Dunhuang: On the Silk Road with smart tourism and big data

As an ancient hub along the Silk Road, China's Dunhuang started life as a meeting point for different people and cultures. Today, it's a popular tourist destination that blends a rich history with natural beauty for more than 9 million tourists a year – dozens of times the city's population of 200,000 and an impressive ratio even alongside China's main tourist cities.

By Xu Shenglan, Xue Hua

The service sector, in particular tourism, accounts for nearly 60 percent of Dunhuang's economy. Unlike other smart cities that focus on urban governance and services, smart tourism lies at the heart of Dunhuang's smart city model. "To build a smart city, you need to find a focus," says Sun Xiaoqiang, Chairman of Dunhuang Smart Travel Company (DSTC). "And Dunhuang found its focus. We've used smart tourism as a lever to build a smart city." Founded in 2014, DSTC is responsible for executing and running the pioneering Dunhuang Smart City project.

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Doing more with less

To build a sustainable smart city, DSTC moved away from "the old way of thinking of relying on government and finance," states Sun. Instead, he says, the company explored a new corporate and social model that combines social capital and city resources. Sun believes that a focus on economic development and top-level planning makes it possible to unify, integrate, aggregate, and share all industry resources. "Under this concept, we've achieved a great deal with relatively few resources," he says.

Today, visitors to Dunhuang enjoy a smooth tourist experience and convenient services that lets them experience the scenery rather than large crowds, even during peak season. Yet city leaders still face challenges. During the high season, masses of tourists are a threat to historical sites and visitor safety, while in the off season resources for tourism are woefully underused.

According to Sun, "Smart tourism should be the engine that propels all of Dunhuang's ICT infrastructure, marketing systems, urban management, public safety, and transportation planning. Our goal is to provide smart tourism services, enable the smart management of scenic areas, and fully market tourist destinations." Sun believes that this will provide the springboard for sharing resources along the Silk Road, which will in turn boost the regional economy and extend smart city infrastructure so it covers all public services.

Smooth and smart

Under Dunhuang's new smart tourism model, tourists can book tickets for major scenic spots online and enjoy fast entry using QR codes. At the Mingsha Hill and Crescent Spring scenic areas, for example, online sales account for 35 percent of total ticket sales. A cloud terminal access management system allows visitors to enter and leave the area using a variety

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of methods, including QR codes, identity cards, facial recognition, and fingerprints. Fingerprint recognition technology has also been applied to electronic ticketing and multiple-entry tickets. As a result of the increased convenience, the two sites clocked up more than 2 million visits in 2017 and tourist satisfaction levels exceeded 96.5 percent.

Advanced video alarm systems and visitor flow monitoring systems are installed at tourist attractions to catch ticket evaders through electronic access

poles. At the same time, a video surveillance system helps protect the lives and safety of sightseers. For example, in summer when surface temperatures at Mingsha Hill hit 45 degrees, the system can detect people suffering from heat stroke and enable first-aid to occur in the critical 10-minute window.

DSTC ensures full Wi-Fi coverage in high tourist traffic areas, which spans 43 hotels, theaters, and other attractions across the city. As Sun explains, "We've distributed Wi-Fi based on tourists stopping for ten

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minutes as standard. Visitors to Dunhuang only need to authenticate once and the Wi-Fi signals follow them, which greatly improves their online experience." DSTC also launched a mobile tour guide service for visitors, complete with interactive tours and mobile phone client services. The service provides info on attractions, electronic maps, navigation, and audio guides. In a virtual panorama display system, places of interest are virtualized, digitized, and connected, letting visitors quickly understand the area before they arrive.

The big data brain

Big data analytics is the brain of a smart city and the key to running a smart tourism system. DSTC worked with Huawei to build a big data analytics platform that manages and controls tourism resources in scenic areas in real time. It can generate tourist traffic models for peak times to facilitate precision marketing. By distributing information about tourist attractions across digital channels, DSTC has increased visitor numbers in the low season, optimized visitor traffic models, and shared regional travel data with other organizations, boosting the sustainable development of the tourism sector.

In the Mingsha Hill and Crescent Spring areas, the big data analytics platform revealed that visitor numbers

exceeded the 3,000-a-day mark 34 days earlier than the previous year and that the tourist peak season was extended by 112 days. Based on this information, the big data platform could better match tourist resources in the surrounding areas to visitors. This boosted 2017 visitor numbers to scenic spots west of Dunhuang by 15.78 percent year-on-year.

Sun explains, "The platform revealed that in 2017 group tourism accounted for less than 10 percent of visitors to Dunhuang. Ninety percent were independent sightseers, of whom 60 percent come in their own cars. We've been able to provide customized services to meet the specific needs of tourists with cars, including vehicle hire and package tours. You can build your own sightseeing passes, on-demand arrival services, and arrange car return to different locations."

Protecting history and sharing resources

Massive tourist numbers can negatively impact historical sites and in some cases compromise tourist safety. A common solution is to restrict visitor traffic, but this negatively impacts user experience as well as the local economy.

For Dunhuang, getting smart was the answer.

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Wireless sensors and other networking technologies are used for real-time monitoring, early warnings, and managing potentially damaging environmental factors such as sandstorms, floods, bad weather, and animals. And Dunhuang is home to some incredibly important sites that require protection, including the Mogao Caves, which according to UNESCO is acclaimed as "the world's greatest discovery of ancient Oriental culture," and the 2000-year-old Jade Gate, which served as a pass in the Han Dynasty's Great Wall. New technologies have transformed protection efforts from salvage-based to preventative-based — a great win for cultural heritage.

DSTC has built up an extensive big data tourist resource pool that it shares with other stakeholders. It comprises 23 databases containing over 200,000 data points covering the Dunhuang manuscripts, the Mogao Caves, and research on Dunhuang. This has formed an initial, integrated system for sharing information that can help with cultural protection, research, and the promotion of Dunhuang. DSTC has also set up an intangible heritage database. This contains a digitized directory of 53 items of intangible cultural heritage, an inheritor system, and an AV manuscript information system.

Supplementing physical visits to sites like the Mogao Caves with an online experience that people can enjoy at home is an effective way to relieve pressure on sites caused by tourist surges during peak season. Thanks to a smart booking management system, the number of visitors to the Mogao Caves is forecast to drop from 30,000 to 6,000 a day, reducing the chance of potential damage to the site's murals. "We're able to determine opening times and maximum number of visitors for the caves by monitoring humidity and temperature, carbon dioxide concentration, visitor numbers, and the density of transport connections," says Sun.

Tourism benefits all industries

The big data platform is the foundation of the new smart city. The time sensitivity and complexity of the smart city ecosystem places extremely high

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requirements on the performance of big data analytics platforms. Openness and universality are also essential, explains Sun, "When selecting equipment manufacturers, we first considered unified hardware standards and high reliability. Huawei was able to meet our needs. As for software, we believe that it should be open. Smart tourism and smart cities are open, shared ecosystems."

The Feitian Cloud Data Center is Smart Dunhuang's unified foundation platform. Built using Huawei's cloud computing technology, the platform features solutions for data sharing, video sharing, geographic information, and big data analysis. It carries smart applications for travel, homes, transportation, government, management, and services, and features capabilities for personalized visitor experiences.

According to Sun, "We can promote industrial planning through the ecosystem to help the smart city become a self-developing and evolving organism." Indeed, Dunhuang's smart tourism has brought huge benefits to the region, revitalizing the car rental and hospitality sectors, and boosting local primary and secondary industries. "Smart tourism has brought to life all of Dunhuang's different elements," says Sun. "But we must go further. We need to extend and replicate what we have done in

Dunhuang to achieve smart tourism in Gansu and along the Silk Road."

Dunhuang was nominated for a Smart City Award at the 6th Smart City Expo World Congress (SCEWC) in November 2016, becoming the first Chinese city to become a nominee for this international award. Set up by the Spanish government, the World Bank, and other organizations, SCEWC is the world's leading smart city expo, and Dunhuang's nomination testifies to successes in planning, strategy, and execution.

"Smart Dunhuang 1.0 is 'an industry-focused smart city led by smart travel' and Smart Dunhuang 2.0 will have 'cultural Dunhuang' at its core," explains Sun. "After the tourists arrived, major investment projects followed and industry flourished. Dunhuang's profound cultural heritage is the next potential area of development for Smart Dunhuang. Dunhuang has a rich repository of human civilization and culture that can be digitized."

He believes that integrating, researching, mining, and processing this data will lead to the development of a new wave of industries, including innovation, incubation, trade, design, processing, logistics, finance, and settlement. "By creating a brand and standards for Smart Dunhuang, the potential for development is unlimited," he says. ▬