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Research Article

ICT Adoption and Value Creation: A Telecentre Ecosystem Approach

Zulkhairi Md. Dahalin, Huda Hj Ibrahim and Nor Iadah Yusop

Universiti Utara Malaysia, 06010 Sintok, Malaysia

Correspondence should be addressed to: Prof. Zulkhairi Md. Dahalin; zul@uum.edu.my

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Abstract

This paper proposes a telecenter ecosystem that could transform the current state of ICT adoption in rural areas into a situation where the community can reap the benefit of access to ICT. Although many initiatives have been implemented to bring access to ICT and the Internet to rural communities, there appears to be a lack of value added benefit that a community can gain from the adoption of ICT. This paper therefore aims to present a telecenter ecosystem that can transform rural areas into a community that is capable of adding value as a result of ICT. Based on a case study of a telecenter involving respondents from twelve neighboring villages in the northern region of Malaysia, the information needs of the local community were identified and prioritized. A telecenter ecosystem was proposed based on information priorities that can optimize the roles of the various stakeholders within the ecosystem.

Keywords: Bridging the Digital Divide, ICT Adoption, Value Creation, ICT for rural development

Introduction

As Malaysia aspires to become a fully-developed country by 2020, efforts are currently underway to transform the nation into a knowledge-based society. This is one marked by ICT literacy with a diffusion of ICT infrastructure, even in remote areas and villages, and communities that embrace ICT in their everyday life. In preparation for this journey, the Malaysian government formulated a national framework to ensure equitable access and opportunity for ICT adoption across the country. The National Strategic Framework for Bridging the Digital Divide (NSF-BDD) forms part of the government transformation program to provide access to ICT in underserved communities to enable ICT adoption, which eventually will evolve into activities that can add socio-economic value to the community. The framework is a government policy that describes a nationwide strategy to address the inequality of universal access to ICT, with the aim to narrow the digital gap that exists between these communities. This framework identifies nine underserved groups that have been "digitally" marginalized. These are: youth, disabled, rural, poor, indigenous peoples, small and medium manufacturing enterprises (SMME), elderly, women and children (Yogeesvaran, 2007).

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This paper focuses on the rural community, though the other underserved groups are also related. The objectives of this paper are to identify categories of information most needed by those living in a rural community and to transform these categories of information into a telecenter ecosystem that has the potential to create socio-economic value in line with the NSF-BDD. This paper therefore attempts to contribute to three of the five main thrusts of NSF-BDD which are: (i) increase access and adoption of ICT, (ii) create value that benefits the underserved population, and (iii) cultivate multi-stakeholder collaboration and coordination. The other remaining thrusts, (iv) develop local content, and (v) institutionalize evidence-informed policy and practice, are subjects for future research. BDD is defined by the Economics Planning Unit, Office of the Prime Minister based on three generations of community development.

The first-generation definition is diffusion of ICT, which is implementation of the various ICT initiatives such as telecenters, telecommunication towers, wireless connectivity, broadband and Internet facilities, etc. that focus on the access to information and communication technologies (ICT). In the context of the telecenter ecosystem, the diffusion stage can be characterized by external interaction and dependency of the telecenter on its stakeholders. The government-funded telecenter implementation is an example of an external interaction involving government agencies and telecommunication companies (telcos) which the community is totally dependent upon for its successful implementation and sustainability.

The second-generation definition is access and adoption of ICT emphasizing the community embrace of ICT. This stage is characterized by the "technology pull" (demand) factor once the "technology push" (diffusion) has taken place. In the context of a telecenter ecosystem, the adoption stage can be characterized to a large extent by internal interaction (to create the pull factor) more than the interdependent relationship among the stakeholders. Put differently, intra-community support and collaboration are needed to ensure active participation and self-sustainability of the telecenter and usage of its ICT facilities. The diffusion that creates demand for ICT facilities would require corresponding support from internal stakeholders such as the roles of telecenter managers and operators, encouragement by village management committees, and participation from locals, working together to ensure that the adoption takes place.

The third-generation definition focuses on the value of the development benefits that ICTs make possible, referred to as value creation. This is the ultimate goal of BDD; to maximize the socio-economic value that ICT can bring to the community. This stage no longer depends on diffusion, but there exists a continuous demand for ICT facilities in a spiral manner to the effect that the community themselves will acquire ICT facilities and create more demand expanding the ecosystem in the process and increasing the socio-economic value of ICT. In the context of the telecenter ecosystem, value creation can be characterized by both internal and external interacting and interdependent relationships among the telecenter stakeholders together and synergistically create value that can increase the socio-economic status of the community.

Telecenter Ecosystem

The term telecenter ecosystem as defined by Shadrach and Sharma (2011) is a community of stakeholders collaborating with one another in a symbiotic manner with the aim of sustaining the long-term operation of the telecenter. Stakeholders are individuals, groups and organizations that have interests for the development of the community in which the telecenter is located. These can include: telecenter managers and operators, service providers and content developers, IT companies, donors, civil society organizations, policy makers and government, and the community itself. According to the authors, lack of interaction

and breaks in the interdependent relationships in the ecosystem will adversely affect the long-term sustainability of telecenters. Hedberg (2010), in addition, observes the important roles of the stakeholders working together in support of the telecenter development. The author found a lack of common understanding on telecenter objectives among stakeholders can affect the operation of the telecenter and limit its potential. The importance of stakeholders in the telecenter ecosystem is reiterated in a study (Ballur, 2006) that applies the stakeholder theory to identify the best practices in implementing telecenter projects.

The telecenter ecosystem in Malaysia appears to be over-dependent on a few stakeholders, mainly government agencies, telcos and local village management. Whilst acknowledging the enormous contribution by the government through various initiatives to bridge the digital divide, other players in the telecenter ecosystem appear to be lagging far behind. Even those telcos and the Internet service providers (ISPs) who have made significant progress in the ecosystem are doing so due to their commitment to the Universal Service Provision Fund (USPF) under the Communication and Multimedia Act (CMA 1998). The act has made it mandatory for telcos to contribute six percent of their gross revenue on Internet-related subscription services to the USPF. In return, these telcos can utilize the funds to rollout ICT-related projects in designated underserved areas throughout the country. These projects, also known as initiatives to bridge the digital divide, are mainly implemented to address the access gap through the building of telecenters as a form of ICT diffusion, and erecting telecommunication towers to expand cellular coverage throughout the country.

Initiatives to BDD

Numerous initiatives have been undertaken by the Malaysian government to bridge the digital divide. A major initiative is the implementation of the telecenters first started in 1998. Today, there are more than 2500 telecenters located mainly in rural and sub-urban areas throughout the country. The latest such initiative is the implementation of One Malaysia Internet Centre as part of the government's rural transformation program started in 2012. In 2010, the Prime Minister launched the National Broadband Initiative (NBI) with the aim to drastically increase the household broadband penetration rate to 50% by the end of 2010 and 75% by 2015 (SKMM, 2010a). The *Kampung Wifi* (literally wireless village) was launched in collaboration with the telcos to boost Internet penetration throughout the country. As a result, by January 2012 the broadband household penetration rate stood at 62.3% (StarOnline, 2012) with more than 1400 villages connected with wireless. By the first quarter of 2015, there were 5737 wireless villages throughout the country with the latest statistics on broadband penetration standing at 70.4% (MCMC, 2015).

Earlier initiatives include the rural Internet centers started in March 2000, and the universal service provision (USP) centers started in 2002 (KPKK, 2012). The rural information kiosks or *Medan InfoDesa* (MID) is another initiative by the Ministry of Rural and Regional Development (MRRD), which transformed into the Rural Transformation Centre (RTC). The same ministry also implemented a scaled down version of the MID called *titian digital* (literally digital bridge). *Titian* digital is a portal that allows community users and other stakeholders to connect with each other (KKLW, 2012). The Community Broadband Centre (CBC) and Community Broadband Libraries (CBL) are initiatives under the USPF regulated by the Malaysian Communications and Multimedia Commission (MCMC), which manages the funds according to the Communication and Multimedia Act (MCMC, 2012)

Issues of the Digital Divide in Malaysia

The growth rate of broadband penetration in the country has been phenomenal in just over the last two years. Statistics show the penetration rate more than doubled from 24.8% in 2009 (SKMM, 2009) to more than 60% in 2012. Despite efforts made to increase the number of e-Government applications and services as well as the development of more local content, community buy-ins and success stories are quite rare, except for those few advertisements in the mass media and television broadcasting. One must be aware that for every underserved member of the community's attempt to adopt the digital technology, there will also be corresponding urban counterparts adopting the same technology. Therefore, the rate of adoption among the underserved community must be higher than the urban community in order to bridge the digital gap. Contrary to this, the implementation of high speed broadband (HSBB) in major towns and urban areas as opposed to broadband for the general population (BGPP) for rural and sub-urban areas as spelt out in the NBI may contribute to the faster response of the Internet take-up by the urban community, thereby increasing the digital gap even further. This is the concern expressed by a World Bank study that predicts the rate of digital divide growing at an exponential rate (Avgeron & Madon, 2005). This is alarming as it can be a major hindrance to national development.

The phenomenal increase of the broadband penetration rate in a short period of just over two years may not reflect the true nature of the increased adoption of ICT by the average Malaysian population. Today, broadband is used by mobile phone subscribers as a means of communication and Internet connectivity. More than 30 million mobile subscribers registered in 2010, which makes up a 107% penetration rate (MCMC, 2010) and means Malaysia is the 34th highest ranked country in the world in terms of the proportion of mobile usage to the population (Wikipedia, 2012). The latest figures show a cellular penetration rate of 146.2% (MCMC, 2015). The statistics on mobile phone subscription clearly explains the corresponding increase in the broadband penetration within a short period of time. Whilst the statistics may give a fairly accurate indication of the diffusion of ICT infrastructure in the Malaysian population by means of the Internet broadband buy-in, the 55.6% broadband penetration in 2011 (EPU, 2011) up to 62.3% in 2012 (StarOnline, 2012) may not give a true picture of computer ownership or ICT adoption in order to gauge the digital divide phenomenon. A study by Zulkhairi et al. (2008) showed a wide digital gap existed among rural communities with less than 1% broadband penetration and less than 20% PC ownership. The average nationwide PC/laptop ownership currently stands at 49% (MCMC, 2015). This clearly indicates the ever-widening gap in the digital divide. More efforts are needed to address the challenges in rural ICT development in Malaysia.

Most ICT for rural development rollouts are initiated by the government, utilizing the universal service provision funds contributed by telecommunication companies (telcos). In return, these telcos will be invited to implement these projects by developing the infrastructure and supplying the ICT facilities, and at times providing technical support and user training. However, due to the limited funding available and the expansion of the universal service projects to cover other underserved communities and rural areas, funding and support would normally stop after a stipulated time period, usually 5 to 10 years. The challenge is survival of the projects beyond the funding and support period. Whilst transformation plans are currently underway towards self-sustenance, the government must ensure that the projects meet the objectives of universal service, particularly in providing equal opportunities for its citizens to access digital content and applications.

Government agencies and ministries that implement ICT initiatives in the rural areas should work together to share resources as it

is expensive to set up more than one facility in a rural or remote village. Through the K-Economy section of the Economics Planning Unit, the Prime Minister Department has been the central coordinating body helping direct the various agencies. Public services from various government departments utilizing a common ICT implementation initiative are still non-existent. Telecenters established by the different agencies are still not talking to each other, though they are located within the same area. As a result, overlapping functions and services are being offered that contributes to under-utilization of services and promotes unhealthy competition among the telecenters. Services of these centers tend to be limited to ICT services and training, whereas other public services involving many other government departments and agencies can extend their services to the telecenter. For this to happen, there is a need to strengthen the overall structure of the rural ICT development initiatives, including the telecenter ecosystem beyond coordination at the highest level. The cascading effect should be felt at the lowest implementation level in order to realize the benefits of true value creation towards the social and economic development of the community. To do this, the information needs of local communities need to be identified to enable local content development, attracting the interest of the community to the telecenter, and making adoption of ICT possible.

Research Methods

Survey

In order to identify the appropriate telecenter ecosystem that can attract the community and other stakeholders' interest towards the telecenter, the information needs of a community were identified. A privately-owned rural community telecenter was chosen as opposed to a public-funded telecenter, as this can potentially represent the majority of ICT for development initiatives given that public funding is limited and government support for existing telecenters is unsustainable. The other reason for the selection is the invigorating ecosystem that can potentially be created as a result of pulling together the interests of communities from several neighboring villages to form a cluster of telecenter ecosystems. This was done through the selection of a telecenter located in a compound of a mosque, specifically in *Kampung Oran* in the State of Perlis, which is situated in the northern region of peninsular Malaysia.

The survey comprised of a set of questionnaires that sought information on profiles of respondents, access to ICT facilities, usage of electronic applications, and information needs. The research instrument adopted was based on instruments used in past studies with slight modification. The questionnaire was used to gather simple nominal and categorical data. The questionnaire was divided into two sections, demographic profile of the community and ICT facilities and applications used in the community. The first section captured the basic demography of the respondents such as age, gender, race, marital status, home location, education level, occupation, household income, daily expenses, and number of dependents. In the second section, computer ownership and the respondent's experience in using a computer were captured. In addition, Internet access facilities, respondent's Internet application usage pattern and experience were also captured. On the last part of this section, the information and ICT related training required by the community were gathered to see the potential applications or programs to be shared with the community.

Data Collection

To capture the information needs of the local community, data collection was conducted based on a convenience sampling. This was carried out in April 2011. Data collection took the form of community gathering at the launching of the telecenter. Members of the community were invited to a social event organized by the mosque's management

committee (*khariah* committee) in which the mosque's telecenter was officially launched. According to the mosque's official records, there are approximately 400 families living within the *khariah* with an average of 50 families per village. Hence the total community population is estimated at 20,000. Observations made at the launch estimated turnout to be 250 based on the total number of questionnaires distributed. This accounts for 1.25% of the population. Questionnaires were distributed to all present by a group of 25 undergraduate students acting as enumerators who also helped respondents if they faced any difficulty in answering the questions. In total, it took two hours to complete the whole data collection exercise, after which the respondents and the study team were treated to light refreshments by the mosque's management committee.

Out of the 250 questionnaires distributed, 203 responded to the survey, representing approximately 1.0% of the population and an 81.2% response rate. All 203 returns were deemed usable for further data analysis. This high return was attributed to the way the questionnaires were administered by hand and respondents attended to in person.

Data Analysis

The data gathered were analyzed to determine the extent access to ICT is made available. Descriptive statistics were used in the form of frequency counts and percentages, as well as cross-tabulation to relate the demographic information with ICT knowledge, as well as the information requirements of the community. Based on the application usage, a mapping was made to determine the potential socio-economic value that can be achieved by the community using the NSF-BDD framework. Categories of information required by the respondents were prioritized to determine the most needed information. Based on these categories, a telecenter ecosystem was formulated and suggestions made to transform the telecenter into reaching the value creation stage.

Findings

Table 1 depicts the profile and ICT access of the respondents participating in the survey. Almost all the respondents are Muslims based on the race indicator, where Malays are equated as embracing the Islamic religion within the context of Malaysia. Hence, the location of the telecenter within the compound of the mosque was considered appropriate and met the condition set in this study. Apart from religion, respondents were generally young, single, and either attended school or were self-employed with little education.

Table 1: Respondents' Profile and Access to ICT Facilities (N=203)

		Frequency	Percentage
Gender	Male	100	49.3
	Female	103	50.7
Race	Malay	202	99.5
	*missing value	1	
Age	Less than or equal to 20	117	57.6
	21 – 30	16	7.9
	31 – 40	10	4.9
	41 – 50	16	7.9
	51 – 60	14	6.9
	More than or equal to 61	28	13.8
	*missing value	2	

Marital Status	Single/Bachelor	117	57.6
	Married	73	36.0
	Single parents	6	3.0
	Widower	2	1.0
	*missing value	5	
Academic Qualification	Primary school	92	45.3
	SRP/PMR	34	16.7
	SPM	39	19.2
	Diploma/STPM/Matriculation	17	8.4
	Degree	9	4.4
	Others	11	5.4
	*missing value	1	
Employment	Government Officer	12	5.9
	Private Agencies	13	6.4
	Pensioner	17	8.4
	Unemployed	1	.5
	Student	107	52.7
	Self-employed	46	22.7
	*missing value	7	
ICT Facilities	Internet Access	102	50.2
	Computer Ownership	137	67.5

In terms of access to ICT facilities, half of the respondents have Internet access, whilst two-thirds of the sample owned a computer. This is interesting as the findings show the majority of the youths in these villages are IT literate. This indicates that ICT adoption may have taken place at least among the youth, which according to the NSF-BDD, is one of the nine underserved groups. However, the comparatively low Internet access may indicate ICT diffusion has not reached its optimal level in these rural areas with limited Internet connectivity coupled with unaffordable broadband subscription rates. This is understandable as the rural community is characterized by poverty where ICT facilities, particularly PCs, are still considered a luxury. The high percentage of computer ownership found in this study is due to yet another initiative by the government, known as the "1 Malaysia Netbook" which is part of the National Broadband Initiative (NBI). Under this initiative, launched by the Prime Minister in 2010, the government gave away one million netbooks to school-going children and university students, especially in the rural and remote areas of the country (SKMM, 2010b). These facts indicate that ICT diffusion is still predominant in rural areas. The telecenter ecosystem is prominently initiated and led by the government with the private sector with telcos trailing as the technology and telecommunication service provider.

Table 2 presents the range of applications used by the respondents when accessing ICT. Not surprisingly, top of the list is computer games due to the young age group that comprised the majority of the respondents. Social networking is also dominant with Internet chatting and email being the applications used. Overall, since the application usage is small and forms a minority of the sample respondents, it can be deduced that the community has not reached the ICT adoption stage. In addition, the small percentage of respondents using applications that can add value to their social and economic wellbeing is proof that adoption has not taken place. Adoption of applications such as Internet banking, office automation, online education, online tutor, Agribazar etc. has the potential to create social and economic values if a large majority from the community is able to use them.

Table 2: Application Usage (N=203)

Applications	Usage (Percentage)
Computer games	42.3
Internet chatting	28.6
Email	21.2
Internet Banking	9.4
Webcam	9.1
Office automation	8.9
Online University application	8.4
Online education (E-Bestari)	7.4
Online income tax	6.4
Check or Pay summon online	6.4
Online University Loan	5.9
Online tutor	5.9
Online examination	5.6
Agribazar	3.5
Others	1

Table 3 presents the type of information needed by the respondents sorted in descending order of priority. Top of the list is information on education and acquisition of new skills with 68% of respondents indicating that they need this information. This is consistent with the profile of the respondents where the majority is made up of youths and school children. Hence, education appears to be the most needed category of information found in this study. Transformation from access and adoption of education-related information to value creation can be made through e-Learning. However, this would require other stakeholders in the telecenter ecosystem to contribute such as local teachers, schools within the community, volunteers and even institutions of higher learning.

Second in the list is information on healthcare, which was selected by 60.1% of respondents. The popularity of health-related information suggests the trend in the rural areas is moving towards a health conscious society, a criterion for a fully-developed country. Given the opportunity to access and adopt information on healthcare, transformation to value creation can be made where patients and doctors can access patient's information and health history in an integrated and efficient manner. A change in the telecenter ecosystem will occur when other stakeholders such as community doctors and clinics, local public health centers, government and private hospitals will interact and share information on the patient and health issues that affect the community.

The third most popular type of information needed by the respondents in this study is religion (55.2%). This is not surprising since the location of the telecenter is within the compound of the mosque, which is a place of worship and study. Access to religious information will give the opportunity to the user to internalize the information, and put into practice what is being taught, which will result in creating value in terms of spiritual gains for the benefit of the individual concerned. This will require changes to the telecenter ecosystem by extending the stakeholders to include religious institutions

such as religious associations, religious departments, Islamic centers, universities, NGOs, etc.

Finally, the next most popular type of information needed by the majority of respondents is information sources (51.7%). This is the ability to search and access the types of information that suit an individual's needs in a dynamic manner. The system should be intelligent enough to remember and predict the sources of information most likely needed by the individual and provide the necessary links to facilitate access to the information in a fast and effective manner. The value that can be created from such information retrieval capability is an individual that is well-informed, and from the perspective of the community is the transformation to a knowledge-based society. Changes to the telecenter ecosystem are imminent for this to take place. First and foremost is the willingness of individuals and the community to change by embracing ICT. Next, the roles of other stakeholders in the telecenter ecosystem need to be rigorously interactive and interdependent with each other to achieve the common course of supporting the individuals and community to embrace ICT. Here, the contribution of additional stakeholders is crucial. The roles of content developers and IT specialists are important to provide an intelligent environment to enable this to occur.

Table 3: Information Needs (N=203)

Types of Information	Frequency	%
Education/New skills	138	68.0
Healthcare	122	60.1
Religious	112	55.2
Information sources	105	51.7
Current news/Sports	95	46.8
Job vacancy	65	32.0
Government information	64	31.5
Tourism	61	30.0
Weather	60	29.6
Product/Service market price	51	25.1
Culture	51	25.1
Product/Service market opportunity	50	24.6
Product/Service renewal	44	21.7
Social & cultural events	42	20.7

Other types of information needed as listed in the table are not discussed as they account for less than half of the respondents.

Conclusion

Based on the categories of information most needed by the community, this study found certain similarities with a previous study involving other rural communities (Zulkhairi et al., 2008). This study found education healthcare and religion as recurring themes found in the past study. It can be concluded that education, healthcare and religion are categories of information most needed by communities in rural areas. These three categories of information, if properly adopted and opportunity given to the community to access through ICT, have the potential for the benefits gained from access to ICT to be transformed into value creation as discussed in this article. Findings of this

study also suggest changes to the corresponding roles of the telecenter ecosystem for such transformation to take place.

A major contribution of the study is its implication to policy in relation to strengthening the NSF-BDD framework. A vital component of the framework is the collaboration of all the government agencies and private sectors, which form part of the community telecenter ecosystem. These agencies together with the private sectors can play an active role in delivering their services to the community via the telecenter, thereby making the telecenter a one-stop rural transformation center. Further studies should focus on the value that can be created from such collaboration of benefit to the community. For instance, based on the outcome of this study that shows information on education as being most needed, an on-going study is currently underway to create local content for a community portal on opportunities for further education in collaboration with public and private education providers and the university as content developer. Likewise, future studies should also look into developing a knowledge repository that can mediate health information from experts in geographically dispersed locations. This information can then be localized via an infomediary such as a university that understands the local community needs and source out the resources by pulling the interest of the various stakeholders together to build the knowledge repository.

Another significant contribution of this study is the study methods employed, that is, using a mosque as the focal point in the telecenter ecosystem to enable an optimal bridge to the digital divide. Since the majority of Malaysians living in rural areas are Muslims, mosques have been a place where the community gathers every day to perform their religious duty. It is common to see large gatherings of the community in mosques particularly on Friday afternoon, at night after sunset and during weekends and public holidays. The presence of an ICT facility within the vicinity of the mosque presents an opportunity for those in attendance to get acquainted with ICT and the Internet. In addition, this can also attract other members of the community from nearby villages to come to the mosque. This is contrary to the telecenter model implemented presently by government and private sectors, where only the village in which the telecenter is located would normally reap the full benefit of its presence, even though as a public facility, communities from other villages can also use the facilities at the telecenter. This perception is logical, as the name of the telecenter is often associated with the name of the village or place where it is located. Hence communities from other villages would tend to shy away from frequenting the telecenter. On the other hand, a mosque is usually situated in a strategic location shared by neighboring villages. A community in one village has equal access to the mosque as the other villages in the neighborhood where every member of the community irrespective of the village he/she belongs to is a member of the same mosque, known as *khariah*. By implementing a telecenter at the mosque, there is a multiplier effect where one telecenter can effectively serve several villages under the mosque's *khariah*. As can be seen from this study, the mosque in which the telecenter is located serves nine neighboring villages, thereby extending the telecenter ecosystem outreach.

In conclusion, this study managed to identify categories of information needed by typical rural villages in Malaysia and describes digital opportunities that can exist through access to ICT. This enables individuals and communities to benefit from these opportunities thereby creating values that contribute to the socio-economic development of the community. Last but not least, the vibrant roles of the telecenter ecosystem are essential to ensure interacting and interdependent relationships exist among the telecenter stakeholders for the transformation to value creation to take place as formulated in the National Strategic Framework for Bridging the Digital Divide. In

relation to this, future research should verify the framework by examining the relationship between ICT diffusion and ICT adoption as digital opportunities, and their effect on socio-economic value creation, in addition to identifying a telecenter ecosystem that can significantly contribute to these digital opportunities.

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