Communication strategies and knowledge management (KM) to conserve and promote cultural heritage, traditional knowledge and the Royal Projects in Thailand

Sasiphan Bilmanoch*, John R. Merrick**
ศศิพรรณ บิลมาโนชญ์*, จอห์น อาร์. เมอร์ริค**

Received: December 18, 2021
Received in revised form: July 22, 2022
Accepted: August 10, 2022

Abstract

Socio-economic change, the importance of tourism in the national economy and need for more sustainable strategies to address many emerging environmental problems have combined to increase interest in cultural heritage and traditional practices in Thailand. The benefits of Knowledge Management (KM) systems, to prevent loss of implicit data or tacit experience, are summarised; in addition, the major physical and environmental processes as well as political and social challenges to conserving heritage and traditional knowledge are explained. The innovative use of multiple new technologies to adequately record and analyse these qualitative, nuanced data is emphasised.

* Ph.D., Department of Innovative Communication Administration, Faculty of Communication Arts, Kasem Bundit University, Bangkok. Thailand.
* ดร., สาขาวิชาการบริหารนวัตกรรมการสื่อสาร คณะนิเทศศาสตร์ มหาวิทยาลัยเกษมบัณฑิต ประเทศไทย)
** Ph.D., School of Natural Sciences, Faculty of Science and Engineering, Macquarie University, North Ryde. NSW. 2109. Australia.
** ดร., สาขาวิชาวิทยาศาสตร์ธรรมชาติ คณะวิทยาศาสตร์และวิศวกรรมศาสตร์ มหาวิทยาลัยแมคควารี ประเทศออสเตรเลีย)

As an extensive network of established projects related to cultural and traditional activities, the Royal Projects have immense national value and can be used as a model to indicate how the collection and utilisation of heritage and traditional information might be enhanced – within existing administrative structures and institutions. Suggestions for possible future improvements include: upgrading Knowledge Management systems at all project data repositories, with emphases on data collection techniques, data integrity and system connectivity; re-assessing existing written records, with a view to developing new working diagrams, animated graphics or other aids that demonstrate functions, mechanisms, processes and outputs more clearly; increasing co-operation and resource sharing between projects (or departments or investigative groups); encouraging new data recording /analysis programs, incorporating multiple gathering / analytical techniques from the start to provide usable online information more rapidly, for public use; progressively integrate all Royal Project KM systems into a network of information hubs, enhancing device connectivity both between projects and other end-users; and extend the Royal Project KM network, by increased interaction with other cultural information hubs.

Keywords: Communication technology interconnectivity / Multi-dimensional implicit knowledge / Recording nuanced data / Qualitative traditional information / Information hub networks

บทคัดย่อ

การเปลี่ยนแปลงทางเศรษฐกิจและสังคมรวมทั้งความสำคัญของการท่องเที่ยวซึ่งส่งผลต่อเศรษฐกิจของประเทศ ได้ก่อให้เกิดการนำกลยุทธ์ด้านความยั่งยืนในรูปแบบวิธีการต่าง ๆ มาใช้ในการแก้ไขปัญหาสิ่งแวดล้อมที่เกิดเพิ่มขึ้นมามากขึ้นเรื่อย ๆ โดยกลยุทธ์ด้านความยั่งยืนดังกล่าวยังสามารถช่วยเพิ่มความน่าสนใจในมรดกทางวัฒนธรรมและขนบธรรมเนียมของประเทศไทยได้เป็นอย่างดี การจัดการองค์ความรู้ (Knowledge Management: KM) ที่เป็นระบบจึงมีประโยชน์ในการที่จะช่วยป้องกันมิให้ข้อมูลความรู้ที่ได้บันทึกไว้เป็นลายลักษณ์อักษรในเอกสารหรือประสบการณ์ความรู้ของบุคคลในด้านต่างๆ ที่ได้มีการนำมารวบรวมไว้ในอดีตเกิดการสูญหาย โดยการจัดการองค์ความรู้เป็นการอธิบายถึงความเกี่ยวข้องของกระบวนการทางกายภาพสิ่งแวดล้อมต่าง ๆ รวมถึงกระบวนการทางการเมืองและสังคมในการดำเนินการอนุรักษ์มรดกทางวัฒนธรรมที่เป็นความรู้แบบดั้งเดิม ซึ่งการนำนวัตกรรมเทคโนโลยีที่เหมาะสมมาใช้ในการบันทึกและวิเคราะห์ข้อมูลจะสามารถช่วยสร้างข้อมูลที่เป็นองค์ความรู้ที่มีคุณภาพและน่าเชื่อถือได้เป็นอย่างดี

จากการที่ได้มีกลุ่มเครือข่ายต่าง ๆ ที่เกี่ยวข้องกับกิจกรรมทางวัฒนธรรมและประเพณีเกิดขึ้นมา อย่างไรก็ตาม โครงการอันเนื่องมาจากพระราชดำริซึ่งถือว่าเป็นโครงการมีคุณค่าต่อประเทศชาติ อย่างมหาศาล โดยการจัดการองค์ความรู้ของโครงการฯนั้น สามารถจะนำมาใช้เป็นแบบอย่างใน การรวบรวมและการใช้ประโยชน์จากข้อมูลดั้งเดิมที่เป็นมรดกทางวัฒนธรรม ที่แสดงให้ถึงระบบ ของการบริหารจัดการข้อมูลว่า โครงการหลวงมีการรวบรวมพัฒนาปรับปรุงและการบันทึกข้อมูล เหล่านั้นอย่างไร และสถาบันที่เกี่ยวข้องอื่น ๆ ได้เข้ามามีส่วนร่วมในการจัดทำข้อมูลอย่างเป็นระบบ ด้วยวิธีใด อีกทั้งยังแสดงให้เห็นถึงกลยุทธ์หรือวิธีการในการดำเนินการจัดทำข้อมูลของโครงการ หลวงอย่างมีประสิทธิภาพ โดยมีระบบการเพิ่มเติมความรู้หรือข้อเสนอแนะสำหรับการปรับปรุง ข้อมูลในอนาคตในลักษณะต่าง ๆ อาทิ การอัปเกรดระบบการจัดการความรู้ที่คลังข้อมูลโครงการ ทั้งหมด โดยเน้นเทคนิคการรวบรวมข้อมูล ความสมบูรณ์ของข้อมูล และการเชื่อมต่อระบบ ประเมิน บันทึกที่เป็นลายลักษณ์อักษรใหม่ เพื่อพัฒนาไดอะแกรมการทำงานใหม่ กราฟิกแอนิเมชัน หรือตัว ช่วยอื่น ๆ ที่แสดงฟังก์ชัน กลไก กระบวนการ และผลลัพธ์ได้ชัดเจนยิ่งขึ้น เพื่อให้สามารถเพิ่มความ ร่วมมือและการแบ่งปันทรัพยากรระหว่างโครงการ (อันได้แก่ องค์กรหรือหน่วยงานที่ต้องการนำ ข้อมูลมาใช้ประโยชน์) ส่งเสริมการใช้โปรแกรมการบันทึก/วิเคราะห์ข้อมูลที่ทันสมัย มาใช้ร่วมกับ การนำเทคนิคการรวบรวม/การวิเคราะห์ที่หลากหลาย เพื่อให้มีข้อมูลออนไลน์ที่สามารถนำมาใช้ งานได้อย่างรวดเร็วยิ่งขึ้น และเป็นประโยชน์ต่อสาธารณะ โครงการหลวงได้รวบรวมระบบ KM ของ โครงการหลวงทั้งหมดไว้ในเครือข่ายศูนย์กลางข้อมูล โดยได้มีระบบการเข้าถึงข้อมูลของโครงการ และกลุ่มผู้ที่ต้องการเข้าถึงข้อมูลเพื่อดูหรือปรับปรุงข้อมูลและจัดทำรายงานต่างๆ และขยายเครือ ข่าย KM โครงการหลวงให้สามารถเพิ่มปฏิสัมพันธ์การสื่อสารกับศูนย์ข้อมูลด้านวัฒนธรรมของเครือ ข่ายอื่น ๆ อีกด้วย

คำสำคัญ: การเชื่อมต่อระหว่างเทคโนโลยีการสื่อสาร / ความรู้ที่ชัดเจนจากหลากหลายมิติ / วิธี การบันทึกข้อมูลที่ถูกต้องเหมาะสม / ข้อมูลเชิงคุณภาพด้านวัฒนธรรม / เครือข่ายศูนย์กลางข้อมูล

Introduction

In the ‘Information Age’ there is growing interest in Thailand about cultural heritage and traditional practices. Major drivers of this enhanced awareness include: accelerating social change with urbanisation, recognition of tourism as a very significant part of the economy, and the need for more sustainable approaches to alleviate many emerging social and environmental problems.

Recent advances in communication technologies, digital conversion of information and other processes associated with globalisation have been studied extensively (Bilmanoch, 2007, 2014; Mettathamrong, 2021). However, much less attention has been paid to the adequate recording and analysis of previous knowledge or traditional practices (Brosi et al., 2007; Lubinski, 2018; Nduka and Oyelude, 2019),

which underpin the social evolution of current socio-economic systems – and may be potentially relevant for the future. Most of the discussion has focused on the technologies, on data-gathering capacities, or data storage / security / accessibility issues (Nooghabi and Dastgerdi, 2016; Satell, 2018; Williamson and Johanson, 2018; Creately, 2021; GeeksforGeeks, 2021; Talend, 2022), as well as the interconnections between mass communication or digitisation and globalisation (Bilmanoch, 2014).

Benefits of Knowledge Management (KM) Systems

In this global context of moving towards knowledge-intensive socio-economic systems, the field of ‘ Knowledge Management ‘ (or KM) has rapidly developed; KM is broadly defined as ‘ the process of organising collected information or data and analysing them to make the best use of knowledge ‘. The concept is most frequently applied to organisations which act as data repositories and share the knowledge to achieve organisational objectives; this interdisciplinary process tries to ensure: the growth of knowledge, while facilitating data access/retrieval; promotion of analyses resulting in usable outputs; maintenance of data integrity and security, to prevent data degradation or loss (OmniSci, 2021). Detailed discussion of this field of management is beyond the scope of this paper and many models have been proposed (Akhavan et al., 2006; Bashir and Rehman, 2016; Ahmed and Elghag, 2017); much of the literature is focused on specific commercial or business needs and challenges to KM implementation have been recognised for some years (Gupta et al., 2000). Table 1 (below) summarises the general benefits of KM.

Table 1. Summary of the benefits of Knowledge Management, with notes on features/resources necessary for effective system function (adapted from: Garfield, 2014; Giva, 2017; OmniSci, 2021).

Benefit of KM system	Features / resources required for optimal system function
Provides a central informational hub– for all organisational data	Ample space required for secure storage of essential paper records and archival documents. Sufficient IT capacity for both digital data storage and rapid retrieval, when required.
Implements a knowledge cycle from gathering data, to organising / sharing information, to utilisation to optimise organisational performance and achieve specific objectives	Dependent on a knowledge culture – encouraging sharing knowledge as an asset, promoting co-operative communication and innovation, to increase team knowledge levels.
Facilitates 4 major KM objectives: improve knowledge capture; enhance knowledge environment; increase access (retrieval) of organisational knowledge; maintain integrity of data assets	Achieving these objectives depends on: encouraging team enthusiasm for gath-ering relevant data; developing a logical IT system for allocating, finding and re-trieving data; promot-ing analysis for improvement, and updating as possible.
Provides a mechanism to grow knowl-edge and analyse, or re-analyse, data to develop solutions to new condi-tions, while logic-ally archiving older information that may be useful in future	These outcomes are dependent on adequate skilled staff (and staff time) for: co-ordination and collection of new data as required; analyses as well as archiving of obsolete data for future reference.
Promotes standardised approaches which increase efficiency at all stages of knowledge cycle. Facilitates staff learning	Logical transparent protocols which minimise inconsistencies, confusion or mis-understandings, unnecessary repetition, or repeat errors.

Benefit of KM system	Features / resources required for optimal system function
Encourages more open communication and continuous learning, which stimulates research and development	Adequate skilled staff and time resources to undertake new investigations in a timely manner.
An integrated system eliminates data silos, enabling more staff to access institutional knowledge	Adequate time for focused staff interaction and individual reflection, with mentoring for short- and long-term benefits.
Increased communication, which usually translates to improved communication (i.e. less delays, confusion or misunderstanding)	Managerial encouragement of information exchange is very important and can be justified by improved performance and use (or re-use) of existing data .
Heightened situational awareness, should lead to improved analyses and decisions with better outcomes	Dependent on being able to provide more information to more decision-makers (or users) in a timely way.

The objectives of this article are: to briefly explain the benefits of knowledge management systems, especially to prevent erosion or loss of implicit traditional information; to outline the challenges of adequately recording traditional cultural information; and to use the network of Royal Projects in Thailand as an example of how collection of traditional knowledge might be enhanced and educational outputs improved, using existing administrative structures, programs and institutions.

Challenges of Adequately Recording previous Cultural Information

The recording of cultural information highlights the limitations of digital systems, which are designed on mathematical principles to distinguish and sort factors by quantitative differences. Traditional cultural information is usually qualitative and far more nuanced, varying under many different circumstances due to altered but unstated assumptions. So adequate documentation requires a variety of technologies that capture different dimensions of the data.

The major problem about traditional information is that it is not formally recorded or written down – it is passed on verbally (or by practical display) within families, or perpetuated by mentoring in work or professional environments; in some instances it is intuitive, or related to personal well-being (i.e. survival in particular unusual or extreme conditions). Just as the circumstances vary widely, the degree of exchange of information also varies – depending on factors such as the personalities and attitudes of senior individuals, as well as the time that is available for explanation or demonstration.

Globalisation processes, contributing to the 'Knowledge Age', have resulted in widespread recognition of the value and relevance of all types of knowledge (Guzman, 2009; Pritchard et al., 2010; Pacharapha and Ractham, 2012) - including practical experience that has often not been recorded adequately (Styhre, 2004). This last category of individual experience, often referred to as tacit knowledge, is important but often unspoken and known to be particularly hard to explain or record (Sanderson, 2001; Sampath, 2018). Even when funding and other resources are made available, unfortunately, further recording or analyses of historic data are inhibited by the absence of individuals who could verify the experiences and situations. However, fortunately, the advances in sensing and communication technologies now provide new options for the collection, analysis and interpretation of traditional data, enabling enhanced understanding of logic, designs and reasons underlying processes or interactions. The limits of historical data and understanding of previous records are highlighted by the many ' archaeological re-assessments' undertaken in recent years; these investigations use basic data of materials and technology available (e.g. stone block size and weight, wooden sledges and hemp rope) to re-consider and analyse (using mathematics) known or suspected building construction techniques, for feasibility (e.g. Keach, 2018; UF MAE, 2022).

Environmental Impacts and Degradation

Having identified major social factors that have limited or influenced the collection of traditional knowledge to date, it is also appropriate to consider other physical processes or current political priorities that may inhibit the gathering of historical or traditional knowledge in the near future. The first category of potential problems relates to decomposition processes. For smaller items (e.g. parchments, pottery, wooden artefacts, metal tools) the deterioration can be slowed or stopped by re- housing in temperature-controlled, low humidity conditions in museums; however, for external structures or extensive internal decoration (e.g. tomb wall paintings) the challenges are much greater. For example, the conservation and management of wall paintings in the Royal tombs of Egypt has been on-going for decades, to address threats such as structural damage (e.g. cracking) as well as deterioration due to physical and environmental impacts from increasing numbers of visiting tourists (The Getty Conservation Institute, 2013; Wong, 2017)

While these local site impacts can be minimised by planning, monitoring, restoration and control of visitor access, the important older paintings in many natural cave systems are subject to many more human and natural threats. Some of these threatening processes are very difficult or impossible to alleviate – even with active site management. Long-term studies of palaeolithic paintings (~ 17,000 years old) in the Lascaux Cave system (south-western France), have revealed a series of physico-chemical and biotic threats associated with human visitation. Initially the growth of lichens and small crystals on wall surfaces was observed; this problem was solved by the creation of a replica cave, as a substitute tourist display. However, the original paintings were subject to continued attack by bacteria and introduced fungi (moulds), so eventually the main cave was closed to the public (RSC Education, 2022). In Sulawesi (Indonesia), other even older cave paintings (dating back to over 40,000 years of age) are now deteriorating more rapidly due to climate change. This tropical area is the most atmospherically dynamic on Earth, due to alternating periods of high seasonal rainfall and moisture and drought; this results in ideal conditions for haloclasty to occur – where salt crystals form (due to repeated changes in temperature and humidity). This crystallisation mechanically separates the painting panels from the limestone walls and ceilings (CNN, 2021; Di Liscia, 2021).

Despite the challenges outlined above and mixed results of some remedial strategies (RSC Education, 2022), there has been considerable progress in the innovative use of new technologies to assess the structure, texture and composition of many of these ancient works of art. These investigations have improved the outlook for on-site preservation but, more importantly, have resulted in detailed and highly accurate recordings of some of this artistic heritage that has enabled recreations for educational display and future research. Ancient cave paintings, ranging from 2,000 to 11,000 years in age, have been identified at a number of remote sites in Thailand in recent years; however, detailed studies are yet to begin (Archaeology, 2020; Burton, 2020; Cheng, 2020).

Political Priorities, Recognition and Relevance

The other category of barriers to recording or utilising traditional information is that of political priorities or lack of recognition.

In day-to-day government the collection and analysis of historic or traditional data are generally not seen as high priorities, as the cultural or educational significance or relevance of the data are not recognised. It is often only when this type of information can be directly linked to financial activity, or a practical problem, that its value is officially acknowledged. For example, where monument restoration can be related to expanding tourism (Vierda, 1995; Lerkplien et al., 2013; Ismagilova et al., 2015); or, where traditional concepts / usage provide alternative sustainable solutions to current environmental or pollution problems (Fransen, 2021; Jonsson et al., 2021).

In the conservation management context, one of the obvious aspects for improvement is the recording and utilisation of indigenous or traditional land management practices in the development of strategies for the future – especially for maintaining biodiversity and wildfire management. Preserving biodiversity is particularly important in Thailand, which is part of a biodiversity hotspot and relies heavily on tourism in ‘ natural ‘ areas (Merrick and Bilmanoch, 2010). Fire management is a growing problem everywhere, as rising temperatures result in more intense and frequent natural fires (Borunda, 2020; Goodman and Horton, 2021).

This neglect of indigenous data occurs in many countries and reflects inconsistencies in legal systems, where:

(a) national legal frameworks, relating to management of biodiversity and climate, do not acknowledge the roles of indigenous peoples as stewards of large

areas of environment;

(b) historically many indigenous communities have been moved from their ancestral lands and/or prevented from conducting traditional practices.

(c) indigenous groups are not granted a legally recognised status – which denies them land tenure or voting rights. This also minimises interaction with other communities or institutions.

The situation relating to indigenous peoples' rights in Thailand and the problems preventing more local co-operation in relation to conservation are discussed by Wongnithisathaporn and Worsdell (2021). In Australia in recent years, there has been substantial progress in incorporating indigenous knowledge in fire management programs, as well as implementation of joint (ecological and indigenous) land management strategies in some reserve areas (Hill et al., 2013).

Finally, in addition to the broad challenges to gathering and recording of cultural or traditional data summarised above, it should be noted that there are further risks related specifically to knowledge workers. In situations where qualitative, nuanced data are collected and where there is much personal interaction combined with human to machine (technology) contact, there is further potential for several kinds of knowledge degradation. Details are not relevant here, but these processes are discussed elsewhere (e.g. Karr-Wisniewski and Lu, 2010; Wagner, 2017). However, despite the above difficulties, processes and barriers, Thailand has a major advantage in collecting and conserving traditional knowledge for the future – the Royal Project Initiative.

Key Roles of Royal Projects in Thailand

In Thailand, a long period of relative stability as well as the foresight and active interest of the late King Rama IX (Bhumibol Adulyadej) resulted in the establishment of thousands of community Royal Projects (Wimuttanon, 2001; Wikipedia, 2022). This valuable legacy of so many diverse cultural activities, which are focused on traditional practice and largely independent of the government of the day, is unique to Thailand – and provides a basic model for how cultural information of all kinds may be collected and conserved for the future.

Project Organisation, Aims and Underlying Philosophy

These numerous Royal Projects are very diverse and vary widely in size and scope; they focus on aspects of integrated small-scale agriculture, animal husbandry and industrial technology as well as many other community activities. When viewed in terms of the large number of local community groups involved, the number of staff employed and large number of projects throughout the kingdom (Wikipedia, 2022), the socio-economic significance of these projects quickly becomes apparent. See Figure 1 for a summary of project stakeholders, interactions and outputs.

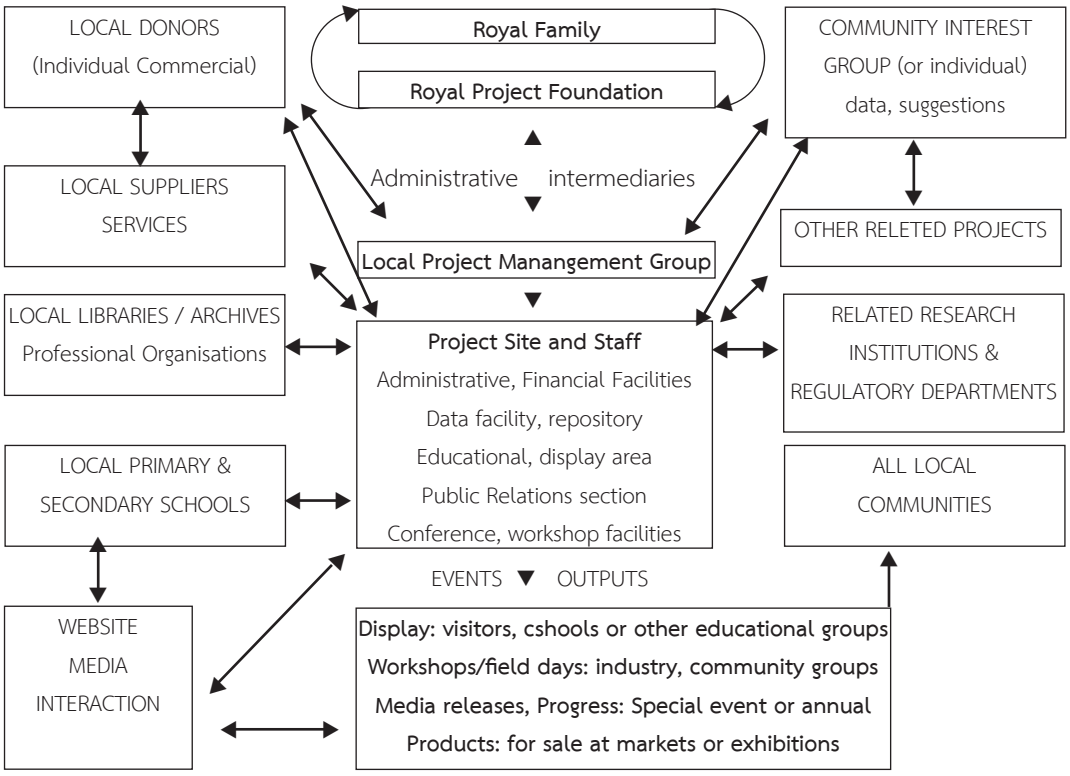


Figure1. A generalised summary of the major stakeholders, componentsand interactions relating to Royal Projects, which continue to be supported by Thai Royal Family. Currently over 4,700 projects arev lised throughout Thailand

While each of these long-term programs have site- or industry-specific aims, they were all established with the broad objectives of: utilising and retaining traditional cultural knowledge and experience for the social and economic benefit of current and future generations; encouraging innovation, using previous and new knowledge (technology), to improve small-scale production efficiency without the need for massive investment or risking environmental degradation. The long-term

practical outcome envisaged was that stimulating communities to produce day-to-day necessities more efficiently, would enable excess products to be sold for economic benefit and raise living standards (Office of National Economic and Social Development Board, 1998; Mongsawad, 2007).

This approach is consistent with the concept of 'Economic Sufficiency (ES)', which is internationally recognised (Bank of Thailand, 1999; Sathirathai and Piboolsravut, 2004; UNDP, 2007) and, directly or indirectly, promotes 'sustainability' at local levels. A detailed explanation of the 'sufficiency' philosophy and theory, developed by the late King Bhumipol Adulyadeh (Rama IX), is not appropriate here and has been fully documented elsewhere (Mongsawad, 2007, 2010; Mongsawad and Thongpakde, 2016); however, it should be noted that to practise this pragmatic philosophy is to value knowledge and to emphasise human well-being, while balancing economic realities both locally and beyond. While most Royal Projects were initially based in rural or regional communities, re-analysis of the priorities and ethics of the SE approach indicate that it can be applied at varying scales beyond community; the same principles can influence thinking and practice in many other sectors, such as health (Nittayarumpong, 2006; Hongsranagon, 2009).

Knowledge Hub Network

While analyses of individual projects can be useful to demonstrate specific benefits, fascinating issues or unexpected challenges over time, the discussion and suggestions here remain deliberately focused at the network level, within the national context. These remarks should also be considered as supplementary and/or complementary to previous recommendations made about other potential knowledge exchange systems in Thailand (Bilmanoch and Merrick, 2012; Merrick and Bilmanoch, 2016).

While the Royal Projects don't necessarily cover all aspects of traditional cultural activity that should be documented they do, in combination with particular government departments (e.g. Archaeology, Fine Arts) and all Museums, form a very extensive network of established information hubs. Although they vary widely in scope and resourcing, all of these projects and / or organisations have an active 'knowledge culture' and similar objectives – in terms of growing, storing and distributing knowledge in usable forms, as and when required. Each project, to varying degrees, also has the physical organisational components that are essential

to perform the informational hub function; these include administrative, financial, data storage and reference sections, as well as public relations (PR) and educational facilities.

While there is considerable interaction between these entities at present, much of the co-operation is serendipitous or results from informal individual personal interactions. It seems clear that the potential value of this network asset could be further enhanced by: encouraging increased co-operation and system connectivity; re-assessing and recording existing, or new data, with new technologies; increasing the capacity for analysis and presentation of knowledge in clearer forms for more users. These general suggestions may involve some increase, or re-allocation, of resources in some organisations; however, they also form the basis of the recommendations listed in the final section below.

Conclusions and Recommendations

The combination of a strong Buddhist tradition, which still pervades all aspects of life, widespread modernising trends and rising education levels as well as a more open parliamentary system of governance has resulted in general acceptance of the importance of cultural heritage and traditional knowledge in Thailand. Growing recognition of the need for sustainability, which underlies many traditional practices, has facilitated official encouragement of many traditional cultural educational programs, such as those promoted in Royal Projects.

Although in recent years most commercial, technical and scientific data have been digitally recorded, it is clear that much heritage or traditional knowledge has not been recorded at all and cannot be adequately recorded as a single digital conversion or expression. This historic or traditional information is qualitative and nuanced; it is logical that these multi-dimensional data be recorded using several technologies, to enhance understanding of records and minimise the risk of knowledge degradation or loss. Examples of the challenges to adequately recording these historic or traditional data include age and decomposition processes, site environmental degradation and climate change, as well as political priorities and failure to recognise the value of these data.

In this context, the benefits of integrated Knowledge Management systems are clear. The unique role of the many Royal Projects through- out the kingdom is

briefly discussed, along with potential future development, and the authors suggest the following for consideration:

(a) That, as resources permit, more emphasis be placed on KM systems at each of the Project repositories (and associated Foundations or Departments), especially in relation to system connectivity and data integrity;

(b) That, where possible, existing data be re-assessed for adequacy and where needed, newer or multiple technologies be employed to gather additional data to enhance understanding;

(c) That, regular interaction be encouraged between projects and associated organisations, with a view to promoting mutually beneficial co-operation and sharing of expertise or technological capacities; to optimise the use of multiple technologies and diverse techniques that individual organisations could not be expected to have or duplicate;

(d) To encourage new data recording and analysis programs that incorporate multiple gathering and analytical techniques from the outset, to provide clear, usable online information for public access;

(e) That, progressively, all Royal Project KM systems be interconnected to become an integrated network of information hubs; and

(f) That the Royal Project KM network increase connectivity and extend interaction with other cultural information hubs, such as museums, research institutions (or centres) and relevant government departments.

It is hoped that the above recommendations can be used as the basis of constructive initiatives that, over time, increase the effective collection of cultural heritage and traditional knowledge and facilitate access to this national asset.

Bibliography

English

Ahmed, A. & Elhag, M. (2017). SMART KM model. World Journal of Science, *Technology and Sustainable Development, 14*(2/3), 172–193.

Akhavan, P., Jofari, M. & Fathian, M. (2006). Critical success factors of knowledge management systems: a multi-case analysis. *European Business Review, 18*(2), 97–113.

Bank of Thailand. (1999). Monetary policy: inflation targeting and the philosophy of sufficiency economy. *Paper presented at the*

Philosophy of Sufficiency Economy Conference. 18 -19 December, 1999. Chonburi, Thailand.

Bashir, K. and Rehman, M. (2016). Comparative analysis of knowledge management frameworks. I*nternational Journal of Computer Science and Information Security, 14*(12), 80–87.

Bilmanoch, S and Merrick, J.R. (2012). The interaction of the media with zoos and temples to improve communication about conservation in urban areas of Thailand. *Journal of Communication Arts Review (Rungsit University), 16*(1), 86–98.

Bilmanoch, S. (2007). The role of New Communication Technologies in influencing socio-cultural change or values in Thailand. *Journal of Communication Arts (Chulalongkorn University), 25*(3), 91–116.

Bilmanoch, S. (2014). The utilization of the internet by TV Stations in Thailand. In Proceedings of the 22nd JAMCO Online International Symposium. *The Japan Media Communication Center (JAMCO).* March to December, 2014 (pp. 9-21). Japan.

Brosi, B.J., Balick, M., Wolkow, R., Lee, R., Kostka, M., Raynor, W., Gallen, R., Raynor, A., Raynor, P. & Lee Ling, D. (2007). Cultural erosion and biodiversity: canoe-making knowledge in Pohnpei, Micronesia. *Conservation Biology, 21*(3), 875–879.

Gupta, B., Iyer, L.S. & Aronson, J. E. (2000). Knowledge management: practices and challenges. *Industrial Management & Data Systems, 100*(1), 17–21.

Guzman, G. (2009). What is practical knowledge?. *Journal of Knowledge Management, 13*(4), 86–98.

Hill, R., Pert, P.L., Davies, J., Robinson, C.J., Walsh, F. & Falco-Mammone, F. (2013). I*ndigenous Land Management in Australia: Extent, scope, diversity, barriers and success factors* (Research report). CSIRO Ecosystem Sciences, Cairns. 84 pp.

Ismagilova, G., Safiullin, L. & Gafurov, I. (2015). Using historical heritage as a factor in tourism development. *Procedia – Social and Behavioral Sciences***,** (188), 157–162.

Jonsson, A., Andersson, K., Stelick, A. & Dando, R. (2021). An evaluation of alternative biodegradable and reusable drinking straws as alternatives to single-use plastic. *Journal of food Science, 86*(7), 3219–3227.

Karr-Wisniewski, P. & Lu, Y. (2010). When more is too much: operationalizing technology overload and exploring its impact on knowledge worker productivity. Computers in Human Behavior, (26), 1061–1072.

Lerkplien, W., Rodhetbhai, C. & Keeratiboorana, Y. (2013). The management style of cultural tourism in the ancient monuments of lower central Thailand. *Asian Social Science, 9*(13), 112–118.

Lubinski, C. (2018). From 'History as Told' to 'History as Experienced': contextualizing the uses of the past. *Organization Studies, 39*(12), 1785–1809.

Merrick, J.R. & Bilmanoch, S. (2010). Communicating about the environment. Media and technology influences on changing attitudes to conservation: comparing Australia and Thailand. *In Proceedings of the Healthy Parks Healthy People International Congress.* 11-16 April, 2010 (pp. 277–305). Melbourne Convention Centre. Melbourne.

Merrick, J.R. & Bilmanoch, S. (2016). Communication and co-ordinating roles of hub organisations in management of environmental issues: a feasibility study of Thailand. *Kasem Bundit University Journal, 17*(2), 175–191.

Mettathamrong, J. (2021). Factors that affect the behavior of adolescents in Thailand due to the use of mobile phones in their daily life. *Utopia y Praxis Latinoamericana, 26*(2), 212–226.

Mongsawad, P. & Thongpakde, N. (2016). Sufficiency Economy Philosophy: a holistic approach to economic development and mainstream economic thought. *Asian Social Review, 12*(7), 134–142.

Mongsawad, P. (2007). The philosophy of sufficiency economy and economic management**.** *NIDA Development Journal,* (1/2550), 159–180.

Mongsawad, P. (2010). The philosophy of the Sufficiency Economy: a contribution to the theory of development. *Asia-Pacific Development Journal, 17*(1), 123–143.

Nduka, S. & Oyelude, A. (2019). Goge Africa: preserving indigenous knowledge innovatively through Mass Media Technology. *Preservation, Digital Technology & Culture, 48*(3-4), 120–128.

Nittayarumpong, S. (2006). *From Sufficiency Economy to Sufficiency Health.* Bangkok: Sahamitrprinting and Publishing.

OmniSci. (2021). *Knowledge Management*. Retrieved from https://www.heavy.ai/technical-glossary/knowledge-management

Pacharapha, T. & Ractham, V. (2012). Knowledge acquisition: the roles of perceived value of knowledge content and source. *Journal of Knowledge Management, 16*(5), 724–739.

Pritchard, D., Millar, A. & Haddok, A. (2010). *The Nature and Value of Knowledge: Three Investigations***.** Oxford University Press: UK.

Sanderson, M. (2001). Records management and the capture of tacit knowledge. *Records Management Journal, 11*(1), 7–17.

Sathirathai, S. & Piboolsravut, P. (2004). Sufficiency Economy and a healthy community. *Proceedings at the Third IUCN World Conservation Congress.* 17-25 November, 2004 (pp. 1–24). Bangkok, Thailand.

Styhre, A. (2004). Rethinking knowledge: a Bergsonian critique of the notion of tacit knowledge. *British Journal of Management, 15*(2), 177–188.

Talend. (2022). *What is data integrity and why is it important?.* Retrieved from talend.com/resources/what-is-data-integrity/

United Nations Development Programme (UNDP). (2007). *Thailand Human Development Report 2007: Sufficiency Economy and Human Development (Research report)*. Bangkok, UNDP.

Vierda, V. (1995). Restoration of monuments and tourism. *Tourism and Hospitality Management, 1*(2), 413–420.

Wagner, D.N. (2017). Graceful degradation and the knowledge worker. In Kupers, W., Sonnenburg, S. & Zierold, M. (Eds), **R***eThinking Management. Perspectives and Impacts of Cultural Turns and Beyond (pp. 171–189).* Springer VS: Wiesbaden, Germany.

Online

Archaeology. (2020*). Rock art discovered in remote cave in Thailand.* Retrieved from https://www.archaeology.org/news/9087-201007-thailand-rock-art

Borunda, A. (2020). *The science connecting wildfires to climate change.* Retrieved from https://www.nationalgeographic.com/science/article/climate-change-increases-risk-fires-western-us

Burton, J. (2020). *Newly discovered 3,000 year old paintings in Phang Nga.* Retrieved from https://thethaiger.com/news/phang-nga/newly-discovered-3000-year-old-cave-paintings-in-phang-nga

Cheng, T. (2020). *Thailand cave paintings: markings believed to date back 3,000 to 5,000 years.* Retrieved from https://news.cgtn.com/news/3045544f33514464776c6d636a4e6e62684a4856/index.html

CNN. (2021). *The climate crisis is irrevocably damaging the world's oldest cave art.* Retrieved from https://edition.cnn.\com/2021/05/13/world/climate-crisis-worlds-oldest-cave-art-indonesia-scn/index.html

Creately. (2022, 16 August). 9 visual tools to gather requirements for your software. [Blog post]. Retrieved from https://creately.com/blog/diagrams/requirements-gathering-techniques/

Di Liscia, V. (2021). *Ancient cave paintings are deteriorating due to climate change.* Retrieved from https://hyperallergic.com/646570/ancient-cave-paintings-are-deteriorating-due-to-climate-change

Fransen, B. (2021). *Revisiting ancient innovations for modern environmental problems.* Retrieved from https://www.ecomatcher.com/revisiting-ancient-innovations-for-modern-environmental-problems/

Garfield, S. (2014). 15 knowledge management benefits. Retrieved from https://www.linkedin.com/pulse/20140811204044-2500783-15-knowledge-management-benefits/

GeeksforGeeks. (2021). *Difference between data security and data integrity.* Retrieved from https://www.geeksforgeeks.org/

Giva. (2017, 18 October). 6 key benefits of a knowledge management system (KMS). [Blog post]. Retrieved from https://www.giva.com.au/blog/index.cfm/2017/10/18/6-key-benefits-of-a-knowledge-management-system-kms

Goodman, J. & Horton, J. (2021). *Wildfires: how are they linked to climate change?.* Retrieved from https://www.bbc.news/58159451#:~:

Hongsranagon, P. (2009). An application of Sufficiency Economy in the health sector in Thailand. *OECD World Forum on 'Charting Progress, Building Visions, Improving Life'. 27-30 October, 2009 (pp. 1-6). Busan, Korea*. Retrieved from https://www.oecd.org/site/progresskorea/44096103.pdf

Keach, S. (2018). *Mystery of how the pyramids were built SOLVED? Genius ancient building hack revealed.* Retrieved from https://www.thesun.co.uk/tech/7668771/egypt-pyramids-built-how-ramp/

Nooghabi, M.Z. & Dastgerdi, A.F. (2016). *Proposed metrics for data accessibility in the context of linked open data*. Retrieved from www.emeraldinsight.com/0033-0337.htm

Office of the National Economic and Social Development Board. (1998). *Sufficiency Economy. Implications and Applications.* Retrieved from http://www.nesdb.go.th/Wld/book/booksuffwork_eng.pdf

RSC Education. (2022). *Mouldy old cave closed – 'bug' danger.* Retrieved from https://edu.rsc.org/resources/dangers-to-cave-art/1547.article

Sampath, S. (2018, 13 June). 8 ways to capture tacit knowledge in organizations. [Blog post]. Retrieved from https://medium.com/@savitha84/8-ways-to-capture-tacit-knowledge-536ef990b82d

Satell, G. (2018). *Data storage is becoming a massive problem. DNA may be the answer.* Retrieved from inc.com/greg-satell/data-storage-is-becoming-a-massive-problem-this-startup-may-have-answer.html

The Getty Conservation Institute. (2013). *Conservation and management of the tomb of Tutankhamen.* Retrieved from https://www.getty.edu/conservation/our_projects/field_projects/tut/overview.html

UF MAE. (2022). *The technology behind the construction of the pyramids of Giza.* Retrieved from https://www.mae.ufl.edu/~uhk/PYRAMID-TECHNOLOGY.pdf

Wikipedia. (n.d.). *Royal Project Foundation*. Retrieved February 25, 2022. From https://en.wikipedia.org/wiki/Royal_Project_Foundation

Williamson, K. & Johanson, G. (eds). (2018). *Research Methods: Information, Systems, and Contexts. (2nd ed).* Chandos Publishing (Elsevier), Netherlands. https://doi.org/10.1016/C2016-0-03932-3

Wimuttanon, S. (ed). (2001). *Amazing Thailand*. World Class Publishing Co. Ltd., Bangkok. 707 pp.

Wong, L. (2017). *Conserving the wall paintings in the tomb of Tutankhamen.* Retrieved from https://blogs.getty.edu/iris/conserving-the-wall-paintings-in-the-tomb-of-tutankhamen/

Wongnithisathaporn, P. & Worsdell, T. (2021). *Thailand's indigenous peoples fight for 'land of our heart' (commentary).* Retrieved from https://news.mongabay.com/2021/03/thailands-indigenous-peoples-fight-for-land-of-our-heart-commentary/