Digital Village Implementations

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1. Concept of Digital Village

Digital village is a social entity concept formed by community awareness, and a desire to think beyond and build a new form of cooperation and alliances using advanced digital technologies [1]. It is not only incorporating digitalization into the village, but also forming a social entity that can address the problems existing within the village. The concept must be based on community awareness and look for comprehensive solutions to all problems efficiently. The implementation could even end up producing a new form of cooperation among residents.

The concept is also considered as an ecosystem, where services are delivered digitally to provide local goods, social services, mobility and communication solutions, and governance [1]. Residents in a village have a range of needs in the form of goods and services. Digital ecosystem could provide solutions to the needs. Digital solutions could also ease mobility and communication problems using integrated systems. This ends up with effective and efficient governance, which provides better services to the community.

The term is also interpreted as a concept whereby all components involved, including people, technology, and governance, can act smart in a highly effective and efficient way [2]. The concept integrates all components to work. Geared with the use of technology, residents will have the tools to think and act smartly, making decisions based on data. As in all integrated systems, governance could be conducted easily in a very efficient and effective way. All the unnecessary tasks and resources will be excluded.

From another perspective, it also exemplifies a new way of thinking for off-grid communities worldwide [3]. The concept provides solutions to the village residents. However, when each digitalized village is connected to the others, all villages' needs and solutions become connected to one another. One village's abundance will be a solution for the other villages that are lacking, and vice versa.

2. General Aims of Digital Village

Digital village is a complex concept that has a lot of aims. One aim of the digital village concept is to empower rural communities. This is conducted by implementing digital technologies through the act of innovation in developing cross-sectoral solutions that are sustainable, cost-effective, and affordable [1][4][5]. Digital village also aims to develop the concept of literacy culture. Culture stimulates new communication patterns, new information and decision practices, new actions and transactions model, and ends up achieving community culture prosperity [5][6].

Implementing the concept of digital village is also equivalent to creating a digital infrastructure that can be used as a utility for every rural resident [6][7]. The infrastructure provides services to rural residents digitally [8], and residents can conduct daily activities effectively and efficiently [1]. Furthermore, the concept ends up also establishing good governance [5][6], by using structured management systems [9] that can improve government performance and productivity [6].

Socially, the integrated concept of digital village reduces digital divides and develops a culture of collaboration and participation between residents, including immigrants, local authorities, and local industry [4][10]. The concept is also used to establish a network for attracting professionals and improving the digital skills of residents [1]. Several larger social outcomes, such as avoiding population drops, anticipating generational changes, and shifting the balance of opportunities and population distribution between villages and cities could also be answered by implementing the concept [1][8][11].

The concept can be used to boost local development economically [7] and revitalize local economic potencies [7]. This in turn can increase the income of rural residents [8], provide a basis for economic self-reliance [10], and stimulate the financial independence of rural residents [12]. One specific area of the concept's implementation is bridging the gap between the digital developer and actual service commercialization [13]. By bridging the two parties, it could result in a growth in the number of businesses [14].

Environmentally, the concept promotes sustainability in village development by setting up livable space ecologically [5]. The integrated concept of digital village avoids the inclusion of unnecessary tasks and uses of resources. By implementing this concept, access to sustainable energy is promoted, and more holistic and integrated approaches can be applied to enable access to energy in the rural contexts [3]. This in general improves the sustainability of the environment [1].

On a macro level, the implementation of digital village, with its economically and socially integrated community concept, pushes domestic product growth and increases income per capita [6] by generating more employment and improving labor productivity [6][14]. This in turn influences the effort in fighting against poverty, and enhances the quality of village life [8][15]. In more detail, the concept could also improve the quality of education, healthcare, and banking access, including avoiding intermediacy, illiteracy, ignorance, a lack of funds, a lack of information, and a lack of investment knowledge [7][14].

3. Expected Deliverables of Digital Village

Digital village is a concept whereby services provided by all stakeholders are delivered digitally. As such, the output expected from the concept is used to stimulate the development of the service industry [16], improve local commerce [17], regenerate local industries [18], stimulate public–private partnerships, especially small–medium enterprises [19], and make it easier for ICT innovators to start a company [19]. By integrating all the related knowledge and means of communication, the concept also boosts the creation of domestic handicraft [20] and helps create more high-quality products [16].

As an integrated system, the concept has the ability to circulate and spread information and news about rural governance and rural services to all residents [4][16][21]. For this purpose, the standardization of broadcasting content is needed [19]. Residents could also contribute to provide content that can stimulate local content development [15]. This concept optimally uses technology and expands the availability of information [7]. With the concept of integrated information, an open data policy can be set [19] to provide easy access to information for residents [21]. Via this process, it provides a means of rapid information dissemination in the village [18]. The concept could also include applications of big data in any projects conducted [19] to encourage variety in information production.

Regarding local government conduct, the implementation of digital village initiates e-governance [19], and transforms manual work into a fully automation system within government [21]. One characteristic of an e-government is that it provides two-way communication between residents and the government [21], so that the government staff can quickly respond to, analyze, and resolve problems raised by residents [6][21]. Another characteristic of e-governance is its ability to stimulate public accountability [6][17], which lessens revenue leakage in government [7] and ends corruption systems [17]. The concept also reduces paperwork [17] and improves work quality in local administration [18]. This ensures good governance and services on demand [6], and all answers to villagers' needs are provided effectively and efficiently [6].

Economically, through information provision, the concept also provides employment opportunities through job creation and job opportunities [15]. Information sharing and information generation through integration produce new employment opportunities that previously did not exist. Its implementation also provides a platform for developing a reliable and trustworthy service system [9], and it can act as an incubator for creating and developing socially responsible ideas that enhance the quality of life [20].

A social center could also be developed to provide a range of improved services [1]. The center could be used as a tool to stimulate a digitally active and healthy aging society [19], and to provide care for the elderly [7]. A combination of the center with the inclusion of digitalization in the village also helps establish an education center providing education for all [21], and improving education systems [17]. The facility will be a catalyst to improve knowledge for villagers [17], and develop villager capacities [6][15]. This also enhances the business skills and knowledge of villagers [15], and in turn develops emerging talents and digital industry entrepreneurship [16]. With villager capacity development, it eventually increases the abilities of villagers to manage village potential [6].

The concept itself cannot be separated from infrastructure development. Software and hardware infrastructures [15] are always part of the concept. It can accommodate so-called baked-in innovation, whereby the infrastructure is incorporated as part of the overall concept [11]. Because of the integration concept, the implementation uses energy efficiently [19] by reducing overall energy consumption [7] and lowering the carbon footprint, with a reduction in fuel consumption, and the promotion of better waste management, greener workplace management, and greener ecosystems [7][14].

4. Existing Concerns of Digital Village Implementation

4.1. Infrastructure Concerns

The most well-known issue in implementing digitalization to a rural area is connectivity. Connectivity is a prerequisite for digital village implementation [7][22][23][24]. The connection can extend as far as the provision of high-speed internet [24] or broadband connectivity [7][17][21][25][26]. However, providing massive broadband connection can cost a lot of money. In substitution, wi-fi hotspots with a wide range of capacities and types can be used instead [7][17][21][27].

To make sure that it is implemented well, the scaling up of connectivity infrastructure is always required [19]. Some infrastructures are aging and need to be revitalized [11]. In this case, fundraising can always target investments in broadband infrastructure [25]. Another infrastructure problem is that the adoption rate of internet in rural areas can be diverse and terribly slow [7]. Collaboration between internet providers in providing towers is also limited [28]. For some that are ready to be used, the bills are too high, and they are not affordable for rural villagers [15][18]. In relation to connectivity, one other principal issue in implementing the concept is the availability of a reliable electricity supply [22].

Related to digital infrastructure, deficits always emerge in rural areas [21]. Several prerequisites for implementing the concept exist, including the needs of updated computers [27], the digital information environment, the application environment [4][5][22][26][27][29][30], infrastructure support [30], and domain-specific services [4]. Such infrastructures need to be well-equipped [27], and their provision by locals is recommended for cheaper price and easier maintenance [31].

Digital village includes the concept of integrating services using applications, so that application infrastructure is an important part of the concept. However, along with implementation, problems arise such as service apps that have not been well developed [21][26]. Demands for comfort in using technology, especially regarding user interface (UI) and user experience (UX), also become a problem [11]. Already-existent digital villages use legacy business systems that lack current technologies [11], and they are often too complex [11][32].

Integrating information also introduces some problems. The first problem regards whether the information required is readily available or not [15][22]. This can be due to the problem of the standardization of information and content

creation [23]. Some types of sectoral informatization, such as administrative and educational informatization, are often conducted without considering the convenience of residents [12].

In providing information to all users, access to information and digital knowledge needs to be set up properly [33]. In this regard, information, in particular personal data, need to be provided securely [19] and guaranteed with the highest safety [23]. Authentication can be implemented for security [17]. Security regarding cyber connections should also be incorporated to make sure that no intrusions occur [11].

4.2. Awareness and Branding Concerns

A digital village is formed based on community awareness. A lack of community awareness [22][28], solidity [28], contributions [22], and commitment [34] will result in an unsuccessful digitalization project. A key resource of a successful digital village project is its residents [26]. Residents can act as drivers to generate demand, values, and motivations [29]. The implementation structure needs to include a platform to collect the support of the community and civil society's participation [4]. Since the concept is developed based on innovation, the implementation should also consider including a facility to improve the awareness of villagers regarding innovation.

Awareness problems could also arise from the existence of poverty and illiteracy [17]. One example of a lack of response problem is that residents are not used to using online systems of purchasing. There are also elderly residents. Encouraging involvement is also a challenging task [18]. Companies involved also often compete with one another, making it hard for them to make a full contribution [32]. There is also an issue of inflexibility within public and private sectors [32]. In solving the problem of awareness, the community background and surrounding environment also need to be analyzed [15]. Resistance to changes and unwillingness to disturb business partner networks are among the backgrounds that need to be taken into consideration [11]. In relation to project awareness, project branding is also an important part of the development [22].

As a digital village connects all existing stakeholders in the village, the types of stakeholders can include residents and businesses, government administration, researchers [4], labor and financial institutions, universities, and intermediaries [5]. Strong coordination and collaboration among stakeholders is always needed [8][17][18]. However, the real-life condones are often opposed to this, with poor private participation [7] and a lack of coordination among departments [7].

4.3. Human Resources Concerns

As skills are fundamental when implementing the digital village [22][23][26][27][29], capacity-building will always be part of the project. Residents need to scale up the rate of adoption [19], improve their digital literacy [19][25], and upgrade their information literacy [22][25]. Strategies to build digital skills need to be developed and implemented [25]. In particular, a capacity for problem solving needs to be developed in residents [23].

Some specific problems regarding human resources include the lack of suitable human resources [15], the inability to coordinate with foreign human resource or outsource firms, and the lack of necessary anthropological and

ethnographic skills to understand users [11]. Residents also often find it difficult to keep up with advanced technology [18]. The gap between users and non-users remains large [18].

Regarding culture, a digital village is often considered to depersonalize the construct of a rural area and its human resources [35]. The balance between the value added by ICT use and the expected structure of rural communities and residents needs to be maintained [35]. Cultures are also different from one community to another [17]. It is necessary to consider the residents and local/regional specifics in the analysis of digital village implementation [3].

4.4. Management Concerns

To ensure that the digital village is running well, regulations must be put in place. A policy environment [30] needs to be set up to make sure all regulatory and legal compliances are met [11]. Several regulations that need to be considered include intellectual property rights for any resulting innovation [19] and outsourcing policies [7], among others.

Funding will always be part of any project, let alone digital village development [22][27][29]. It is known that digital village development's costs of implementation are among the highest [7]. The costs include electronic development [7] and costs of services [22]. A mechanism to channel the required funds needs to be set up [8][22]. Some funds can also come from sponsors/donors or researchers [15]. In relation to fundraising, the widespread problem that arises with digital village development is that the development often yields an unclear payback and return [11].

Among other things that arise in digital village development, several management concerns must be analyzed and resolved before proceeding with the development and implementation. The first one is that the implementation structure must have an applied, targeted, and effective policymaking mechanism [8][35]. The organization's structure, leadership, the leader's commitment, strategic thinking, political support, transparency, and development targets are among the concerns related to management that need to be considered during the implementation [21][27][29]. Lacking effective data governance, management, standardization [11], and transparency of the projects [32], as well as the issue of time overruns [7], are among the problems often faced in management. The lack of preliminary studies could also result in the implementation strategy not making any contribution to the success of the project [36]. Research and evaluation are also important parts of management when implementing the digital village concept [8].

5. Development and Management Concepts

5.1. Enterprise Architecture Concept

In implementing the concept of the digital village, an established implementation concept can be used as a base. One such concept is enterprise architecture. Enterprise architecture is an emerging discipline that can help guide the enterprise towards an expected future state [37]. It is a complex system composed of human, political, social, software, hardware, and technological components. The concept can be used to visualize the enterprise at many distinct levels. It can be used to define strategic, tactical, and solution architecture concepts aimed at a wide range

of stakeholders. The steps involved in an enterprise's architectural concept are planning, managing, developing, and documenting. Along the way, frameworks, standards, techniques, and tools will be used in the development.

There are four sub-architectures within the enterprise architecture concept. These are business, information, application, and technology architecture. Because of their importance, sub-architectures that cross-cut with other sub-architectures are often separately added. These include security-based, geospatial, and social architectures.

Business architecture refers to the overall successful outcome of the enterprise architecture. It consists of the business strategy, including vision and mission, operational models, drivers, goals, objectives, capabilities, and business processes. Information architecture constitutes the existence and exchange of information within an enterprise. Understanding the types of information that are handled, and which business functions and processes they are handled by, is an important part of this architecture. The architecture includes a conceptual information model, a logical data model, and a physical data model. Application architecture refers to the catalogue of applications used in an enterprise. It includes descriptions of interfaces and interactions between applications, among others. It can be visualized using application lists, diagrams, or matrices. In the business architecture, the application is often connected to capabilities and business processes. Technology architecture describes the logical, physical, and virtual infrastructure that supports the application services.

5.2. Project Management Concept

Projects can be managed using project management tools, techniques, and methodologies [38][39]. There are ten subtypes of management/knowledge included in project management, including scope, time, cost, quality, human resources, communication, risk, procurement, stakeholders, and project integration managements. The first four knowledge areas are the core knowledge areas that lead to the setting out of specific project objectives. The next five knowledge areas are the facilitating knowledge areas, which are the means to achieve the project's objectives. The last knowledge area, project integration management, is affected by all other knowledge areas.

Scope management includes defining and managing all the work required to finish the project successfully. Time management includes estimating the time it takes to complete the work, developing schedules, and ensuring the completion of the project. Cost management includes preparing and managing the budget for the project. Quality management includes ensuring that the project satisfies the stated needs. The management of human resources includes making effective use of the people involved. Communication management includes generating, collecting, disseminating, and storing project information. Risk management includes identifying, analyzing, and responding to risks related to the project. Procurement management includes acquiring goods and services for the project from other organizations. Stakeholder management includes identifying and managing the expectations of and impacts on stakeholders. Project integration management includes managing all aspects such that they connect with one another.

6. Digitalization and Sustainability Management

Sustainability is a concern that must be addressed in each step of development. Sustainability lies in between environmental performance (planet), economic performance (profitability), and social performance (people) [40]. In an era during which digitalization focuses more on economic impact, the integration of digitalization with HRM and SCM will help us to develop sustainability capacity and ultimately deliver sustainability value [41].

Regarding the sustainability evaluation, the ICT resources can be divided into four types: automate, informate, transform, and infrastructure [41]. Automate resources are used to automate business processes, reducing the hands-on role played by humans. Informate resources are used to make timely and relevant data available to stakeholders. Transform resources are used to restructure business assets, capabilities, practices, processes and/or relationships. Infrastructure resources comprise the deployment of standardized ICT services to support the work of other resources. A study on how to develop ICT resources' sustainability capabilities [41] has shown that infrastructure resources are needed to contribute to the current and future internal conditions. Automated ICT resources are needed for the current implementation, transform ICT resources for future implementations, and informate ICT resources help in supporting external implementation.

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