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The National Palace Museum in Taiwan had to partner with experienced cloud providers to deliver television-quality exhibits.

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Challenges Deploying Complex Technologies in a Traditional Organization

AS MUSEUMS FOCUS increasingly on the public, they must develop new means of attracting and entertaining their visitors. Information and communication technologies (ICT) have great potential in this area. But deploying complex ICT in a traditional organizational setting like a museum is likely to be challenging.

The word "museum" comes from the Greek word "mouseion," signifying both the seat of the Muses and a building specifically used to store and exhibit historic and natural objects. From a knowledge-management perspective, museums preserve, create, and share knowledge. In a museum, ancient wisdom is preserved in objects and rediscovered through research. In terms of their intellectual contribution, museums create knowledge by recruiting researchers and giving them necessary incentives and resources. As a result, museums offer abundant knowledge to all. In the past, professional researchers worked independently to enhance their own expertise in their respective academic fields rather than for the benefit of the general public. Although museums stage exhibitions, visitors rarely have an intimate view of the related objects, which must be protected and preserved.

In line with social development, the function of museums has gradually changed over the years—first object-oriented (before 1980), then education-focused (1980s to 2000s), and finally public-centered (after 2000).[4] The International Council of Museums[9] redefined the 21st-century museum as follows: "A nonprofit institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates, and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment."

Advanced information technologies (such as cloud computing) and communication technologies (such as global telephone systems and third- and fourth-generation mobile telecommunications technologies) are converging.

» key insights

- **We developed a conceptual framework for how an organization can provide a new ICT-enabled service through a value-networkwide solution for establishing a service ecosystem.**
- **Any traditional organization must understand the needs of its business partners to be able to set up such an ecosystem.**
- **To implement a new value network for providing an ICT-enabled service, museums must consider these non-technical but ICT-related issues before and during development of projects related to a new service.**

Adventures in the NPM: Poster for Formosa Odyssey.

IMAGE COURTESY OF THE NATIONAL PALACE MUSEUM

This convergence has created a considerably less expensive ICT infrastructure that more effectively connects components, including information, knowledge, content, people, organizations, information systems, and other heterogeneous devices. As a result, new ICT-enabled services are available at lower cost to customers in general and members of the younger generation in particular. ICT-enabled services provide online, real-time interactive opportunities through applications; for example, a number of ICT-enabled services are offered through mobile applications.

Previous studies[1,7,12] showed museums use computing technologies primarily to increase interactivity and enhance their visitors' experience visiting a museum. Various ICT-enabled museum services have been designed to meet the needs of the public; for example, the world's top museums, including the Louvre Museum in Paris, the Metropolitan Museum of Art in New York, and the National Palace Museum (NPM) in Taiwan, have established Facebook fan pages and other interactive, social, informative, entertaining online elements to stimulate awareness of and interest in their collections and encourage users to visit their physical sites. Another example is the British Museum Channel playing video clips of exhibitions, collections, and behind-the-scenes experiences at the museum. This content is available on the museum's website. These technologies and platforms are expanding ways visitors access and interpret the objects displayed in museums.[2]

ICT-supported services enable museums to expand their social role and values by improving the timing and increasing the scope of their individual and collective engagement with visitors worldwide. Their services can be used to reach out to frequent museum visitors and potential visitors and nonvisitors alike. Their purpose is to enhance the interaction and visiting experience of a broader range of visitors, on-site or online. Many such services are designed specifically to attract young people, who are often interested in experiencing new ICT and accustomed to using multimedia services in their daily lives.

Digital Archives Project

NPM was recognized in 2014 as one of the most visited museums in the world by *The Art Newspaper* and is distinguished by its extensive collection of high-quality artifacts from Chinese history, making it one of the most popular destinations in Taiwan for international tourists. NPM management is supervised by the Executive Yuan, the highest administrative organ in the government of Taiwan.

NPM implemented the National Digital Archives Program (2002–2013) to digitize its collections on an ongoing basis, resulting in a large volume of high-quality IT-generated content on the museum's cultural and historical artifacts. In addition, NPM recognizes the novel opportunity provided by video and interactive objects to introduce historical treasures and revive interest in ancient artifacts. NPM also uses corporate advertising to stimulate the public's imagination and help them more fully appreciate China's historical artifacts. It continues to produce a number of videos related to collections, IT-generated content, and behind-the-scenes experience at the museum.

The videos produced by the museum have been extremely successful at sharing NPM's digital collection worldwide. In 2007, NPM used cutting-edge techniques to create a 3D animation called *Adventures in the NPM* that was

Figure 1. Components of the iPalace service system (adapted from Huang et al.[8]).

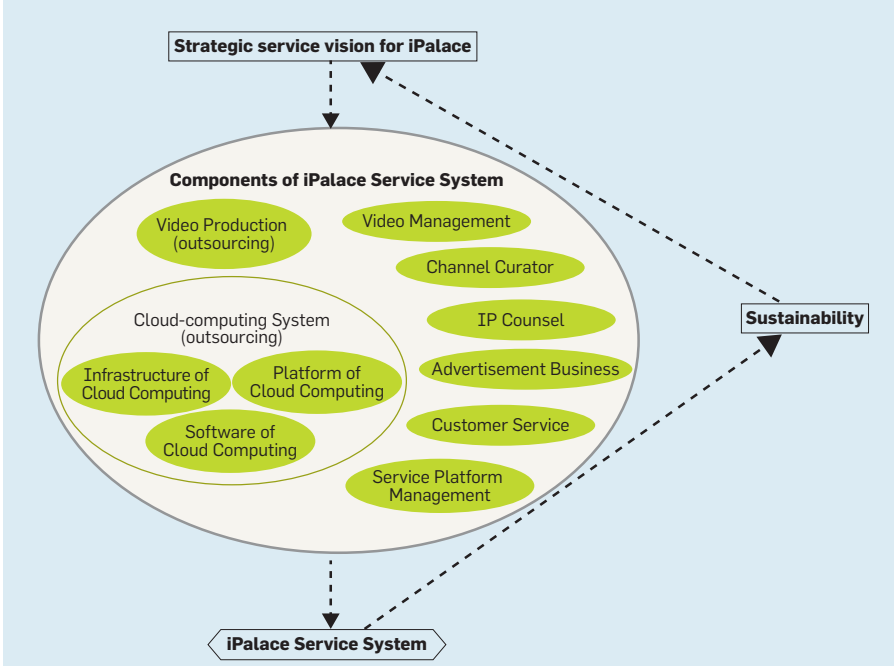


Figure 2. NIST cloud computing reference architecture (source: Liu et al.[10]).

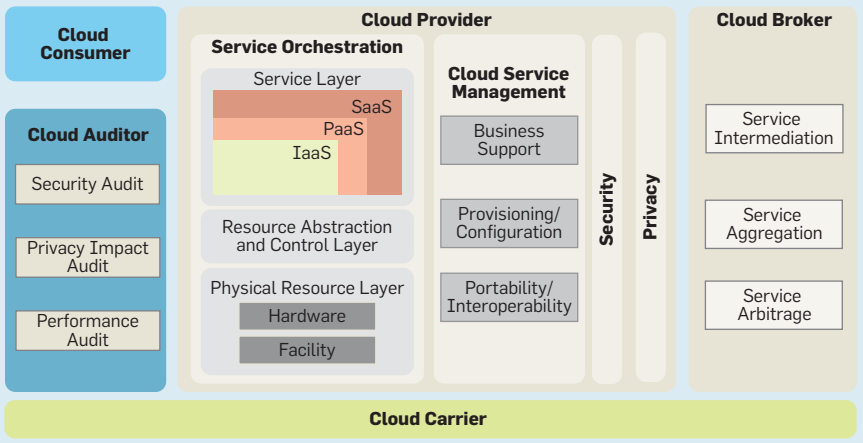
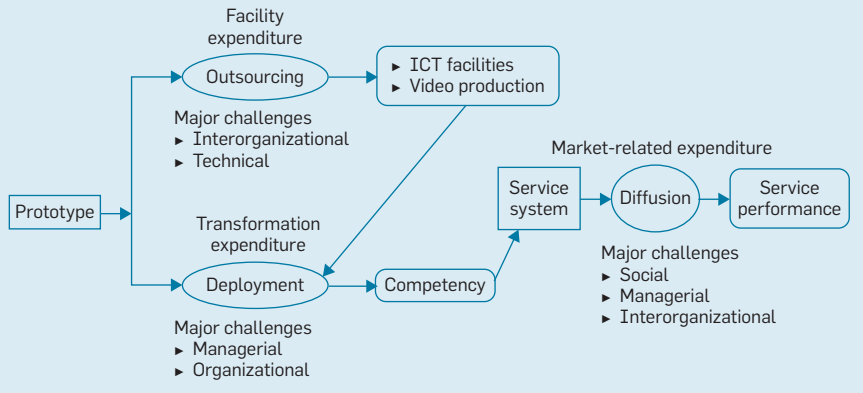


Figure 3. Process of diffusing iPalace from its prototype.



considered a milestone accomplishment, winning first prize in the public section of the 2008 Tokyo International Anime Fair, in addition to the Prix Coup de Coeur award at the in 2008 Festival International de l'Audiovisuel et du Multimédia sur le Patrimoine. At the 2009 Muse Awards, organized by the Media and Technology Professional Network of the American Alliance of Museums, NPM received a Silver Award for marketing development for a documentary called *Inside: The Emperor's Treasure* and a multimedia installation called *Passé-Future: The Future Museum of NPM*. In 2013, at the 46th Houston International Film Festival, NPM gained additional recognition by winning six major awards: two platinum, two gold, one bronze, and one special-jury. Its lighthearted comedic entry *Journeying from Past to Present—APP Minifilm* received a Platinum Award, the festival's highest accolade, in the network category. NPM plans to showcase its most representative collections on the global stage by internationally releasing its animated video *Adventures in the NPM*. Released in 2011, *Adventures in the NPM 2* featured treasures from the Palace Museum in Beijing to inspire and promote collaboration.

In 2012, NPM partnered with Google to display exquisite Chinese artifacts worldwide on Google's Art Project webpage. The Art Project initiative allowed NPM to publicly display its collections on an online platform, overcoming the temporal and spatial boundaries separating the museum from the rest of the world. NPM chose 18 artifacts familiar to the Taiwanese public to reach audiences worldwide on the Art Project webpage.

The experience collaborating with Google and creating so many high-quality videos inspired NPM to construct a video-streaming website to enable young people to access the museum's collections of inspiring Chinese artifacts. The iPalace initiative (http://npm.nchc.org.tw) was developed, then revised in December 2014 to address this goal.

iPalace

The table here outlines NPM strategic vision for the iPalace initiative. The target audience includes mainly young people who use Web browsers, are in-

terested in China's heritage, and enjoy videos and animations. The service concept emphasizes efficiently curated, well-organized video exhibitions that deliver fresh, attractive video content with smooth streaming in the form of a television program, giving viewers a high-quality online experience with NPM artifacts. Achieving these goals involves several operating strategies: a video-production process to ensure videos and animations are original and attractive; regular updating of the appearance of the interface to make it user friendly; and load balancing with such features as a task-oriented process design, an elastic Web service infrastructure, and peer-to-peer networking capability. As NPM's online counterpart, iPalace must deliver services that complement the museum's brand reputation while also coping with potential huge peaks in demand.

From the museum's perspective, iPalace was a radical innovation in ICT-enabled service, or RIIS. In addition, it is primarily a video-streaming service based on Web technology that provides a wonderful online visiting experience not linked to an in-gallery experience. Technically, however, iPalace requires expertise in sophisticated cloud-computing technology NPM does not have. From the public's perspective, iPalace is radically different from NPM's traditionally text-heavy webpages. Typical museum video channels offer a variety of video clips; for instance, the video content of the British Museum Channel is accessed through individual clicks on video clips. In contrast, operation of the iPalace initiative would be like a television program that broadcasts continuously until the viewer turns off the channel.

iPalace Value Network

The iPalace prototype was built in accordance with the strategic service vision within a reasonable timeframe and with limited effort. As the prototype was positively evaluated,[3] NPM sought to transform the pilot service system into a real-world service system by implementing a full-scale value network. However, as outlined in Figure 1, the full iPalace value network includes video-production and cloud-computing services—areas where NPM lacked expertise. As a result, time and effort beyond the museum's capability would have been necessary to vertically integrate the full value network. NPM thus chose a value-networkwide solution involving outsourcing video production and cloud computing. As discussed earlier, though NPM previously outsourced video production, it lacked experience outsourcing cloud-computing systems.

After several rounds of negotiation with potential outsourcing partners regarding the cloud-computing system, NPM became more realistic about how it could address the complexity of the iPalace value network; for instance, it recognized the usefulness of the cloud-computing reference architecture developed by the U.S. National Institute of Standards and Technology involving cloud consumers, cloud providers, cloud carriers, cloud auditors, and cloud brokers, as outlined in Figure 2. In outsourcing the cloud-computing system for iPalace, NPM functioned as a cloud customer aligned with other cloud actors identified as reliable strategic partners. Ultimately, it was necessary for NPM to collaborate with four categories of business partners in the iPalace value network:

Content makers. Studios, channel managers, and cloud operators;

Connectivity makers. Cloud operators, Internet service providers, and telephone operators;

Technology makers. Infrastructure manufacturers and middleware manufacturers; and

Sponsors. Agencies and advertisers providing sponsorship.

Leading the Value Network

Fitzsimmons and Fitzsimmons[5] said one of the challenges facing all service innovators is how to achieve the required degree of integration; Figure 3 outlines the process of diffusing iPalace, beginning with its prototype. Related activities can be classified into three architectural categories—outsourcing, deployment, and diffusion—based on expected outcomes and underlying expenditure. Outsourcing activities involve expenditure on appropriate ICT-enabled facilities through interorganizational collaboration. Deployment activities require expenditure on transformation, as NPM and its partners must ensure the museum's existing capabilities and ICT facilities are able to support iPalace. Moreover, the museum's diffusion activities must be able to translate the new service system into concrete service performance through market-related expenditure on specific means of diffusing iPalace.

The challenges in the deployment process, as in Figure 3, relate to intra-organizational integration (such as employee acceptance involving employee culture and incentives and other organizational matters); processes in organizational management/reengineering (such as enforcement of interdepartmental collaboration or establishment of new departments and functions); and acceptance of a reference group. Additional professionals (such as curators

Strategic service vision for iPalace (adapted from Huang et al.[8]).

Service-Delivery System	Operating Strategy	Service Concept	Targeted Market Segments
Fresh, attractive video content Well-defined NPM experiences: ▸ NPM images; ▸ Ease of use; and ▸ In-depth insight into Chinese culture and aesthetics. Smooth video delivery	Continual provision of new video exhibitions Periodically changing interface appearance Effective load balancing: ▸ Task-oriented process design; ▸ Elastic Web-service infrastructure; ▸ Peer-to-peer networking; and ▸ Distributed system architecture capable of multitasking.	Video service that smoothly displays NPM relics: ▸ Well-arranged exhibition; ▸ Available anytime, anywhere; and ▸ Uninterrupted multicasting. Easy-to-use user interface: ▸ Updated for the occasion; and ▸ In-depth insight into Chinese culture and aesthetics.	Young people who ▸ Use Web browsers; ▸ Are interested in China's heritage; and ▸ Enjoy videos and animations.

and marketers) must also be recruited to implement iPalace, as in Figure 1. In contrast, the challenges in outsourcing and diffusion activities, as in Figure 3, relate to interorganizational integration. NPM thus had to ensure video production and cloud computing could be outsourced appropriately.

Theoretically, RIIS diffusion is an organizational process involving participants from different industries and sectors across the value network. Although the aim of the service-science discipline is facilitating and improving interaction and collaboration of multiple entities to achieve mutual benefits, service science studies are generally summarized as "too much, too little, or too soon."[11]

Reflecting the museum visitor's perspective on iPalace, NPM seeks to gain a comprehensive understanding of the role, responsibilities, and involvement of every stakeholder associated with the iPalace value network. Moreover, iPalace delivers a viewing experience and post-viewing experience that must complement one another to ensure success.

With regard to the viewing process, the museum's online visitors desire an emotionally positive experience facilitated by a personal computer or portable computing device. As outlined in NPM's strategic vision for iPalace, fresh, attractive video content, well-defined NPM experiences, and smooth video streaming are necessary for ensuring online visitors have a positive experience online. NPM recognizes the content maker is responsible for producing fresh, attractive video content, the channel manager curates the video content and defines the NPM experience, and the connectivity maker ensures smooth video streaming.

With regard to the post-viewing experience, iPalace service quality directly correlates with viewer satisfaction, as with any commercial media experience in the real world. Service provision and the fulfillment of museum visitor needs are critical determinants of a viewer's use and enjoyment of iPalace. As a result, all parties in the iPalace value network, including NPM, content makers, connectivity makers, technology makers, and sponsors, must ensure effective viewer relationship management (VRM) and viewer fulfillment. Note the emotive force of traditional television media leads viewers from brand awareness to brand consideration. This is where the process ends, and no other means extends into the post-viewing period. In contrast, agents (such as NPM, sponsors, and advertisers) are able to harness the reach and emotional power of iPalace and motivate viewers to complete the post-viewing process. This ability makes iPalace attractive to sponsors and advertisers and in turn to other service partners and stakeholders. During the post-viewing period, connectivity makers, sponsors, and advertisers are likely to risk loss of visitors' attention or failure to attract new visitors due to substandard VRM or insufficient viewer fulfillment.

Operation of the iPalace initiative would be like a television program that broadcasts continuously until the viewer turns off the channel.

Although iPalace theoretically consists of two processes, online visitors participate in both, yet regard them as a single, seamless experience. Online visitors expect a high-quality, consistently reliable service that safeguards user privacy. To ensure the success of iPalace technology, all participants in the iPalace value network must fulfill this expectation. However, service quality and reliability, as well as privacy, are particularly important for the channel manager and connectivity maker, who are likely to be deemed iPalace "providers" by museum visitors. The brands of the channel manager and connectivity maker may also be subject to negative evaluation if mistakes are made in service delivery; that is, online visitors contact the channel manager or the connectivity maker if iPalace delivers a disappointing experience. Museum visitors usually view brands that fail to fulfill VRM and viewer-fulfillment expectations negatively. As iPalace's VRM is Internet-based, it faces a particular threat of negative evaluation, as there are more than one billion Internet users (and thus potential museum visitors) worldwide.

All parties are thus responsible for determining the most appropriate way to carry iPalace through the value network, addressing several significant issues along the way:

Carrier-rights agreements. Carrier agreements, including channel sponsorship, are a key point of negotiation; in addition, connectivity makers must exercise caution when creating (or

outsourcing) VRM and viewer-fulfillment solutions;

Creative-rights agreements. Creative rights are a significant issue of contention among the various content makers. NPM's current distribution agreements do not include the right to develop an overlay on top of existing video content. Therefore, any future distribution agreements must include incentives for studios to allow channel managers to build iPalace enhancements; and

Sharing income from sponsorships. Facility expenditure, transformation expenditure, and market expenditure represent an ongoing burden for NPM and its service partners, requiring additional income from the service provided. NPM must address conflicts that involve other partners, including ownership of sponsorship income and how to share it fairly.

Conclusion

Garrison et al.[6] said trust "between client organization and cloud provider is a strong predictor of a successful cloud deployment." It was therefore necessary for NPM to identify a suitable method of collaboration with other cloud actors, as well as with other business partners. NPM, a governmental entity, determined its own process of collaboration, which is largely regulated and conservative. NPM investigated the possibility of working with other cloud actors, including IBM, YouTube, Google, and domestic companies that have not yet established themselves as professional cloud actors. These alternatives presented strategic and managerial barriers, as well as different levels of technological readiness. Following several rounds of negotiation, the museum became more realistic about the future of iPalace and deployment of relevant complex technologies; for instance, due to the complicated political issues involved in collaborating with foreign actors, NPM identified a domestic value network as its first choice for helping develop museum artifacts and exhibitions. As Taiwan's cloud actors are not yet fully professional, NPM had to deal with a lack of technological readiness. In addition, NPM encountered conceptual differences relating to expenses, profit making, and trust when dealing with certain domestic cloud actors; for instance, it did not wish to pursue commercialization due to the museum's not-for-profit status and operation, whereas most potential cloud actors aim to profit substantially from iPalace. NPM's current business model does not involve generating and sharing more than reasonable revenue. NPM has thus chosen to work with the National Center for High-performance Computing in Taiwan, as the Center's main objective is national technological advancement rather than pure profit making.

This study has several potential implications for managers of any traditional organization with less-advanced ICT expertise. To deploy and launch an RIIS, managers must establish and lead a radically innovative ICT-enabled service system. They must have in-depth understanding of all business partners and stakeholders involved in the embedded value network. They must negotiate carrier-rights agreements and creative-rights agreements. And they must also develop an effective business model (such as income sharing) to ensure success. Moreover, as in the case of iPalace, trust must also be nurtured and sustained.

Traditional organizations could also face other challenges, including conflicting laws and regulations that discourage development and implementation of an RIIS strategy; ineffective partners unable to provide expected service; inferior ICT infrastructure that makes new ICT-enabled service unattractive, thereby invalidating the whole project; and inadequate customer (or social) acceptance.

Market-related expenditure is also required to support social objectives (such as government support and social acceptance), interorganizational goals (such as satisfying key stakeholders, identifying trustworthy partners, maintaining good institutional governance, and understanding competitors' strategies), and managerial objectives (such as knowing the market and responding proactively).

The NPM experience provides other traditional organizations with lessons on how to deploy sophisticated technology; for instance, when an organization comprehensively implements an RIIS strategy to gain competitive advantage, unresolved challenges like those described here could inhibit the RIIS and impede (and delay) the organization's evolution. On the other hand, the challenges associated with RIIS entail a valuable business opportunity for organizations able to implement an organization-centered, ICT-enabled, radically innovative value network.

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