TELEMEDICINE ADOPTION AND DIFFUSION: THE CASE OF THE UNITED ARAB EMIRATES

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Abstract: This research was initiated to explore telemedicine (TM) adoption and diffusion in healthcare organizations in the UAE. According to the exploratory findings of this research, the research endeavored to achieve two main targets. Initially, it was revealed that the telemedicine phenomenon was not that extensive in the UAE in the sense there was no self initiated TM networks or specialty TM centers as such. According to this finding the researcher attempted to explore the perceptions of healthcare professional in the UAE about their attitudes and behavior towards adopting the TM technology in their organizations using a theoretical construct extended from the technological innovation literature. Secondly, the existing TM initiatives in the UAE were initiated in cooperation with Mayo Clinic to have complete multimedia TM system for tele-consultations (second opinion). The effectiveness of this approach is also examined in this research. The research discusses the research findings in the light of the overall literature highlighting further implications and suggesting ways where TM could be pushed forward in the UAE. What is yet to be seen in the UAE context is the initiation of self governed specialty TM systems and networks.

1 INTRODUCTION

Telemedicine (TM) means medicine from a distance where distant and dispersed patients are brought closer to their medical providers through the means of telecommunication technologies (Charles, 2000; OTA, 1995; Noring, 2000; Perednia & Allen, 1995; Wayman, 1994). TM can assist in reaching out to rural patients (Charles, 2000; Harris, Donaldson, & Campbell, 2001) and to areas where patient volumes for certain services are limited (Edelstein, 1999). It can also assist in implementing administrative and clinical meetings (i.e., journal discussion, case discussion), in providing different health-awareness courses to patients (smoke treatment centers), in delivering training courses to physicians (discussing research journal), nurses, and other medical staffs (Perednia & Allen, 1995; Wayman, 1994), and even to a level where telemedicine could be used to promote disease prevention, lifestyle management and well-being (Lemberis & Olsson, 2003).

TM covers a wide spectrum of benefits in healthcare through the use of TM utilizing the video conferencing technology in areas such as consultations, diagnostics, therapeutic, transfer of patient related records, case management, training, and meetings. This mounting hype amongst researchers and practitioners about TM advantages lead to a conclusion that TM could be an essential building block in the strategic plan of many healthcare organizations (Charles, 2000). In a rural setting, TM could help health providers in supplying quality, fast, and economical medical services to patients including rural ones and hence, saves doctors and patients valuable time wasted in commuting large distances (Oakley et al., 2000). Specialists could utilize this extra time in seeing more patients at the main hospital.

1.1 Telemedicine in the UAE

Medical services in the UAE has improved dramatically during the past 30 years where the number of hospitals increased from 7 to 30, the number of beds increased from 700 to 4473 and the number of primary health care centers increased from 12 to 115 (MOH1)

In the UAE, the term telehealth and TM is not widely recognized as such. In scanning for telemedicine initiatives within the UAE, to the best

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of the author's knowledge, the following organizations were the only ones reported to adopt telemedicine projects and applications:

i. Tawam hospital.
ii. Mafraq Hospital.
iii. UAE University (UAEU):
iv. Higher Colleges of Technology (HCT).

The first two are hospitals in the Emirate of Abu Dhabi and the last two represents an educational institution. The UAEU has a Faculty of Medicine and Health Sciences (FMHS) in Al-Ain city and the HCT provides health-related courses and degree nationwide.

Given the above stocktaking of the above TM initiatives in the UAE, it is important to investigate the potential importance of the TM technology in the above cases. Therefore, this research attempted to achieve the following objectives:

i. what are the adopted TM technologies in these institutions.
ii. where they are being used.
iii. reasons for adoption
iv. challenges facing TM adoption and usage.
v. Extent of adoption and usage of TM.

In the following the research will introduce the theoretical framework followed by the research methodology. This is followed by a description of the cases and the adopted TM technologies. The next section will show analysis across the different cases followed by a discussion and a conclusion.

2 THEORETICAL FRAMEWORK

In search for a guiding theoretical framework that could assist this research in explaining factors influencing TM success, the classical innovation diffusion theory (Rogers (1983; 1995) model) appeared to be the most widely accepted framework by researchers in identifying critical characteristics for technological innovations (Moore & Benbasat, 1996; Premkumar & Roberts, 1999; Thong, 1999). Rogers' (1995) framework comprised the following factors: relative advantage, complexity, compatibility, observability, and trialability. Relative advantage is the degree to which using technology is perceived as being better than using its precursor of practices. Complexity is the degree to which technology is perceived as being easy to use. Compatibility is the degree to which using technology is perceived as being consistent with the existing values, and past experiences of the potential adopter. Trialability is the degree to which technology may be experimented with on a limited basis before adoption. Observability is the degree to which the results of using technology are observable to others. Rogers' (1995) compatibility characteristic is highly envisaged here as past studies (Austin, 1992; Austin, Trimm, & Sobczak, 1995) have considered the problem relating to physicians accepting information technology (IT) for clinical purposes. Cost was outlined as an important factor by other researchers (Bacon, 1992; Elliot, 1996; Tornatzky & Klein, 1982). Cost means the degree to which technology is perceived as cost effective. The image factor was found important to the adoption of technologies in the health literature (Little & Carland, 1991). Image means enhancing one's image or status in one's social system. Even-though Rogers (1995) highlighted the importance of the image factor on IT adoption he suggested that it could be studied from within the relative advantage characteristic. However, Moore and Benbasat (1996) stressed the image factor as an independent factor on its own. As TM projects involve considerable investments, top management support is viewed as important to the adoption decision (Kwon & Zmud, 1987).

2.1 Determinants of TM Adoption

In review of more recent literature it was observed that despite the rapid growth and high visibility of TM projects in health care (Grigsby & Allen, 1997), few patients were actually being seen through the TM for medical purposes. In almost every TM project, tele-consultation accounts for less than 25% of the use of the system (Perednia & Allen, 1995). Other research reported mid-level success for telemedicine projects (Guedemann, 2003). In a large study in the US, Edwards and Patel (2003) found that the clinical uses of the telemedicine network did not exceed 30%. The majority of the online time was used for medical education and administration (Edwards & Patel, 2003; Wayman, 1994; Perednia & Allen, 1995; Hassol, 1996). Earlier success stories of telemedicine in countries such as the US demonstrated that telemedicine was feasible while maintaining diagnostic accuracy, which challenged the widely held belief that a patient and a provider must be in close proximity for healthcare to take place.

The important unresolved issues revolve around how successful TM can be in providing quality healthcare at an affordable cost and whether it is possible to develop sustainable business model that would maintain profitability over time. This depends on (Perednia & Allen, 1995): (1) clinical

expectations, (2) matching technology to medical needs, (3) economic factors like reimbursement, (4) legal (e.g., restrictions of medical practices across state lines (licensure) and issues of liabilities), and social (e.g., changing physician behaviors and traditional practices and workflow) issues (Anderson, 1997), and (5) organizational factors. Edwards and Patel (2003) attributed the success of TM projects to defined clinical needs, organizational support, physicians' and patients' acceptance, exhibiting measurable cost and clinical benefits, and moving toward sustainable operations. Interestingly, Whitten et al. (2002) in a comprehensive study concluded that there is no evidence that TM is a cost effective mean of delivering healthcare.

In their review of the literature, Finch et al. (2003) supported the above factors and found the following hurdles which could increase the resistance to telehealthcare in practice:

i. telehealthcare is somewhat unstable.
ii. there are some concerns relating to the doctor-patient interaction.
iii. concerns about clinical risk and potential litigation
iv. at an international level, some difficulties relating to licensure and reimbursement were reported.
v. the production of evidence about the safety and effectiveness of telehealthcare
vi. despite the numerous trials of telehealthcare in Britain and elsewhere, such services typically fail to become part of routine healthcare delivery.

3 METHODOLOGY

This research is exploratory in nature in the sense that there is no prior research in UAE to guide this research in achieving the above objectives. Case studies are appropriate for the exploratory phase of an investigation (Yin, 1994). Therefore, this research will follow the qualitative paradigm by adopting Yin's (1994) hard case-study methodology.

Yin's (1994) positivist approach is acceptable by the interpretivist school as well. For example, Walsham (1995) indicated that although Yin (1994) adopted an implicit positivist stance in describing case study research, his view that case studies are the preferred research strategy to answer the above type of questions would also be acceptable by the interpretive school. Details of the different cases are provided in the following section.

Interviews were sought from many experts involved in telemedicine projects in the UAE. Those experts were: educational, specialists/surgeons, IT and administrators/managers (Table 1). Those experts were requested (after explaining the research objectives and content) to complete a qualitative survey questionnaire. Site visits were implemented to FHMS and Tawam to see TM installations and meet respondents.

Table 1: Respondents' distribution across the different cases.

Case	Number of respondents
UAE University	3
Tawam Hospital	4
Mafraq Hospital	1

4 THE CASES

4.1 FMHS

FMHS in UAEU uses the video conferencing technology to deliver classes to male and female students separately as classes are unisex and mixed classes are not allowed within UAEU. Faculty member alternate between female and male classes, usually synchronized to take place at the same time. For example, if a faculty member existed in the male class; female students attend the same session in an adjacent classroom through the video conferencing link across the two classes.

4.2 Tawam Hospital

Tawam Hospital2 TM project represents a partnership between UAE Ministry of Health and Mayo Clinic (Rochester, Minnesota, USA). Implementation started in September 2000 and first case was sent in February 2001. The developers are Mayo Clinics IT and Mayo Office of Middle East Healthcare and Mayo subcontractor – Wellogic, Boston, USA. Tawam TM technologies include: 512 Internet leased line; direct text captures entry; digitized transparent images i.e X-rays, CT, MRI, nuclear med, ultrasound, clear prints; digitized reflective images, i.e. any paper print, document, item needing scanning; CD drive to attach directly still and motion films in DICOM format; video/Audio conferencing; and fax.

The TM system is designed to handle complicated patient consultations with the ability to

transmit multimedia clinical information. Item that can be transmitted include: Scanned paper medical records; scanned X-ray films; digitized echocardiography video; digitized cine-angiography; and live videoconferencing.

There are four user groups that work closely together to accomplish a TM consultation. These groups include: UAE site requesting, UAE telemedicine office coordinator; Mayo clinic telemedicine office coordinator; Mayo clinic consulting physician. Tawam adopted a standard with Mayo clinic concerning reporting and receiving patient consultations. Tawam reported that on average, 4 cases were reviewed each month with Mayo clinic.

Recently, Tawam established a large scale video conferencing centre with the capability to have simultaneous video sessions with several online locations for meeting and educational purposes. The centre will serve many clinical and administrative staff as Tawam has signed with several international medical centers and institutions to provide training courses.

4.3 Al Mafraq Hospital

Similar to Tawam's TM system where on November 1996, The Ministry of Health signed an agreement with Mayo Clinic Foundation, Rochester, Minnesota, USA to receive technical advice and support in the design and construction of a TM system to link three referral hospitals in Abu Dhabi, Al Mafraq and Al Ain with Mayo Clinic for medical e-consultation. As commented by one of the respondents, "the TM system will be suitable for store and forward as well as "real time" communication link" and will be based on Mayo's experience of maintaining the integrity of patient data, static images and full motion studies during the process of digital acquisition, processing, transmission and reconstruction. However, Mafraq Hospital favored the "store and forward" option more than the videoconferencing one as it does not require that partners be present at the same time. This is important specially if there is a time difference between the two remote sites. Mafraq implemented the solution using 512k internet link through its Wide Area Network.

5 CROSS CASE ANALYSIS

Tawam and Mafraq adopted the same TM system from Mayo clinic and hence, similar views were unified into one depiction in this research in order not to repeat reporting the same findings twice. However, Tawam has adopted another large video conferencing centre for education and meeting purposes which could differentiate their responses from Mafraq hospital. Table 2 summarizes the research findings and analysis across the different cases.

Table 2: Research findings and analysis across the different cases.

Issue	UAEU	Tawam	Mafraq
Advantages	Education	Consultations with Mayo clinic Education	Consultations with Mayo clinic
Complexity	Not complex Training and onsite support should remove any complexities	Not complex	Not complex
Compatibility	Compatible	Compatible	Compatible
Observability	Important	Important	Important
Trialability	Important but difficult to implement	Important	Important
Cost	Not important An issue if going to bigger TM projects	Not important	Not important
Image	Moderate effect	Important	Important
Top Management Support	Important Simple decision process and structure	Important	-
role of the Government	Important UAEU leading role to encourage others to adopt TM	-	-

Most notably, the relative advantages and the compatibility factors attracted most of the discussions amongst the different cases. Those are explained next.

5.1 The Relative Advantages

All cases retained positive view about the potential and the applications of TM in different departments in their hospitals. The main issue raised by Tawam is that some hospitals may not have the capabilities and the needed resources to diagnose for specific illnesses where TM could play a vital role here – where they highlighted the following advantages:

i. Expanding the reach of the medical services you can provide
ii. Reducing the costs associated with unproductive travel
iii. Saving time away from clinical or educational practice
iv. Sharing medical knowledge throughout dispersed groups
v. Maintaining professional certifications without going off-site
vi. Increasing team interaction, and improving work flow and quality
vii. Sharing images easily for quick consultations – across desktops

However, due to the educational role of FMHS, they envisioned using the TM system for educational purposes only, commenting "thus, the main focus of telemedicine in FMHS is centred more on educating future physicians than on providing immediate medical service to patients outside the teaching hospitals". The same respondent commented that "we have the specialists and the technology; we just don't have the mandate. We can, however, provide specialty education in the way of CME to physicians at a distance. The other specialty service that we could provide to the Health Authority (and physicians at a distance) is assessment of basic competency skills through online exams (similar to the Canadian Medical Council exam and the US Medical Licensing Exam)." In addition, another respondent from FMHS indicated that TM could be used to supervise junior doctors or nurses in a remote place, virtual attendance at overseas conferences, importing/inviting conferences from overseas, employment interviews and examining research theses. This respondent confirmed that these practices using have been implemented since 1994.

By adopting TM the hospitals (cases) could provide health consultations to areas that these services are not available. Mafraq hospital indicated that the TM technology enables an electronic patient visit virtually to Mayo Clinic without the inconvenience and cost of traveling overseas. TM delivers telehealth care services to hospitals like Mafraq and Tawam Hospitals in the UAE for medical consultation, referral, and second opinion. It captures medical information electronically, compress and transmit high-end resolution images, digital full motion videos like angioplasty procedures, colonoscopy, electronic EEG, MRI, CT Scan, X-ray films, laboratory reports, and Digital Clinical Still and Video Images.

Another respondent from Tawam confirmed that TM could make specialty care more accessible to underserved rural and urban populations in the UAE. Video consultations from a rural clinic to a specialist can alleviate prohibitive travel and associated costs for patients. Videoconferencing also opens up new possibilities for continuing education or training for isolated or rural health practitioners, who may not be able to leave a rural practice to take part in professional meetings or educational opportunities. Mafraq supported the same and raised other advantages as well:

i. Provide more access to patients and families by reducing the need for travel during severe weather conditions.
ii. Reduce expense to patients and their families as well as the UAE government at the hospital level:
    a. reduce travel distance & time away from work/home for patients/families
    b. provide a more efficient use of hospital staff.

The other cases emphasized that they could utilize TM in consultations, diagnostics, therapeutic, in-surgery, transfer of patient related records, case management, training & meetings (clinical/admin.). One respondent from Tawam hospital envisioned TM to be used in all clinics. Another respondent from Tawam specified that TM could be used in neurology, dermatology, gen/surgery, gastrology, haematology, special Service, internal medicine, ophthalmology, orthopaedic, urology, pediatrics and gyn.

5.2 Compatibility

As for the compatibility aspect of the TM technology, the cases did not view TM as incompatible with them as such. For example, the case of FMHS did report some issues concerning old staff accepting the TM technology and

administrative staffs were more comfortable using the TM technology than doctors. However, such incompatibilities could be reduced by providing minimal training in order to build up experience professional responsibility amongst faculty members. With time, all clinical and administrative staff would be encouraged to use TM.

The case of FMHS further commented that change as a result of introducing new technology is always difficult for some people. This is particularly important in the case of people who feel they are already stretched out with duties and tasks (like most doctors). The case pointed that change could be accelerated if there is clear and significant advantage of using TM to doctors commenting, "they will be motivated to change." For example, medical faculty staff had to learn how to lecture in simultaneous video classrooms and had no trouble in dealing with the TM technology. The majority of those faculty members were quite proficient at using the technology and adapting their teaching style to the new environment – although the case of FMHS admitted that faculty members had no choice but to use the TM technology in running the simulcast video classrooms commenting, "so that made the need for adoption strongly convincing!." FMHS noted that more recent graduates were quite comfortable with technology commenting "I believe they will be the models for the use of technology in medicine."

Tawam strongly believed that by giving the TM technology the chance to operate inside the hospital, the staff will get used to it. Although Tawam admitted that TM should be used more frequently by doctors and administrators. The same respondent indicated that TM could fit in easily amongst the different technologies inside the hospital, i.e., integrate with Hospital Information System (HIS). Other specific incompatibilities were reported as well. From example, Tawam indicated that the still video conferencing feature was not active due to time difference between UAE and the US. Tawam hospital reported that it was looking into signing agreements with other known medical centers that do not have significant time differences with them. Also, they raised security concerns in sending patient information over non-secure channels as one of the impediments.

As for the compatibility of the TM with patients, the cases pointed that this issue could be one of the most difficult hurdles to overcome with respect to the accuracy of diagnosis commenting "when 70% of diagnoses are made from the patient interview, it seems critical to be able to elicit this same amount of information from patients using the TM technology." The case perceived that such expected incompatibility could be reduced if there is a support person in the room with the patient, such as a nurse, this might help the patient to become more comfortable. Tawam confirmed the same by commenting "if it was necessary to have TM in the remote location then yes."

Another interesting issue reported here is that patients favored traveling overseas over using the Mayo clinic remote consultation service.

6 DISCUSSION

6.1 The Significance of the Research Model

It was clear that the decision to adopt TM was motivated by the relative advantage specifically, its compatibility, lack of complexity, observability, trialability, image enhancement to the cases, top management support and the role of the government in playing a leading role in the country for other hospitals to follow. The cases have reported many advantages as a result of adopting the TM technology as detailed above. Although cost was viewed as unimportant to the adoption decision of a medical tool but it would play a role if the cases opted to expand their TM initiatives beyond the current simple TM technology in collaboration/cooperation with Mayo clinic in the US.

The different factors in the research model have helped is shedding interesting light on the adoption and usage of TM in the different cases. Most of the factors appeared as positively motivating the adoption decision of TM (Table 2). The implications arising from this positivism are twofold. Initially, it could be argued here that such positive views represent a good foundation for the large scale adoption of TM in the UAE and indeed, such simple and imported "know-how" and successful initiatives could facilitate the adoption of more complex TM initiatives at the national level in the UAE. However, this could only be judged upon initiating such projects within the UAE first. Secondly, such positivism was expected given the limited scope of the adopted TM technology in the hospital-cases. The lack of more comprehensive and interactive TM initiatives in the UAE (networks of TM projects, involved specialist in TM consultations in rural settings, collaborative/cooperative TM initiatives

across hospitals and universities, etc.) could have contributed to such response by the case. This conjuncture could be supported or refuted upon implementing such advanced TM initiatives in the UAE. This is yet to be seen.

However, such finding does not undermine the importance of the depicted framework as it helped in gauging the respondents concerning different important issues surrounding the adoption and diffusion of the TM technology in their organizations. Thus, it is important to keep monitoring the progress of TM in the UAE alongside the research factors and whether any serious national initiative is being activated in response to the above suggestions. This raises the importance of conducting longitudinal research in order to monitor and report such progress.

6.2 The Compatibility of TM

The compatibility factor attracted a lot of the discussion in this research and indeed, policymakers need to introduce training programs to address the emergence of such possible incompatibilities between people working in the health sector and technologies in general and TM technologies more specifically. Part of the compatibility factor, security was raised as one of the impediments to the adoption decision of TM and hence, introducing more secure measures to protect data and people across the video link could warrant against any breaches or hacking activities.

Given the time difference between the UAE and the US, the Mafraq and Tawam hospitals favored the "store and forward" option more than the videoconferencing one. Also it was convenient to both hospitals as this solution does not require that partners be present at the same time. However, this limiting aspect needs to be resolved in order to maximize the utilization of the TM technology to the benefit of the hospitals in the UAE. The cases suggested some solutions where for example, Tawam hospital reported that it was looking into signing agreements with other known medical centers that do not have such significant time differences with them. However, the suggested national initiative could address such perspective more effectively.

6.3 Research Implications and Suggestions

The research findings lead to a conclusion that TM, as a medical tool, is being adopted minimally in the UAE context. Its use for educational and administrative purposes is well noted across the different cases. Indeed, this is one of the important tools of TM but due to its strategic importance in the healthcare area and to the fact that the UAE have several rural areas and communities, it was expected that the potential use of TM in serving these communities was more extensive.

Accordingly, the implications here are twofold. Initially, the use of this TM system seemed ideal in this context (consultation and providing second opinion). On the other hand, the second implication points to the importance of exploring the effective use of the TM in different areas – more specifically:

i. In an internal and rural settings. Healthcare providers in the UAE need to consider establishing TM initiatives that could capitalize on existing medical specialties and services within the country and devise ways to integrate TM into these services. This tight coupling between the TM technology and medical practices is the only way for TM to succeed in the UAE. Providing TM services at the outset or in parallel to existing medical services will waive its importance as an efficient technique or as a replacement to existing inefficient/old medical practices or services.
ii. In a regional setting. The potential advantages of such effective medical and social TM networks could have a profound impact on the health and the wellbeing of people within the UAE. This is of great importance to the UAE's context given the extant geographical dispersion of the different Emirates in the Federation, cities and rural areas/towns.

TM could play a vital role in bridging many gaps:

i. Shortage in specialty staff in rural areas.
ii. Shortage in specialty staff in main centers (where Mayo clinic link is well justified here).
iii. Moving patient from rural areas to specialists in main hospitals.
iv. Commuting specialist to rural health centers.

Encouraging linkages (collaboration/cooperation) with other health centers within the UAE to share resources, expertise and knowledge. This could lead to the establishment of specialty centers in certain health fields.

Running such TM networks could yield monumental economies of scope/scale in the medium to long term projections and could prove to

be an efficient and an effective medical tool in the UAE. The current TM systems in the UAE represents an initial and a vital resource for such networks as the quality of consultations provided by such specialty centers like Mayo clinic represent a climax in the area of healthcare in the world. At the regional level, such TM networks could establish the UAE as a leading healthcare destination. The UAE is well qualified to occupy this position given the witnessed economical, technological and educational growth and the stable political and legal environment. The culture and the social environment in the UAE is characterized of being as open to other cultures. However, learning from the experience of other medical destinations in the region (i.e., Jordan, Kuwait) is very important. Hurdles concerning the TM technology such as obtaining approvals and certifications of the TM equipment (i.e., from the FDA), reimbursement, litigations, and licensure are big concerns in the US but not to the UAE context. These issues provide further drive to the adoption of TM in the UAE.

The amount of resources provided by the government to the adoption of latest techniques and tools in healthcare are tremendous and indeed, TM could be considered as one of these strategic projects. Indeed, this alone could remove many of the hurdles surrounding justifying the financial efficacy of the TM in healthcare in the UAE. Such hurdles at the beginning of any TM projects could kill the project at its infancy.

What is yet to be seen is to push the current TM initiatives into the more interactive ones (TM networks). Of course, providing a strategy for the effective use of such networks is very important as well. Looking for leaders and product champions in each hospital is very important. This fact was also supported in this research. Given the technical and social complexity of the TM technology, leaders and product champions could play a vital role in empowering and facilitating the adoption and the usage of TM in their organizations in the UAE.

It could be argued/agreed here that the UAE government is engaged in executing more urgent projects (infrastructural) but that should not undermine the fact that TM could be considered as one of such priority/strategic tools. This is yet to be seen as well.

7 CONCLUSION

This research has addressed many of the issues surrounding the adoption and usage of TM in the UAE from a theoretical and a professional stance and pointed to several implications and suggestions. Such findings are of great importance to professional, policymakers and researchers interested in the research findings in general or in the UAE context more specifically. The research calls upon such stakeholders to initiate more comprehensive and interactive TM projects in the UAE and to consider the TM technology as one of the strategic building blocks of the national health strategy in the UAE. Thus, elevating beyond the current simple use of the TM technology and hence, emancipating into more daring TM initiatives could benefit the health sector in the UAE. This may not necessary take the form of “big-bang” project and indeed, such national initiative could be achieved in phases. The research findings set broad guidelines and suggestions for such stakeholders and indeed more consequent research studies could monitor the progress and the development of the TM technology and the research model in the UAE.

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