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Eradicating Malaria: Innovation Diffusion in the Face of Grand Challenges

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ABSTRACT

What is the role of organizational innovation—beyond technological innovation—in an era of grand challenges concerning health, poverty, and economic development around the world? How is organizational innovation developed and diffused to influence resource allocation in the field? We conduct a qualitative case study by analyzing a Chinese pharmaceutical firm's efforts to combat malaria in Africa over 10 years. Through documentation and extensive interviews, we study the role of innovation diffusion and resource allocation to address grand challenges in emerging markets with significant institutional voids. Our conceptual model delineates the different stages of innovation diffusion to show how organizations can draw from various stakeholder resources grounded in cooperation and capability-building to sustain the effects of innovative solutions.

Keywords: Organizational Innovation, Innovation Diffusion, Grand Challenge, Malaria, Africa

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INTRODUCTION

The COVID-19 pandemic has raised significant challenges concerning the resilience of public health systems worldwide as well as the role of business in supporting the implementation of healthcare policies and the welfare of the communities. Indeed, one of the grand challenges the world is facing today is diseases that have devastating impact on people's health and livelihoods (Vakili & McGahan, 2016), such as malaria, which prevails in Africa, South America, and many parts of Asia. Malaria is a mosquito-borne infection affecting humans and other animals and is caused by parasitic single-celled microorganisms.[2] In many countries, malaria disproportionately afflicts poor and disadvantaged people, who have limited access to healthcare. Reducing the morbidity and mortality of malaria is a worldwide public health challenge.

Pandemic and endemic diseases, such as COVID-19 and malaria, represent some of the most significant and complex challenges that modern, globally connected societies face (Olsen, Sofka, & Grimpe, 2016). Thus these challenges have been termed "grand challenges." Such a challenge affects a large population and has implications for technology, policy, and ethics. Tackling a grand challenge requires innovations in technology, healthcare, policy, and commerce, often in combination. Developing such multifaceted solutions also calls for new management theories. Indeed George et al. (2016) encourage management scholars to address broader societal challenges through research on not only technological innovation but also innovation in policy and business practice. Similarly, Birn (2005: 518) argues that "the longer we isolate public health's technical aspects from its political and social aspects, the longer technical

[2] The word "malaria" originated from the Italian "mal aria," which literally meant "bad air." This was when people thought that malaria was caused by bad air emanating from swamps and marches. This was before the causes of malaria were understood. Now scientists know that malaria is caused by Plasmodium parasites being transmitted through the bite of the female *Anopheles* mosquito (called a "vector"). Within days of infection, the parasites will have found their way to the human liver and multiplied rapidly in red blood cells, causing them to rupture. Short terms symptoms of malaria include fever, nausea, vomiting and diarrhea. Complications that can result include brain damage, organ (liver, kidney) failure, anemia, and respiratory problems.

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interventions will squeeze out one side of the mortality balloon only to find it inflated elsewhere."

Most of the grand challenges are concentrated in developing economies, which are characterized by institutional voids, that is, the absence of intermediaries and formal rules under which buyers and sellers can interact (Khanna & Palepu, 1997). Such institutional constraints can result in higher costs for crucial components of innovation, such as materials, capital, information, and skilled employees. As innovation—especially technological innovation—remains central to sustainable growth and competitive advantage for emerging economies, the presence of institutional voids significantly hinders efforts to address such grand challenges as public health crises. Yet innovation in business models and policy implementation may help mitigate the harm of institutional voids and provide organizations alternative solutions. Innovation can also diffuse across a field through different patterns, which depends on the interactions among organizations and their stakeholders. Understanding how innovation evolves and diffuses in emerging economies can help unpack the mechanisms through which new technologies, knowledge, and practices can alleviate the harms of institutional constraints on the well-being of the poor and underprivileged (Gordon & McCann, 2005; Henderson & Clark, 1990; Owen-Smith & Powell, 2004; Rosenkopf & Tushman, 1998).

Our paper focuses on the grand challenge of how innovation in processes and business practices can help eliminate malaria in Africa. Instead of taking a macro-level perspective by examining the effectiveness of international aid, intergovernmental collaboration, and policy design, we take an organization- and field-level approach to understand innovation development and diffusion. To this end, we aim to answer the following research questions. (1) How can organizations develop and diffuse innovative practices to help tackle grand challenges? (2) What are the roles of stakeholders across the field in this process?

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To address these questions, we conduct a qualitative study on a Chinese pharmaceutical firm, Artepharm Co. Ltd., which has been working to eliminate malaria in Africa since 2003 by developing artemisinin-based medicines and medical treatments. A qualitative study is more suitable for addressing our questions because it can reveal particularities of the decision-making process and thus better describe the development and diffusion of innovation, which is difficult to do with quantitative and longitudinal analysis. With a deep understanding of the African market, Artepharm has developed an innovative solution for malaria elimination, namely "Fast Elimination of Malaria by Source Eradication" (FEMSE), which concerns not only medical treatment and technical instructions but also collaborations with stakeholder groups in the international and local communities. We use an inductive approach via chronological documentation and interviews to describe how Artepharm's innovative solution penetrates an emerging market and diffuses to combat the malaria epidemic. In addition, we take an organizational perspective to explore the motivations behind a for-profit firm's choice to persistently pursue nonprofit goals via innovative solutions. Our findings have important implications for the global efforts to combat the COVID-19 pandemic, especially the crucial role that businesses can play.

Africa provides a unique setting to answer these important questions. As argued by Zoogah, Peng, Woldu (2015), Africa-focused management research can address the problem of organizational effectiveness by investigating the roles of institutions and stakeholders. We therefore first describe the institutional environment in Africa and the unique resources that the Chinese company has to cope with these institutional challenges. We then develop a conceptual framework based on the literature on knowledge diffusion. This framework enables us to describe the formation of the innovative solution and to examine how knowledge exchange and diffusion help with the adoption of the solution in the local community.

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Our case study provides unique insights to the innovation literature and management practice in addressing grand challenges. While traditional studies mostly focus on technological innovation, we focus on innovation in business models and practice. To this end, we delineate the process of innovation diffusion and the key stakeholders involved. We consider the mechanism of innovation diffusion to be "grounded cooperation," which suggests that diffusion requires in-depth cooperation between foreign organizations and local teams and illuminates how foreign organizations draw support from local stakeholders. We explore the factors influencing this process. As we show in Artepharm's case, both external factors, such as the institutional environments and local stakeholder support, and internal factors, such as firm managers' backgrounds and values, jointly shape the patterns of organizational innovation. Through delineating the diffusion of Artepharm's traditional Chinese medicine-based antimalaria solution through the FEMSE program in Africa, we aim to illuminate how organizations and management practice can help solve global development problems.

LITERATURE REVIEW

Grand Challenges in Health

Health and well-being is one of the 17 Sustainable Development Goals (SDGs) outlined by the United Nations.[3] The SDGs demand policy interventions, such as reforms in professional training and the public health system (Daar et al. 2007). However, policies and practices conceived in high-income countries by international organizations for improving the lives of citizens of low-income countries have been often criticized as ineffective and even harmful (e.g., Vakili & Mcgahan, 2016). An article by Lidén & Nantulya (2004), published in *The Lancet*, even accused the WHO and the Global Fund of "medical malpractice" for continuing to fund the use of older and ineffective anti-malarial drugs rather than

[3] https://www.un.org/sustainabledevelopment/health/

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artemisinin-based combination therapies (ACTs) in some African countries. Clearly, adequate attention to the public's health requires cooperation in sectors beyond health, such as education, justice, and labor, through collaborations among governments, nongovernmental organizations (NGOs), and faith-based organizations (Collins et al., 2013).

Innovation and Innovation Diffusion

An important part of addressing global health issues is innovation, a key activity in an organization and the economy. Innovation can refer to a new product or service (Dobbins, Ciliska, Cockerill, Barnsley, & Dicenso, 2010); a new technology (Silvestre, & Neto, 2014); a new policy or standard (Delmas, 2002); an evidence-based intervention (Rabin, Glasgow, Kerner, Klump, & Brownson, 2010); or a new program or practice (Kotabe, 2007). Studies examining innovation usually apply resource-, industry-, and institution-based perspectives (Peng, Wang, & Jiang, 2008). These studies divide the factors influencing innovation into internal ones, such as firm capabilities and strategies, and external ones, such as institutional context, networks, and patent protection (Allred & Park, 2007). These factors are often interdependent, especially in emerging markets such as India and China (Peng, Wang, & Jiang, 2008).

Studies not only investigate how innovation emerges but increasingly how it diffuses across organizations and fields. Researchers have developed a diffusion framework by synthesizing several bodies of research—organizational behavior, corporate culture, and managerial decision-making from the management literature and research dissemination, utilization, and evidence-based practice from the health literature. In its most basic form, the diffusion of innovation refers to the spread and adoption of new ideas, techniques, behaviors, or products across a population or a field (Rogers, 1995). This line of research focuses on understanding how and why diffusion happens (Perez-Aleman, & Paola, 2016; Dobbins, Ciliska, Cockerill, Barnsley, & Dicenso, 2010; Kaplan, 2008). In addition,

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the institutional environment may also influence the speed and effectiveness of innovation diffusion, especially across countries, which then influences the risks and potential returns of innovation projects (e.g., Galang, 2012). Besides the effect of host and home country institutions and governments, the type of business tie with other organizations, such as customers, suppliers, and other trade partners, also influences innovation and diffusion.

The above mechanisms fundamentally shape a crucial element of the innovation diffusion process, namely knowledge flow (Mcdermott, & Corredoira, 2010). The context of innovation can be seen as a form of knowledge creation and transfer. The "owner" of knowledge can be an individual or a firm, who can integrate, create and apply the knowledge. Theory that regards an organization as a knowledge integrating institution helps explain a firm's boundaries and has important implications for organizational level innovation (Grant, 2015). Further, knowledge transfer itself in the process of innovation diffusion can facilitate innovation development (Kotabe, 2007). The mechanism of diffusion also varies across industries and between home and host countries and can support not only ongoing learning but also frequent modifications (Jonsson & Foss, 2011). In the context of emerging markets, this process usually manifests itself as the diffusion of quality standards, which emphasize the collective knowledge building (Perez-Aleman, & Paola, 2016).

Following the increasing awareness of the importance of knowledge in innovation and its diffusion, a growing body of literature has been examining how organizations learn and absorb external knowledge (e.g., Cohen and Levinthal, 1990; Caloghirou et al., 2004), accumulate knowledge (e.g., Figueiredo, 2002), manage and create new knowledge (e.g., Silvestre and Dalcol, 2009), and the capabilities needed to innovate (e.g., Galunic and Rodan, 1998). Some argue that knowledge and associated capabilities are more likely to be acquired and innovations are more efficiently developed and diffused within a cluster of

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organizations (Batheld et al., 2004). What's more, the processes for knowledge creation and innovation can vary significantly between developed and developing countries (Kim, 1998).

Knowledge flow can also be shaped by connections among individuals. Interpersonal ties can help in obtaining knowledge resources and taking business actions (Levin, & Barnard, 2013). Some studies attribute the differing diffusion patterns in different institutional environments to organizational, network, and knowledge traits (Galang, 2014).

In the medical and health fields, theories and evidence of innovation diffusion are quite mature and encompass all the instruments, equipment, drugs, and procedures that might influence diffusion. For example, a new medical intervention or health treatment usually needs to undergo a period of diffusion from medical research to utilization (which is also called dissemination or translational science). This process includes transferring the knowledge, skills, and systems to a target audience, which could be practitioners, communities, or policymakers. Practices, policies, and guidelines can all be diffused, and characteristics of individuals, groups, environments, and innovations can influence adoption (Dobbins, Ciliska, Cockerill, Barnsley, & Dicenso, 2010).

Knowledge diffusion usually occurs through conversation, which is the most powerful medium for imitation (Tarde, 1986). Diffusion theory provides a place for interpersonal influences by explaining how new ideas and cultural practices unfold within and across communities. Empirical studies on this topic have shown that the central role of interpersonal communications in these processes underscores the importance of providing contacts with social networks (Hawe & Ghali, 2008; Valente, 1995; Valente & Rogers, 1995).

However, the findings from numerous studies suggest that there is a substantial lag between when technical information is generated and when it is used in practice (Utterback, 1994). This is particularly problematic in healthcare,

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where time lags may harm medical outcomes for patients because advances in knowledge and technology can take years to implement. As a result, dissemination research, that is, the study of the processes and variables that influence the adoption of knowledge, interventions, or new practices by various stakeholders (Johnson, Green, Frankish, MacLean, & Stachenko, 1996), has become a priority among health services planners, decision-makers, and researchers (Canadian Health Services Research Foundation, 1998; 1999).

With regard to the challenges of innovation and its diffusion in emerging markets, regulatory, logistical, and social barriers are very common on account of institutional voids. Many of the typical institutional supports available in established markets, such as credibility enhancers, information analyzers and advisers, aggregators or distributors, and transaction facilitators, do not exist in emerging markets. Due to the lack of institutional supports, potentially effective responses to serious social issues, such as malaria, are left unexplored. As a result, the process through which communities import certain practices can be a "high-stakes institutional translation" (Lawrence, 2017). Emerging markets also usually lack clear rules and infrastructures. Thus, when introducing or diffusing an innovative technology, scheme, or practice, businesses need help to build the necessary ecosystem, such as investing in infrastructure, persuading policymakers, and collaborating with local players (Jonsson & Foss, 2011; Perez-Aleman, and Paola, 2016). This process requires collective knowledge-building (Perez-Aleman, and Paola, 2016).

Based on the above review on the work on the institutional and organizational contexts of innovation, we next describe the institutional environments faced by Artepharm in its anti-malaria effort in Africa and how it developed and diffused its innovative practice to help address a grand challenge in healthcare.

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DATA AND METHODS

We use an inductive approach and conduct a qualitative case study on the innovation diffusion by Artepharm in Africa in its effort to eradicate malaria. Pharmaceutical companies usually face unique challenges from the institutional voids in emerging and foreign markets, because their operations involve not only the sales of drugs but also medical research, medical ethics, and public health systems that are often inconsistent between the home and host countries. Why and how pharmaceutical firms penetrate into new emerging markets is poorly understood, and qualitative research is thus well suited to examine the phenomenon (Marshall & Rossman, 1995). Moreover, qualitative research is appropriate when "(a) contextualization, (b) vivid description, (c) dynamic (and possible causal) structuring of the organizational member's socially constructed world, and (d) the worldviews of the people under study" are important (Lee, 1999: 43). This fits well with the goal of our analysis.

Research Context

The African market

Malaria is one of the most disastrous infectious diseases in the world. Medical interventions for malaria control are widely used in Africa, and many forms of international aid are provided to help with elimination. The effort involves stakeholders from multiple cultures. Indeed, the process stretching from artemisinin-based medical research to the delivery of antimalaria drugs involves the participation of universities, the WHO, NGOs, local communities, and the private sector (mostly for-profit companies). Various governmental authorities, such as business, health, and technology ministries, across different countries are also involved.

The innovative approach by Artepharm

Artepharm was jointly established by a group of experts specializing in the research of artemisinin-based antimalarial and antiviral traditional Chinese

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medicines from Guangzhou University of Chinese Medicine (GZUCM) and Guangdong New South Group. These researchers advance artemisinin-based combination therapies (ACTs), which are a first-line therapy that combats malaria by reducing transmission of the parasite. This parasite's life cycle alternates between its insect host (the mosquito) and its vertebrate one (humans). Crucially, as far as is known, humans are its only vertebrate host. In the case of smallpox, a vaccine was used to make humans hostile territory for the pathogen. Since there is no vaccine against malaria, the solution provided by Artepharm is to use drugs (artemisinin and piperaquine). Artepharm's antimalaria approach stems from traditional Chinese medicine and creates a drug that combines artimisinin and piperaquine, is marketed as Artequick, and is put forward in an innovative program called Fast Elimination of Malaria by Source Eradication (FEMSE). The FEMSE program works through ensuring universal access to ACTs to quickly clear the source of a malaria infection and thus stop the spread, eventually leading to elimination.

FEMSE was first implemented in the Comoros, a sovereign archipelago island nation in the Indian Ocean, located at the northern end of the Mozambique Channel between northeastern Mozambique and northwestern Madagascar.[4] More than 90% of the inhabitants of some villages on these islands are infected by malaria.[5] At the request of the Comoros government and under the framework of the assistance provided by the "China-Africa Forum," authorities in China and Comoros jointly formulated the Compound Artemisinin Fast Malaria Elimination Plan.[6]

[4] The country consists of four major islands and numerous smaller islands, all in the volcanic Comoro Islands. The major islands are commonly known by their French names: northwestern-most Grand Comoro (Ngazidja), Mohéli (Mwali), Anjouan (Nzwani), and Mayotte (Maore).

[5] Malaria is a major public health problem in Comoros. Information from the Ministry of Health in the Comoros in 2006 showed that malaria ranked first in various local causes of death, with malaria accounting for two-thirds of the country's population of 800,000, 38% of the number of outpatients, and 60% of hospitalized patients.

[6] These authorities include the State Administration of Traditional Chinese Medicine, the Ministry of Health in Comoros, the Comoros Sanitation Administration, the Ministry of Science and Technology, the Ministry of Science and Technology, the Health and Family Planning Commission

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In 2007, the FEMSE project, directed by Artepharm, was first implemented in Moheli, an island of the Comoros. The program was proved to be very effective: after its implementation, the incidence of malaria was reduced by more than 90%.

Data Collection

We collected a mixture of data through interviews, archival sources, and internet searches. Our primary source of data is interviews with key people from Artepharm. For example, We interviewed Mr. Zhu Layi, president of Artepharm, who focuses on the vision, strategies, and milestones for company development, and interacted with key stakeholder groups in promoting malaria elimination. We also interviewed the key scientists behind the artemisinin-based solutions and the marketing and product managers in Artepharm who are familiar with research and compliance issues. With regard to the FEMSE program, we interviewed the program leader in the Comoros and the other African countries. We asked the interviewee to describe the process and the reactions of various stakeholders to better understand the dynamic interactions among stakeholder groups under Africa's institutional environment. We also relied on a wide range of archival documents, including copies of presentations from meetings, program reports, and academic papers by researchers from GZUCM and Artepharm. All the interviews were taped and organized from open questions to directional questions for deeper exploration of certain issues. During the first few interviews, we mainly asked the interviewees about the major milestones and strategies for penetrating into African and other international markets. During the second stage of interviews, our questions focused on the field practice of FEMSE in the Comoros. Compared with the interviews in the first stage, we also interviewed people who had experience in the field practice, besides the key managers of Artepharm, in the

and other relevant state ministries, the Guangdong Provincial Government and the Chinese Embassy in Comoros, the Guangzhou University of Chinese Medicine. The Plan draws on the opinions of relevant experts from China and the Comoros and WHO experts and is approved by the Comoros Ministry of National Health and Ethics Committee. It applied to 30 malaria prevention and control centers in Africa, according to the Artemisinin Compound Fast Control of Malaria Cooperation Agreement.

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second stage. Through both stages of interviews, we tried to identify the characteristics of the firm's key leaders that could shape the strategy of innovation and diffusion for the artemisinin-based antimalaria drugs and FEMSE program. During a third stage of interviews, we added questions about key leaders' early-lives and work experience to understand the role of personal imprinting in shaping innovation and diffusion strategies. Detailed information about the interviews is summarized in Table 1.

Insert Table 1 about here.

Besides the data from interviews with key stakeholders of Artepharm, we also collected archival data from WHO, including Global Technical Strategy for Malaria 2016–2030, Guidelines for the Treatment of Malaria (third edition), and other information on the WHO homepage. We analyzed the speeches by the minister of health in the Comoros. Additional archival data included news reports from Reuters, *The Economist*, and media in the Comoros and in China.

Data Analysis

We developed a narrative account that chronicles the development of Artepharm's ACTs and FEMSE program. Table 2 provides a chronology of major milestones in development and the key stakeholders. We divide Artepharm's development into three stages, according to the different challenges and main stakeholders that the company faced: the research stage, the practice stage, and the diffusion stage. Our data analysis is also classified into three stages accordingly, and we investigate the interconnections among the stages.

Insert Table 2 about here.

The three-stage classification helps with the description of the innovation

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application and diffusion. First, the company experienced a period of technology development and initial innovation diffusion. The company's strategy evolved with the changing environment both internally and externally. Internally, with the maturity of FEMSE program, the scope of the innovation diffusion gradually expanded. Externally, artemisinin-based drugs have obtained more approvals, and more public attention has been drawn to the global efforts to combat malaria. Our longitudinal in-depth study helps analyze the interaction between the firm and its internal and external environments.

We can examine the change in the company's focus at different stages of the FEMSE development. In the first stage of data analysis, we assess the activities of the company and identify the main challenges. First, the company needed to decide on its domain in the pharmaceutical space. Challenges at the research stage relate to medical experimentation and production. For a pharmaceutical company, investment in R&D accounts for the most of its total costs. Thus, at this stage, the research team needed to address the major technological challenges and gain funding.

In the second stage (practice), we identify that the main challenge is enabling innovation diffusion. The main stakeholders in this stage mainly are comprised of organizations and individuals in the field, including the local government and people at the risk of malaria infection. During this stage, the program must be renewed and adjusted, according to the changing environment of the region. The professional team of the company should be familiar with local cultures and norms. Barriers to diffusion include language and knowledge of antimalaria drugs. The company was mainly concerned about its interactions with the local people in terms of explaining and mobilizing them to take the drugs as instructed. The process at this stage includes (1) negotiations with the local government and healthcare organizations, (2) determination of the agreement, (3) dissemination of the program's objectives, (4) execution of the interventions, (5) detection and

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compilation statistics of malaria cases after the interventions. The program needs to be implemented gradually across regions. The formal documentation of the program's progress through summary statistics helps with the later process of normalization and institutionalization for the FEMSE project, thus the innovation diffusion practice.

The third stage features knowledge diffusion in the long run, which entails acquiring more recognition and acceptance from funders, buyers, and the subjects of the program intervention (i.e., local people). This recognition is largely driven by the efficacy of past practice, which will lead to more successful future interventions. In addition, social networks in the local communities can provide important contacts to help further spread new ideas and practices (Green et al, 2009). We also show the characteristics of the innovation application through analyzing Artepharm's project promotion in the Comoros and embedding it into the "higher-order framework" proposed by George et al. (2016). Table 3 illustrates how the practices of Artepharm in the Comoros fit into the higher-order framework for addressing grand challenges in terms of the theme, main stakeholders, and context.

Insert Table 3 about here.

For a more systematic data analysis, we transform the raw data from our interviews into more structured concepts and themes, following Pratt, Rockmann & Kaufmann (2006). Table 4 summarizes the core concepts, empirical themes, and data from our case.

Insert Table 4 about here.

The Diffusion of FEMSE Practice in Africa

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We next discuss the diffusion of the FEMSE program by Artepharm, which draws on China's experiences in prioritizing scientific research and involves multi-level cooperation and capacity building with the local team.

Drawing on China's Experience Prioritizing Scientific Research

We first describe the role of the innovator, that is, the research team for the artemisinin-based antimalaria medicines and treatments, in initiating the innovation process. GZUCM is a research institution that has provided technical support for Artepharm's project. The project was developed with a large-scale clinical trial in Cambodia. The massive drug administration (MDA), that is, the administering of drugs and prevention treatment to a massive population, has been made possible through the accumulation of experience in conducting scientific research in China and other countries for many years. A similar MDA program was implemented in Hainan Province in China and has achieved remarkable results. According to our interview with Song Jianping, a professor at the GZUCM and the lead of the research team:

> *Hainan and Yunnan are full of outdoor mosquitoes that transmit malaria. They run away after they suck blood. So in this case, the effect of spraying insecticides indoors is definitely poor. The spread of a disease (such as malaria) across Hainan and Yunnan is usually on a large scale. The main measures in this area are not aimed at mosquitoes. It is a full-time medication and is taken by the whole population. At that time, the program was undoubtedly to reduce the morbidity and mortality. This is the case in our country. Every county, every quarter, once every time, the population is fully covered by the medicine.*

In terms of malaria research, by the time of Artepharm's establishment, there were no patients in China for the research team at GZUCM to conduct clinical trials on artemisinin-based compound domestically. Therefore the team had to

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conduct the trials abroad. At the beginning, the idea and the goal were simple and straightforward: doing clinical research on the effectiveness of antimalarial drugs. As the program in the Comoros rolled out, the researchers also began to leverage it as a research project for the purpose of publications in academic journals. With the success of their experiments, the scientists increasingly realized the commercial and social values of the African market for malaria treatment. Therefore they cameo to believe that the Chinese experience—including the guiding principles summarized from the practice in Hainan and Yunnan—could be replicated in Africa. According to our interview with Song Jianping:

> *[T]here is a book called* Malaria Prevention and Control in China*, which summarizes China's experience in successfully combating malaria during [the 1970s]. The strength of malaria prevention and control in China was definitely higher than that in Africa. The guiding principle was to adapt to local conditions. … It is necessary to consider different regions according to local conditions, which kind of malaria and mosquitoes is transmitted. At that time, the experts who had attended the seminar in China were all experienced. For example, in the Yangtze River Basin, the scheme adopted is the whole process, and all the medicines were sent to the door of everyone's home.*

These interviews and the archival information illustrate how the innovation was initially developed and diffused to a new emerging market. An important determinant of the success of the diffusion is that both China and Africa are emerging markets and face similar institutional voids, which made China's innovation experience adoptable in Africa.

Multi-level Cooperation with Local Healthcare Team

In the second stage of the diffusion, a three-level collaboration was established during the FEMSE program in the Comoros. The multilevel cooperation included

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the national teams responsible for the project plan, regional teams responsible for the implementation of the FEMSE program on each island under the coordination of the national teams, and district teams that execute the plan on the ground. According to Lu Chunming, the CEO of Artepharm:

> *If we come to any place to give medicine directly to the community, the community will not accept it. We must work with the health department responsible for this matter to explain the reasons for what we do. Therefore, before the implementation of the project, it is necessary to have in-depth cooperation with the local health authorities. Not only that, the implementation of the project requires strong intentions to cooperate from the national health department.*

The project team of the China Malaria Prevention and Control Project and the National Malaria Prevention and Control Center of the Comoros were coordinating and negotiating the formulation and implementation of the project plan through guiding the sub-centers and district-level anti-malaria stations across all islands. Over the eight years since the implementation of the project, 36 technical workers for malaria control, each of whom had accumulated 160 hours in-person time, were dispatched from GZUCM and collectively worked for 6,600 days in the Comoros. They cooperated with the Comoros Ministry of Health, Mohéli, Anjouan and Grande Comoro Island Health Bureau, local hospitals, medical centers, and village workers to carry out on-the-ground prevention and treatment of mass incidents, training supervision, distribution of medicines and equipment, and public health education. They also helped publicize special reports from the intervention through television shows and newspaper articles in the Comoros and distributed posters and banners across the country, in an effort to encourage participation. This promotion and awareness-raising mattered because an important part of the FEEMSE program (or any MDA) is that people within a certain area (one island,

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province, or region) need to take ACT medicines simultaneously (except those who could not take the medicines due to pre-existing conditions).

Artepharm also paid significant attention to the information feedback from the local community and other organizations during the implementation of the FEMSE program. According to our interview with Lu Chunming:

> *There are many steps in the process of implementing the project, such as signing of the informed consent form before taking the medicine. The feedback information in the process is particularly important. For example, the whole population taking drugs should get approval from the ministry of public health ethics committee, and we need to know what kind of requirements need to be satisfied during the process. Thus information communication mechanism should be built.*

Capability Building of Local Team

The third stage concerns capability building of the local team to sustain the program. For Artepharm, while the reduction of the malaria-related mortality, what is just as important for continuing success is that the firm can build in the local community a highly professional team. The team in the Comoros was trained by professionals from Artepharm and GZUCM who were experienced in malaria prevention and control. As a result, the local team could continue working to combat malaria after the FEMSE program, ensuring a sustainable capability. According to Lu Chunming:

> *China helps train African officials and experts in various fields every year. However, the main problem of the training is not technological, because the technology is common and mature. The most important thing is to enhance mutual understanding through communication. What is most lacking in Africa is human resources. Having a sufficient number of qualified doctors and nurses is most critical. … It is better to teach*

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people how to fish than to give them the fish.

Another important innovation in practice is the integration of the local team in Africa with the Chinese concept of "barefoot doctors," who were healthcare providers who underwent basic medical training and worked in rural Chinese villages.[7] According to our interview with Lu Chunming:

> *More and more countries in Africa are very interested in the concept of barefoot doctors. Stringent and high medical standards are certainly good, but it is not realistic to raise the level of African economies and medical conditions to the western standards. Therefore barefoot doctors are a great inspiration for African countries. A barefoot doctor may not have a degree. Some medical problems cannot be dealt or even improperly handled by a barefoot doctor. But this situation is always better than nothing. We need to establish mechanisms and systems.*
>
> *For example, I often say that a team of 100 people who can only score 60 points each is better than a person who can score 120 points. A team with 60 points per person can achieve 70 and 80 points per person through learning. Each may not be as strong as an individual with 100 points in the end, but these 100 people contribute more to the society than a person with 120 points.*

The organization of local team capability building took full account of the actual conditions of the local areas. During the implementation of the project, part-time barefoot doctors were mobilized to organize the slack labor force in the region. This, too, was revealed in our interview with Lu Chunming:

[7] Such barefoot doctors included farmers, folk healers, rural healthcare providers, and recent middle or secondary school graduates who received minimal basic medical and paramedical education.

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Whether it is international certification or certification by individual African countries, the acquisition of legitimacy is a minimum requirement rather than an advantage. It is hard to find a good team that can successfully penetrate areas with high rates of malaria inflection. Conditions in these areas are harsh, with no electricity, no water, and no cell phones. Once such a team is built, it no longer belongs to China or a company. The value of the team lies in its future influence. The future development space of the team is the core asset of the company. A company's products may be replaced, a project can continue to be optimized, but to form a complete team is difficult and takes a much longer time.

Once a qualified team is built and the program is rolled out across the whole community, the field workers can help sustain the actions for malaria control going forward. According to Lu Chunming:

Aid cannot be provided only by giving materials and building hospitals. To help them build capacity, we have to reply on local people and teams. The essence of China's aid to Africa is to train people who can continue to do things.

The local healthcare and medical teams in Africa are usually at the state level and provincial level, but there is no team in remote areas. Fulfilling the task for the whole population to take medicines requires it to start from the most basic level. In the local area, every two hundred people need one local person to be responsible for taking records of their medicine taking, side effects of medicine, etc., contracting the communication and information feedback work in the village. Through this malaria control project, we helped Africa to establish a grassroots medical and epidemic

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prevention team and trained this team. This team can do more things in addition to eliminating malaria in the future. Most members of the team are native people. The people who are sent by the company will have to leave sooner or later. These local people can guarantee the execution and future continuity of this organization and project. The capacity building of such a team is the most critical and valuable thing we did in Africa. Because of the method of the project itself, we already have a clear implementation manual, which contains specific details of the operations for each period of project execution. Subsequent monitoring and information feedback of the project can ensure the stability and sustainability of the effect, and in essence, it is still a problem of a mature and experienced team.

The whole practice of malaria elimination in the Comoros through FEMSE is a process of innovation diffusion. During the cooperative stage, the local people fully participate in project execution, and the firm (Artepharm) strives to build local capability.

FINDINGS

Artepharm's innovation practice through FEMSE helped fill in the institutional voids in Africa and brought healthcare benefits to the local community. Measures that respond to voids like these aim to facilitate interactions among buyers and sellers and reduce the transaction costs. The FEMSE program in the Comoros, which is based on successful experiences in China, is a practice of knowledge sharing and application, which bridges the gap between effective decision-making and health-policy development. Increasing access to such MDA interventions and maintaining their effectiveness, in the face of insecticide and drug resistance, are cornerstones of the latest healthcare efforts (Bhatt et al. 2015). With the replication of the home market experience, the application of the innovation will

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eventually be diffused and practiced across the field. For a foreign company, leveraging local power is necessary for gaining legitimacy and approaching a large target population. Based on the data and the evidence presented above, we offer the following proposition.

Proposition 1: Innovation diffusion can serve as an internationalization strategy in penetrating into new emerging markets through replicating and refining the experience and practices from the home market.

Grounded Cooperation

During innovation diffusion, the local environment of the host country and interactions between a foreign firm and the local community are vital. Cooperation pattern a pivotal impact on the effectiveness of innovation diffusion. Entry by a foreign firm into a field practice in the new market requires building connections with multi-layer organizations in the local healthcare system, a process we term as *grounded cooperation*.

A determinant of the success of large-scale medical interventions, such as an MDA program in a foreign market, is to make connections among institutions at multiple levels and form the local administrative team that can directly reach out to the people in need of malaria protection. Cooperation with multiple organizations locally can facilitate the establishment of information channels, and information feedback is crucial for adjusting the intervention practice. The local organizations can help diffuse the innovation to the selected community. In fact, a foreign team bringing an innovative solution should rely on the local healthcare system to build such a hybrid multi-layer network and bring it closer to the community.

In Artepharm's case, its legitimacy was achieved by cooperation with local departments responsible for the antimalaria interventions. Participating in local work through such cooperation helped Artepharm learn how to communicate with

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local communities and understand the routines of the local people. The legitimacy gained through such cooperation ensured the success of the early-stage penetration of the innovative solution, despite the significant institutional voids in the community and the need to obtain trust from the community. Cooperation can also accelerate a foreign entrant's adaptation to the local environment. Grounded cooperation helps a foreign firm build an information channel that can communicate the knowledge of its innovative program and help the community adopt that knowledge. This process can shape practices in the field, which further leads to institutional changes in the local community.

We thus propose that the information channels should be built to ensure effective information transfer, communication, and timely feedback about practices in the field.

Moreover, during the grounded cooperation, leaders play an important role facilitating interactions among participants. In this process, the most important task is to build capability of the team, which must be adapted to local conditions. In the case of Artepharm, this is reflected by the Chinese company's training of the local team.

Another important factor in the interaction between the foreign company and the local teams is culture. There are likely to be significant cultural differences between the home and host countries. In the case of Artepharm's experience in Africa, the Chinese medical culture and customs differ significantly from those in Africa in many ways. For example, the traditional Chinese medicine takes a very flexible approach and includes raw herbs. In addition, patients can discuss and even negotiate with the doctor on which medicines to take and how. As a result, at the beginning of the FEMSE program, there was significant concern that African people would not take the medicines that the doctors gave them. But in Africa, people usually follow the doctors' instructions. Therefore the Artepharm team could first explain the innovative FEMSE program to the local doctors to

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persuade them. The African people were more willing to follow the instructions of their doctors, which would enable the program to operate more smoothly. Based on the above arguments, we put forward a second proposition, with a graphic illustrating how the innovation diffusion practice is shared among the environment, organizations, and the field.

Proposition 2: To promote innovation diffusion in a new emerging market, an organization needs grounded cooperation with local authorities and professional organizations through capability building, which helps empower and sustain practices in the field in the local markets.

Insert Figure 1 about here.

We further use inductive analysis from the interviews with Artepharm's leaders to understand the company's insistence in rolling out and scaling up the FEMSE program in Africa, despite significant obstacles and institutional voids. Artepharm's had strived to evolve from conducting scientific research on malaria treatment, to selling drugs in Africa, and then to addressing a grand challenge, that is, malaria elimination. This evolving goal had motivated the company to overcome series of problems in foreign markets, including training local workers and doctors, establishing a multi-level medical team, and managing treatment data and feedback. These actions were made possible because of Artepharm's insistence on targeting medical outcomes (to eliminate malaria), and many of these actions were the extension and continuation of Artepharm's vision and strategy. In the implementation of the project, the company committed to training the local team to help ensure a successful implementation. In contrast, other companies that produce artemisinin-based malaria drugs mainly focus on selling the drugs;

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Artepharm's goal, in contrast, was trying to protect more people from malaria. As Lu Chunming said: "*… our project confidence comes from many professors and scholars' persistent research for many years, and Artepharm's vision is to promote the value of artemisinin in society and improve the world reputation of traditional Chinese medicine.*"

The goal and motivation of the company also evolved over time, from pursuing profit (which could partially be used to provide financial support for medical research) to promoting sustained healthcare benefits in Africa through malaria eradication. These goals are not mutually exclusive. The consideration of brand promotion and the reduction in the mortality rate of malaria helps support the company's longer-term research, practice, and financing.

Our interview with the Chairman of Artepharm Zhu Layi also revealed that the way that the FEMSE program was implemented closely related to his personal experience and motivations. Zhu was once a barefoot doctor and had expertise about traditional Chinese medicines. The idea of eradicating malaria and helping the poor was thus imprinted in the company's organizational logic by the founder. In addition, it is worth noting the hybrid composition of the firm, which originated from a research institution. The ACT-based FEMSE program stemmed from innovation research led by Professor Song Jianping and thus reflected academic rigor. The diffusion of the FEMSE program in Africa was also shaped by the CEO, Lu Chuming, who insisted on garnering support from the WHO and diffusing the innovation to more companies. That means the innovative practice can be repeated and can achieve broader effects. The imprinting of these corporate leaders' ideas on organizational thinking and action comes from their early-life and work experiences and supports the company's strategies at different stages of dealing with the complexity of the grand challenge. Thus we put forward the following proposition.

Proposition 3: The effectiveness and persistence of an organization's

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innovation and its diffusion in dealing with grand challenges is shaped by its leaders and their backgrounds.

DISCUSSION AND CONCLUSION

We examine the process of innovation development and innovation diffusion in the context of entering emerging markets with significant institutional voids. These markets are often complex and require cooperation among various organizations at multiple levels. Through a case study of a pharmaceutical company both situated in and entering emerging markets, we find that, when facing grand challenges, an organization can take initiatives to mobilize stakeholders in the field to facilitate the development of a more systematic innovative solution. We emphasize the importance of innovation diffusion and knowledge transfer, which can bridge the gap between "what we know" and "what we do." In addition, institutional conditions matter a lot in innovation diffusion.

Specifically, we describe and analyze the cooperative approach led by a Chinese pharmaceutical company, Artepharm, to respond to institutional voids in Africa in an effort to eradicate malaria. We focus on innovation in both medical treatment and implementation, which can happen within the organization and diffuse across the field to enhance societal welfare. Empowering local medical teams through knowledge sharing can substitute for the institutional supports that are often lacking in the antimalaria market in Africa. In addition, adapting to the local culture and shaping the institutional environment can accelerate the innovation diffusion. We also found that local capability building can sustain the positive effects. Based on descriptive data and inductive interview analysis with corporate executives and key stakeholders on Artepharm's Fast Elimination of Malaria by Source Eradication program, which combines TCM treatment, mass drug administration, and grounded cooperation with African authorities and local

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workers, we propose an effective innovation diffusion approach for addressing healthcare-related grand challenges.

The contributions of our research are threefold. First, from the perspective of innovation management, we delineate the processes of innovation development and diffusion. Our findings suggest that the two processes are correlated but happen at different stages of the innovation process and thus have their unique characteristics, which should be analyzed separately. At the innovation development stage, we stress the importance of internal organizational factors, such as the organizational motivations and goals, which have not been thoroughly studied in the literature. In particular, we highlight the important role of key individuals in an organization in shaping organizational goals and the innovation process. We describe the varying experiences and professional backgrounds of several key decision-makers and show that these personal factors not only help motivate organizational innovation but also help the organization balance short-term and long-term goals. At the stage of innovation diffusion, institutional environments, such as local authorities (healthcare systems) and cultures, play a more important role. The innovating organization must make concerted efforts to accommodate, shape, and even create the environment in which it will operate during the process of innovation diffusion.

Second, we contribute to the understanding of grand challenges and institutional voids in emerging economies and how innovation can be developed, despite these constraints. The grand challenges in emerging markets cannot be solved by only technological innovation, and organizations must recognize the complexity of their environments and address institutional constraints in a systematic way. We show that, by utilizing grounded cooperation through working with the local stakeholders, building a common team, and developing a communication routine, an organization unfamiliar with a new institutional environment can still promote knowledge transfer and address grand challenges.

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Knowledge sharing and transfer during the innovation diffusion process can also be seen as a mobilization process. Every organization and stakeholder face constraints, and the process of building cooperating pattern can help them break through and navigate under challenging environments. Through repeated communication and negotiation, trust and mutual understanding between the organization and its stakeholders in the field can be enhanced. In our analysis, the effective interventions and the establishment of local medical teams can be seen as a response to Africa's institutional voids.

Third, our study contributes to the understanding of diffusion practice in public health. Public intervention is believed to be the most important approach in dealing with public health issues. However, progress of combating malaria has been quite slow, compared to other disease control efforts, such as the eradication of smallpox. Many believe this slow progress is largely a result of significant gap between science and practice. The diffusion theory can help bridge this gap, as it comprises various explanations of social behavior and has been used in the study of communication, marketing, and educational practices (Green, Ottoson, García & Hiatt, 2009). The FEMSE program in our research concerns diffusion of medical innovation and practices across millions of African people and involves building a local team, sharing knowledge, partnering with local leaders, and establishing timely feedback and follow-up mechanisms. Given that MDA has proved to be cost-effective in controlling malaria , the diffusion of the FEMSE program may provide an efficient solution that can be rolled out across the African continent and the rest of the world.

Our study also has practical implications. The world has reached a critical juncture in the fight against malaria (Vakili and Mcgahan, 2016). The international financing for malaria control increased approximately twentyfold from 2000 to 2015 (Bhatt, Cameron, Bisanzio, Mappin, & Dalrymple, 2015). Malaria elimination raises many economic, financial and institutional challenges.

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Therefore an important question is how an innovative approach such as the FEMSE program by Artepharm, which combines profit-making and social objectives, can obtain financial sustainability and scale up its business and innovation practices to have broader social reach. A related question is how organizations can ensure the effective, efficient use of financial resources, such as intergovernmental funding and corporate donations. The WHO's Global Technical Strategy for Malaria 2016–2030 has been developed with the aim of helping countries reduce the human suffering caused by the world's deadliest mosquito-borne disease. By adopting this strategy, WHO member states have endorsed the bold vision of a world free of malaria and set the ambitious new target of reducing the global malaria burden by 90% by 2030. They have also agreed to strengthen health systems, address emerging multi-drug and insecticide resistance, and intensify national, cross-border, and regional efforts to scale up malaria responses. By advancing this strategy, countries will make a major contribution to implementing the post-2015 SDG framework. A major scale-up of malaria responses will not only help countries reach the health-related targets for 2030 but will also contribute to poverty reduction and other development goals. The process we describe can contribute to malaria control and poverty alleviation. In particular, we describe the details of societal barriers, multilevel actions, cooperating patterns, and sustainable mechanisms. These patterns of cooperation can help coordinate goals and develop and reinforce norms and standards. The cooperation, in turn, will enhance trust and make the work at different levels proceed more smoothly. A National Library for Health can be developed to organize and contain knowledge relevant to the health problems in a particular country for further dissemination (Collins, Insel, Chockalingam, Daar & Maddox, 2013). Future implementations can also gain insights about practical processes in this article. If successful, the Artepharm model would help solve one of the major grand challenges. As *The Economist* (2014) wrote, an effective approach to malaria would "not just bring it

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under control, but wipe it from the face of the Earth, saving 660,000 lives a year, stopping hitherto endless suffering, and abolishing a barrier to economic development reckoned by the World Bank to cost Africa $12 billion a year in lost production and opportunity."

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Table 1
Interview information (in chronological order)

Length	Interviewee	Theme
100min	Mr. Zhu Layi (Chairman of Artepharm)	Corporate strategy and the motivations for Artepharm's medical innovation
40min	Prof. Song Jianping (Professor at GZUCM)	The practice in the Comoros and Africa; experiences in malaria control in China and the challenges and external environment faced.
50min	Dr. Deng Changsheng (Ph.D. student of Song Jianping)	The practice in the Comoros and the challenges and external environment faced.
60min	Mr. Lu Chunming (CEO of Artepharm)	The practice in the Comoros and Africa, especially the environment Artepharm faced and the interactions among the company and their local stakeholders.
60min	Mr. Zhu Layi (Chairman of Artepharm)	Mr. Zhu's early-life experience as a barefoot doctor; challenges faced by Artepharm and the company's future strategy.
100min	Mr. Lu Chunming (CEO of Artepharm)	The markets of Artepharm and challenges faced when penetrating into new markets; the unique advantages of Artepharm; the practice of the FEMSE program in Africa.
60min	Dr. Deng Changsheng (Ph.D. student of Song Jianping)	Experience and details in the implementation of the FEMSE program in Africa; interactions with various stakeholders of the FEMSE program.
100min	Mr. Lu Chunming (CEO of Artepharm)	Experience and details in the implementation of the FEMSE program in Africa; interactions with various stakeholders of the FEMSE program.

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Table 2
Chronology of Major Events

Year	Event
Since 1974	Guangzhou University of Chinese Medicine (GZUCM) antimalaria research team has been conducting clinical research on artemisinin-based drugs and related medical treatments, and developing artemisinin compound.
2003	Mr. Zhu Layi (Chairman of Guangdong New South Group and Founder of Artepharm) invested $9 million as the first round of funding for Professor Li Guoqiao's artemisinin-based antimalaria research project.
2004	Artepharm was jointly established by a group of experts specializing in the research of Artemisia annua L, artemisinin-based antimalarials and antiviral traditional Chinese medicines from GZUCM and Guangdong New South Group. Prof. Li Guoqiao is the chief scientist of Artepharm.
2004-2006	Artepharm developed and upgraded its antimalaria drugs to the latest fourth generation, Artequick, a combination of artemisinin and piperaquine, for the treatment of malaria and especially the resistant P.falciparum malaria.
2005-2009	Artepharm conducted a study on the pathogenesis of artemisinin-resistant and severe malaria in collaboration with academicians such as the Miller Fellow of the National Institutes of Health (NIH) in Cambodia.
2007	The FEMSE project, directed by Artepharm was implemented in Moheli.
2010	The Ministry of Commerce of China listed Artequick® as China's approved anti-malarial drug for Africa.
2012	The FEMSE project, directed by Artepharm was implemented in Anjouan.
2013	The FEMSE project, directed by Artepharm was implemented in Grand Comoros.
2015	The World Health Assembly adopted the World Health Organization's Global Technical Strategy for Malaria 2016-2030 which provides comprehensive technical guidance to countries and development partners for the next 15 years, emphasizing the importance of scaling up malaria responses and moving towards malaria elimination.
2015	Tu Youyou, a Chinese scientist who discovered artemisinin for malaria treatment, was awarded half of the 2015 Nobel Prize in Medicine for her discovery.
2017	The FEMSE project, directed by Artepharm in collaboration with the Malaria Control Center of the National Health and Social Security Division of Togo, was launched.

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Table 3
Context of the Practice in Comoros in the Higher-Order Framework for Addressing Grand Challenges

Theme	Main Stakeholders	Context
Actors and aspirations	Artepharm and GZUCM	Protecting more people who suffer or at the risk of malaria using their ACT-based antimalaria drug Artequick.
	Epidemic countries	Protecting people from malaria and promoting the health of the people in general.
Societal barriers	Artepharm and GZUCM	Language and culture differences between African people and the Chinese team.
	Epidemic countries	Understanding the nature of the malaria disease and the TCM solution.
Organizational constraints	Artepharm and GZUCM	The need to make profit and break even.
	Epidemic countries	Limited budgets for malaria control and inefficient health systems.
Articulating and participating in addressing grand challenges	Artepharm and GZUCM	GZUCM undertakes the task of establishing a malaria prevention and control team in the Comoro.
	Epidemic countries	The establishment of 30 malaria prevention and control centers in Africa and the start of the FEMSE program at the request of the Comoros Government and under the framework of the assistance provided by the "China-Africa Forum".
Multilevel actions	Various	Establishment of the three-level team including the national group which is responsible for the project plan, the regional group which is responsible for the implementation on each island, and district groups which directly execute the plan in the target population.
Coordinating architectures	Various	Summary meetings held by the three-level team in the first month of each quarter in the regional group center on every island to summarize the annual and quarterly progress of the project and exchange experiences on the implementation of the project, with participants including district coordinators, supervisors, district chiefs, village heads and anti-malarial representatives. Participants would study how to promote publicity, strengthen public health education, popularize malaria control

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		knowledge, implement the various measures and other issues, and further improve the details of the work.
Reinforcing mechanisms	Various	A local malaria control system and a professional team are established and being improved over time to timely report the number of positive malaria cases and other information. The National Malaria Prevention and Control Center conducts analysis on the information of malaria cases received and designs intervention policies to prevent outbreaks. Comprehensive monitoring systems are being established for later consolidation of various platforms, strengthen the information management of the population, track the number of malaria incidences and prevent and contain the spread malaria among family members. A nationwide anti-malaria drug distribution network is also set up (numerous stations that are 2-3 kilometers apart to ensure medicines can be distributed to villages in a timely manner). Establishment of side effect and adverse reaction monitoring and warning system to collect the drug efficacy and safety information, and guide the drug safety throughout the project.
Outcome and impact	Various	The Comoros achieves a 95% reduction in the incidence of malaria three months after the implementation of FEMSE. The connection between industry practice, academic research and policymaking is strengthened. The entry of Chinese artemisinin-based antimalarial drugs into Africa is facilitated.

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Table 4
Summary of Core Concepts, Empirical Themes, and Illustrative Data

Core Concept	Empirical Themes	Illustrative Data
Grounded Cooperation	Multi-layered organization (from the nation level to the field level)	The local medical teams in Africa are established at the state-level and the provincial level, but there are no medical team in remote areas. Fulfilling the task for the whole population to take medicines requires it to start from the most basic level. In the local area, every two hundred people need one local person to be responsible for taking records of their medicine taking, side effects of medicine, etc., contracting the communication and information feedback work in the village.
	Cooperation with local government	Africa has its own management system but lacks field-level management team. Artepharm's project implementation in the local population requires the local governments' willingness to cooperate and wll-established implementing mechanism to ensure in-depth collaboration.
Knowledge exchange in emerging market	Learning of cultural difference	Paying attention to the knowledge inflows and outflows in the process of communication, which may change the original knowledge. For example, Chinese people do not fully rely on medical doctors and often prefer to diagnose themselves, whereas people in the West tend to fully follow medical doctors' instructions.
	Information feedback	There are many steps in the process of the project, such as signing of the informed consent form before taking the medicine. The information feedback and communication mechanisms need to be set up during the process is particularly important. For example, the implementation of MDA needs approval from the Ministry of Public Health Ethics Committee and the project team need to know what data and actions are needed to meet the requirements for carrying out the MDA.
	Commutations and interactions	Every year, China will organize training programs for African officials and experts in various fields. The most important goal from these trainings is to enhance mutual understanding through communication, instead of technical skills.

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Capability building of the local team	Leveraging local labor	The establishment and organization of local teams take full consideration of the local conditions. During the implementation of the project, the Chinese team leverage part-time barefoot doctors to organize the local idle labor force.
	Training local people with skills of project implementation	The Chinese team realized that aids cannot be provided only by giving materials and building hospitals. The essence of China's aid to Africa is to help build capability in local teams with qualified doctors and nurses. Human capacity building depends on the local conditions and many other specific matters. The process of implementing the FEMSE program itself through various malaria control measures is a practice that can help train the local teams.
	Team work and optimization	The acquisition of legitimacy—through either international certification or verification by individual African countries—is a minimum requirement for the implementation of the project. It is hard to find good teams to penetrate into areas with high rates of malaria, where the conditions are harsh (with no electricity, no water, and no internet or cellphones). The value of building a good local team lies in its future development, as the malaria prevention and control project can continue being optimized even without the Company's intervention.
	Sustained capability in malaria control	Through its own experience of carrying out the FEMSE program, the company has already compiled a clear and comprehensive implementation manual, which contains specific details of the operations for each period of project execution. Subsequent monitoring and information feedback of the project based on the manual and well trained local teams can ensure the stability and sustainability of the malaria control interventions.

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