acer Group, put forward the theory of "smile curve"[9]. He believes that from the perspective of medium and long-term operation of enterprises, compared with investing in the middle end of the supply chain (assembly, manufacturing), it is far better to get more profits from the front end (technology, patents) and back-end (products, services). With the empowerment of creative culture at the front end of the supply chain, the integrated concept and operation system of "product design + manufacturing" in the Greater Bay Area has become more stable, followed by an era of "design turning white-hot", and international marketing campaigns for manufactured goods around the back end had to follow. Therefore, the transformation of the manufacturing industry under the empowerment of creative culture should not only take into account the front end, but should approach the back end.

In terms of the back-end, the early marketing path of manufactured products mainly relied on traditional media. Although in recent years, short videos, the new media has gradually become the main marketing channel. Short videos usually refer to videos within 5 minutes in length. Professional short video companies or short video experts create short video works by gathering creative themes and connecting product brands with social mainstream culture. Short videos have broadened the path for product promotion and sales, with the emerging of new marketing models such as "idols selling goods live stream", "new retail" and "data interconnection". The author believes that creative short videos will become the key content of the transformation of modern manufacturing marketing.

2.1. Humanized and Precise Marketing

Short videos generate higher communication efficiency and have easier access to users' emotional resonance. The information dissemination of short videos is network and emotion-oriented [10], and through recording explicit data and implicit data, media service providers recommend in-depth content to users based on a variety of increasingly accurate decision-making algorithms. In the future, with the collection and promotion of multi-modal data, the recommendation system will be further optimized, and the short video platforms can make more accurate recommendations for the audience according to different user profiles with less time and money costs.

2.2. Sustainable Communication Marketing

It is easier for short videos to obtain a large audience and a controllable user stickiness mechanism, as well as to achieve continuous marketing. First of all, the marketing

of short videos has a broad space for development. For example, the usage time of short videos by Hong Kong users exceeds 50% of the media usage rate [11]. In addition, short video marketing is capable of capturing the audience. Studies have shown that nearly all the audiences, despite their various emotional characteristics, will choose to use short video entertainment continuously [12], because short videos can bring them a sense of self-actualization [13] and social identity. Although they are fully aware that they are prone to overuse [14], they are always the weaker side in the mutual dependence relationship [15]. Due to the development of usage habits, users with FoMO (an emotional state of being afraid of missing out on important content) will actively pay attention to product dynamics, enhance their impression of brands [16], and integrate products into their daily life.

2.3. Marketing Beyond Time and Space

Moreover, short video is a fragmented marketing medium that transcends time and space, which breaks the limitations of traditional marketing. During unpredictable public events, smartphone media can help reduce the negative impact of physical social distancing during the COVID-19 pandemic [17]. Meanwhile, users are keen to build shared information spaces [18], and short video marketing is helpful to efficiently carry out a series of activities on the Internet that consumes a lot of manpower and material resources.

3. THE DILEMMA OF THE ROAD TO EMPOWERMENT - "CULTURAL SENSITIVITY"

The Greater Bay Area continues to attach importance to creative culture and the digital economy. It is believed that the back-end transformation towards intelligent marketing can increase the main profits and benefits in the era of excess economy [19]. However, using creative short videos to achieve effective communication is not easy, especially for international markets.

Culture is the spirit and material accumulated by human beings in the process of social development and practice. Societies of different regions and styles have different cultural cognitions. Therefore, in the global dissemination of short videos, the effectiveness of information transmission needs to be taken into account, and thus the concept of "cultural sensitivity" is born. Resnicow [20] defines cultural sensitivity as "the extent to which the target population's racial/cultural characteristics, experiences, norms, values, behavioral patterns and beliefs, etc., are incorporated into design, delivery and evaluation". Communicators should not only take into account the individual cultural system, but should actively break through their own cultural norms in a diversified world system, and clarify the cultural variables of the other society [21], in order to find the

medium, content and dimension acceptable to the audience and respect them [22], so as to obtain the communication benefits of breaking the boundary. Cultural sensitivity plays an important role in international business across cultural boundaries [23]. For example, when BMW entered the Chinese market, considering that the pursuit of motor sports is different from the West, the Chinese petty bourgeoisie pursues the symbol of "eliteism". Therefore, they improved the BMW Brilliance 5 Series and launched an extended model and deepened the brand's visual design, creating a noble and exquisite brand image which is highly sought after.

Additionally, products that do not conform to cultural values will deprive brands of certain market opportunities, and touching on taboo topics must be disastrous [24]. Therefore, before launching short video marketing, apart from assessing the symbolic nature of product design, product manufacturers must also carefully consider the effectiveness and compliance of creative themes and content design. In the era of big data, how to use emerging technologies to solve the culturally sensitive communication dilemma of video marketing in the transformation of manufacturing industry becomes more and more important. Therefore, in this paper, the author proposes the following research questions:

Q1) How to choose the adaptive strategies and technologies that help "creative culture + back-end transformation of manufacturing in the Greater Bay Area"?

Q2) Do strategy and technology have theoretical and practical significance?

Q3) How to plan the core strategy and content of strategy and technology?

Q4) What should stakeholders pay attention to when implementing technology in the future?

4. TECHNOLOGICAL BREAKTHROUGH TO SOLVE CULTURAL SENSITIVITY

4.1. Strategy Planning For Transformation Based On The Concept of human-machine Collaboration

Human-machine collaboration is a new development direction of artificial intelligence. Machines can greatly improve the analytical capabilities of practitioners. In the meanwhile, the creativity in short video marketing is also valued, which is suitable for the reality of manufacturing transformation. Based on the concept of human-machine collaborative innovation, the author believes that data visualization platform technology can improve the cultural insight of creative executors in the transformation of manufacturing in the Bay Area. Also, it can help manufacturers capture diverse and dynamic audiences with intelligence, precision, and efficiency, which breaks

the communication barriers of cultural sensitivity, and realizes effective creativity, and improves the capabilities of the back end of the manufacturing supply chain.

4.2. The construction significance Of The Strategy And The Corresponding Theoretical Value

4.2.1. Practical Level

Under the concept of human-machine collaboration, the data visualization analysis platform has strong practical significance for the transformation strategy.

First, the data visualization platform has a low threshold, and even employees without a strong analytical foundation can gain insight into the dynamic social and cultural situations, hotspots and knowledge maps of the product importing place. Second, the data visualization platform is real-time and efficient. Visual designers and interaction designers use visual symbols to empirically define real-time cultural information exchanges, which can improve the convenience of identifying data and the effectiveness of tasks. Workers can be more specific about short video copywriting planning and filming, and operators can better understand current events and seize opportunities for dissemination. Last, the data visualization platform is highly intelligent. By setting up cultural big data acquisition channels and processing models by data miners and algorithm engineers, the platform can provide a rational basis for business decisions in a real-time and one-stop manner. For example, the DAM marketing project created by the team of Tezign founder Fan Ling can extract real-time Internet hotspots, and accurately connect the output of the producer and the input of the user[25].

4.2.2. Theoretical Level

The data visualization analysis platform, as a transformation strategy, is in line with the theoretical significance of communication and design.

Marshall McLuhan put forward the great prediction of "global village" in his media theory, believing that based on the development of electronic technology, the global information flow will take on the form of "village", which is consistent with today's concept of media decentralization [26]. In the development process of the global Internet (Web 1.0), the media carries the ability to reflect the relationship between content production and social network. Everyone has equal rights to participate in the production, sharing and reception of cultural content on the Internet. In the upgraded Web 2.0 era, the cultural industry gradually matured and received official support, and netizens had more active, flat, and low-threshold content production based on platforms such as Facebook, so the decentralization became obvious. In today's Web

3.0 era, new technologies such as multi-directional information flow, RDF/RDFS/OWL architecture, and multi-modal sensory interaction are emerging [27]. The combination of social media and mobile technology provides further power for decentralization, enabling peer-to-peer communication [28]. The decentralization of media greatly reduces the difficulty of obtaining global multi-dimensional cultural data, enabling acquisition of cultural data from mainstream social media in many importing places of manufactured products, which is in line with the basic requirements for data visualization platform construction.

For industrial design, Professor K Krippendorff and Professor R Butter [29] first proposed the concept of product semantics, believing that products should not be limited to expressing basic shapes and functional attributes, but adapt to the user's environment and have deep connotations. It is important to integrate them into product design by trying to identify appropriate visual, tactile and auditory information, because design research is supposed to find ways to integrate and understand people's choices, attitudes, and expectations, so that design outcomes can be improved [30]. The "Cultural Intelligence+" data visualization platform estimates the relationship between the product itself and users and the corresponding social attributes by managing the relationship between the nature, law, meaning and human activities of symbols. With the combination of symbols, the data visualization platform accurately analyze creative scenarios for enterprises from the contextual dimension, and solve the difficult problem of evaluating culturally sensitive variables. Meanwhile, the platform conveys the concepts of human-machine collaboration, "Intelligent Manufacturing in the Bay Area" and back-end transformation of manufacturing from the social dimension.

5. THE SPECIFIC CONSTRUCTION STRATEGY AND DESIGN PRACTICE OF THE "CULTURAL INTELLIGENCE +" EMPOWERMENT ROAD

From the perspective of human-machine collaboration, the author selects the strategic technology of the data visualization platform with logic, applicability and practicability to solve the communication barrier of "cultural sensitivity" in short video marketing in the manufacturing industry. Based on the manufacturing industry, the "Cultural Intelligence +" system uses multiple algorithms to analyze subdivision requirements and rules as the dial design principle. With data crawling, sampling, cleaning, and modeling a large amount of social media data as a means, the system extracts measurable global manufacturing marketing data and narratively outputs "cultural stories" that are more commercially valuable than intuitive analysis [31].



Figure 1 Prototype design of "Cultural Intelligence +" Human-Machine Collaborative Data Visualization Platform

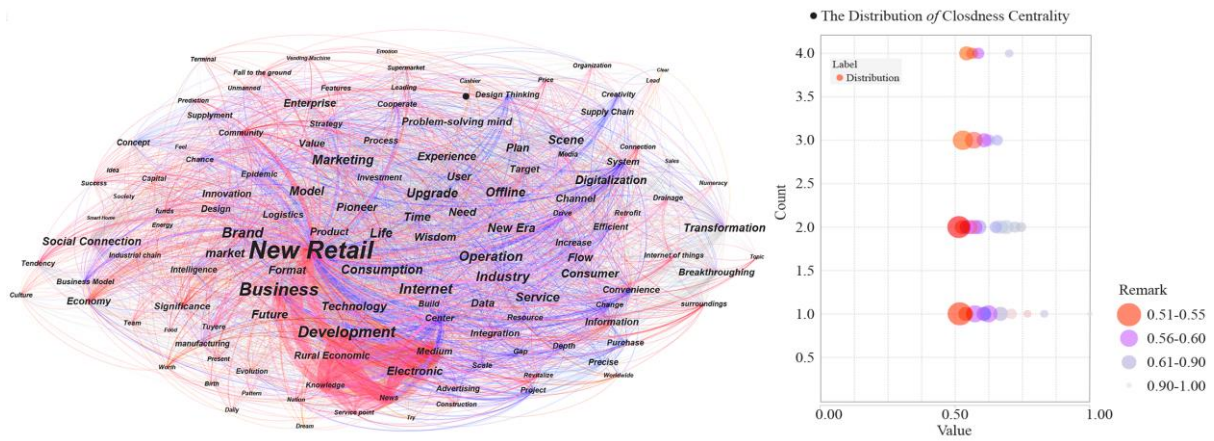


Figure 2 Basic algorithm for cultural transmission sensitivity variable mining

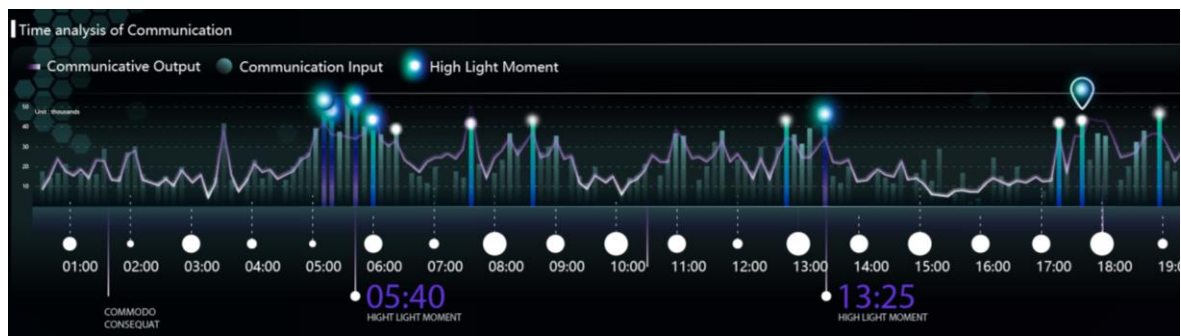


Figure 3 Social media text cleaning and time series control components



Figure 4 Data visualization platform product rendering

The author proposes that machines need to provide manufacturers with cultural strategies based on short video marketing, and then explains the basic prototype architecture of the "cultural intelligence +" visual analytics platform based on the graphic drawing software Adobe Illustrator 2022, the programming language Python and the social network visualization tool Gephi.

5.1. Potential Marketing Locations

The machine assists the manufacturer in identifying potential locations to launch short video products.

The platform has data storage space, visually using strong contrast, high light and dark contrast, light effect and flow sense, etc., and covering the composition of GIS (Geographic Information System) to present changes in real-time optimal marketing locations. Users can enter products, types, and marketing when they use it for the first time, and the platform will recommend historical marketing cases and project them on the map and dot chart (left UI of the dashboard). That helps to realize the evaluation of execution strategies in the historical short video marketing cases databases, excluding defective, isolated, and bottlenecked marketing locations [32]. Also, it can directly analyze the corresponding marketing locations (the bottom side of the dashboard) based on the search and regional positioning components.

5.2. Cultural Attribute

The machine assists the manufacturer in identifying the mainstream culture in the short video product's potential delivery location.

The platform needs to have the ability to crawl the corresponding cultural information, based on the

mainstream social media of the marketing site, it crawls text data, cleans it, and constructing the knowledge map and word cloud map for the manufacturer to check (located in the middle right side of the dashboard). Covering such content as current affairs, communication channels, content themes, etc., it cleans unstructured data and visualizes relevant elements. In addition to the geographic dimension, this information can also be scoped through the time series component. For example, when mining the definition of China's new retail market, the platform helps the product achieve the insights into communication hotspots using natural language processing technology based on the 70,000 pieces of people's discussion information about the issue crawled in Weibo.

5.3. Decentralized Channel

The machine assists the manufacturer in identifying the potential dissemination partners of the short video product in the potential delivery location.

The platform can help the manufacturer find a group of communication leaders who have a leading voice in the society to build cooperation in advertising and live broadcast (Upper right side of the dashboard), which directly reduces possible sensitivity. When measuring this indicator, the author mainly combines the Closeness Centrality algorithm, which is an important concept in network metrology. It evaluates a participant (i) and other participants in the network through the geodesic distance $d(i,j)$. The degree of proximity of (j) is used to define its importance. In data calculation, the disseminator with the largest weight with other nodes is obtained by effectively reducing information dissemination redundancy.

5.4. Marketing Benefit Evaluation

The machine assists the manufacturer assess the potential dissemination benefits of the short video product in the potential delivery site.

The corresponding transformation cases are recorded in the case database of the platform, for evaluation of the execution costs of ideas and the profits obtained by the manufacturing alliance in the marketing area in the same period of previous years. That covers a series of basic descriptive statistics, and the platform can also use time series algorithms to simulate potential Benefit Variation (Right side of the dashboard).

6. THE VISION OF STRATEGY REALIZATION UNDER THE EMPOWERMENT ROAD OF "CULTURAL INTELLIGENCE +"

6.1. Consumers And Consumption patterns

Based on the promotion of this strategy, with the help of the platform, consumers around the world can break through the limitations of time and space and participate in more live broadcast activities. They will learn about the manufactured products exported from the Greater Bay Area in a more interesting way and make a purchase. Thus, the quality of life and convenience will be greatly improved.

6.2. Producers And Production Methods

Due to the promotion of this strategy, the economic growth model of the manufacturing industry will be optimized, and the traditional marketing professional work such as curation, visual art design, copywriting and film and television planning carried out by the marketing team will be carried out more accurately. And there will be more insights regarding the road of the back-end transformation of the manufacturing industry in the Greater Bay Area. Meanwhile, global self-media and creators can have deeper cooperation with manufacturers, so income sources and entrepreneurial opportunities will be expanded.

6.3. Content Dissemination

Due to the promotion of this strategy, cultural data stored in a decentralized manner because of media decentralization can be better maintained. With the speed and effectiveness of content dissemination are being improved, the actual value of short videos as new media will also be greater. Moreover, it can drive the growth of the usage rate of other types of media markets. In the era of media ecology, the possibility of cooperation between this channel and media from various regions and of various categories will also be raised.

6.4. Technology

Professional disciplines and technologies such as artificial intelligence, business operations research, and media communication will be better developed with the help of this strategy. Receiving more accurate scene-based supports, it will also raise the possibility that more business model innovations would be generated by this type of platforms.

6.5. Theoretical Framework

The construction of this strategy is supported by the "Global Village Theory (Media Decentralization)" in the field of communication, the "Product Semantics Theory" in the field of design, and the "Smile Curve" in the field of economics, which provides the "Cultural Sensitivity Theory" with practical solutions. Also, this strategy and platform serve as a test of the applicability of theories in the new era.

7. CONCLUSION

In this research, from the perspectives of theory and practice, the author proposes a strategy that combines the concept of AI technology and creative communication, using data visualization technology to help the back-end manufacturing industry in the Guangdong-Hong Kong-Macao Greater Bay Area use short video marketing to achieve intelligent transformation.

Because time is limited, communication researchers, interaction designers, and data scientists can further optimize the visualization platform so as to realize technology implementation. It is worth noting that there are three points to be further discussed: 1) Further segmentation of cultural variables that are important for manufacturing transformation. 2) Build a Java interactive program and find a data source to test the usability of the platform architecture. 3) Further plan narrative design from the perspectives of user experience to improve comfort when using the platform.

AUTHORS' CONTRIBUTIONS

In this study, Yimin WANG¹ is mainly responsible for literature review and prototype design as well as Yonglin DAI² and Qiuyuan LI³ are engaged in theoretical research and further design practice, while corresponding author Honglin ZHU is responsible for planning and delivery of this project.

ACKNOWLEDGMENTS

Thanks to thanks to our readers for their support and everyone on the team for our hard work. The transformation of the manufacturing industry in the Greater Bay Area is equally difficult and arduous, and creative empowerment and practical work require the joint

efforts of scholars and practitioners from various disciplines.

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