

Digital Tourism Business Ecosystem: Artifacts, Taxonomy and Implementation Aspects

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ABSTRACT- Digitalization and inter-connectedness of business systems have increased the dependency between business entities. The ever-changing environment and business demands have increased competition and collaboration among diverse entities, which have forced the concept of ecosystem models. This work highlights the need for a digital tourism business ecosystem model for the tourism industry of Nepal. The work is built on interviews with experts from the Nepal tourism sector and the study of literature, reports, and publications in the field of tourism and digitalization in tourism of Nepal. Interviews are carried out on a one-to-one basis with 30 selected industry experts as a source of information and data. The study builds a taxonomy of different scenarios of tourism, a conceptual model for the Digital Tourism Business Ecosystem, and an Implementation model for Nepal. Further, as the selection of resources is a crucial factor in Digital Business Ecosystem, an Analytical hierarchical processing model is proposed as a solution for resource selection and optimization. This work is important as it brings out the need for a Digital Tourism Business Ecosystem in today's context, especially for the tourism industry. Secondly, it demonstrates the practical aspects of the Digital Tourism Business Ecosystem Model for Nepal. The work can further serve as a reference and knowledge base for digital business system analysts, system designers, and digital tourism business implementers for better digital business system designs and implementation in the tourism sector.

KEYWORDS- Digitalization, digital ecosystem, digital species, integrated systems, taxonomy, Nepal tourism

I. INTRODUCTION

The advent of Information and Communication Technology (ICT) has brought massive changes to almost all sectors of human endeavor in the last 20 years [1]. There is no field of research or application that has not been affected by ICT. Business organizations have experienced a massive change with ICT and this has given rise to new forms of business, new boundaries, and new opportunities extending the spheres of business from domestic to global markets [2]. The technology has empowered big enterprises, SMEs, and independent ones by integrating them in a chain of inter-related and inter-dependent components [2]. The tourism industry is one of the leading examples that depict the true impact of ICT on business. The rise of different technologies, tools, social applications, sensor networks, mobility systems, augmented reality and computing paradigms have reinforced a new digital value in business scenarios [3]. The expanding digital value sphere challenges the current business models and requires future business models to address technological advancements and changes.

Digital Business Ecosystem or DBE is the answer that addresses the growing complexity of technological advancement and developments. The DBE relates to a system that is a distributed, adaptive, open socio-technical system with properties of self-organization, scalability, and sustainability inspired by natural ecosystems [4] as shown in figure 1. They have been considered highly relevant especially in the case of clustered and fragmented sectors where a good number of Small and Medium Enterprises are operating, as it is in the case of tourism [4]. Further, the current research scenario has also shown that underdeveloped and developing nations have an immense scope to utilize the power of ICT to empower themselves and witness short-term and long-term growth [6]. The application of ICT becomes vital for landlocked and small

countries like Nepal to promote growth opportunities and reduce the digital divide [7]. Tourism is one of the most significant areas to look at, as it is the second biggest

industry of Nepal and contributes as the second industry to the Nepalese economy.

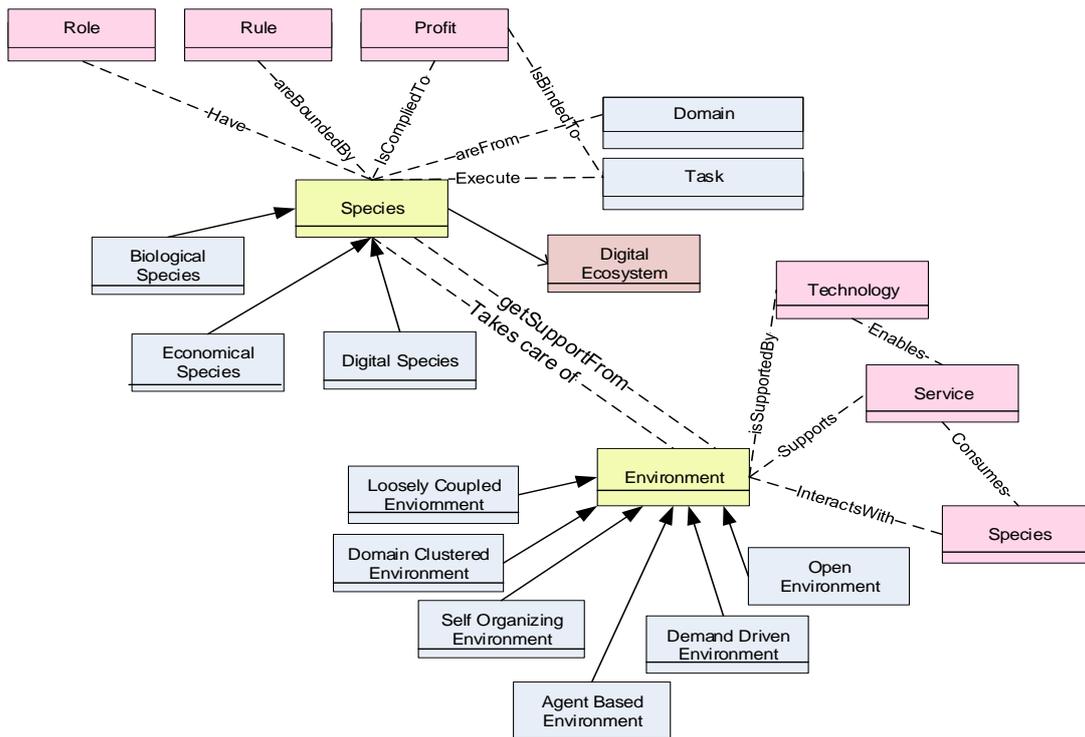


Fig. 1: Digital Business Ecosystem Concepts. Ref [5]

The tourism industry has witnessed growth with a rising number of tourists as shown in fig 2 which holds a lot of scope for business in the coming days. The geographical diversity, rich culture, growth in the ICT sector, accountable penetration of mobile and data networks makes Nepal a good source of research for understanding the role of ICT and implementing ICT-related systems and services [8] [9]. The use of technology to cater to current needs and provide sustainability, in the long run, needs the implementation to be in the form of a Digital Business Ecosystem.

II. DIGITAL TOURISM BUSINESS ECOSYSTEM

A digital business ecosystem is an interdependent group of enterprises, people, and/or things that share standardized digital platforms for a mutually beneficial purpose, such as commercial gain, innovation, or common interest [10]. Digital ecosystems enable you to interact with customers, partners, adjacent industries – and even your competition.” These systems have come up as a new area of research and many business organizations like SMEs are adopting this model to find sustainability in their businesses. An investigation of the various components of the digital ecosystem serves as an important base for the construction of the Digital Tourism Business Ecosystem Model (DTBEM). Digital Business Ecosystems were triggered as an initiative, Go Digital, aimed at boosting ICT adoption by European SMEs [11]. It is generally thought that ICT is one of the major contributors to economic growth and economic efficiency. “ICTs are central to boosting productivity and improving competitiveness”; “Public and private information and communication technologies contributed nearly 50% of EU productivity growth between 2000 and 2004 [11]. The synthesis of the concept of Digital Business Ecosystem emerged in 2002 by adding “digital” in front of Moore’s (1996) “business ecosystem” in the Unit ICT for Business of the Directorate General Information Society of the European Commission [12].

Digital Business Ecosystems are known for digital value creation, which depends on the community, complementors, competitors, and customers. Interconnection of these concepts and exchange of information decides the value of the information generated in the digital environment. The literature and research documents show that the future

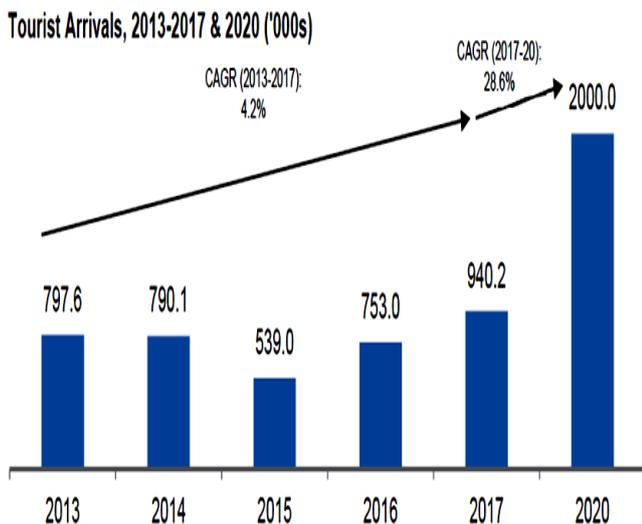


Fig. 2: Tourist arrival rate representation from 2013-2020 based on tourist statistics published in the year 2020 [9]

organization will be influenced by customer experience, continuous sense, responsive environment, and value creation through distribution. These systems will serve as a game-changer for business enterprises as shown in figure 3. The strong relationship existing between ICTs and tourism leads almost naturally to considering a tourism system as an integrated ensemble in which both a real physical component (the companies and organizations active in the field) and a virtual one (the digital representations of the physical elements) act in a strongly coupled way. ICTs empower consumers to identify, customize and purchase tourism products and support the globalization of the industry by providing "information of needs" to develop, manage and distribute offerings worldwide. The increasing use of ICTs plays a critical role in the competitiveness of tourism organizations and destinations [13]. The DBE is a proposed methodology for economic and technological innovation. Specifically, the DBE is an infrastructure that supports large numbers of interacting business users and services [14]. It aims to be a next-generation ICT that will extend the SOA concept automatically combining available and applicable services in a scalable architecture, to meet business user requests and facilitate business processes [14].

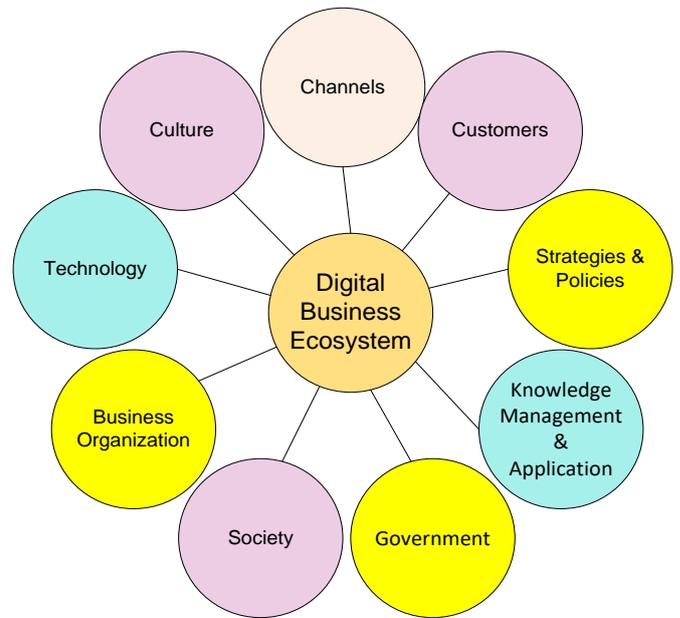


Fig. 4: Digital Business Ecosystem Inter-Dependent Components. Ref [15]

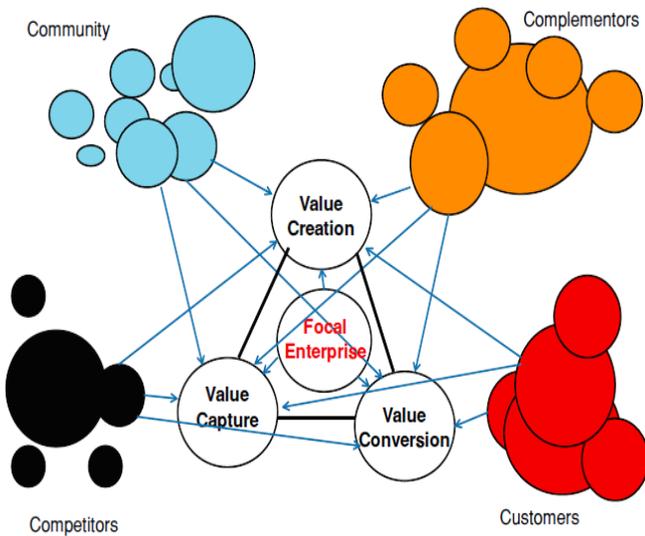


Fig. 3: Value Map of Digital Business Ecosystem. Ref [11]

Digital Business Ecosystems are made possible by the convergence of three networks: ICT networks, Social networks, and Knowledge networks. The networked connections enabled by the Internet and the WWW grew along with the links of the pre-existing and underlying social, professional, and business networks between governments, researchers, businesses, and companies to coin the powerful concept [15]. These systems have evolved as a mature discipline of scientific literature to describe business-oriented socio-technical systems regardless of their location and structure. [15]. Thus any future implementation of ICT must be in terms of Digital Ecosystems to be sustainable.

Figure 4 depicts artifacts of a digital business ecosystem that is based on the Gartner research group and is modified to include other artifacts of the digital business ecosystem based on literature and work of other scholars as shown. The model has 8 dimensions that form an integral part of the system. The described components form an integral part of the system and are very important for the execution and survival of the Digital Business Ecosystem. Culture, society, and customers form the basis of social computing whereas technology, knowledge management, and channels serve as infrastructure and medium of transfer and communication and business organization, government, and strategies and policies make up important components of the business environment for the tourism business. Similarly, table 1 shows some of the renowned work in the area of Digital Business Ecosystem in the current scenario.

Table 1: Studies on Digital Business Ecosystem

Publisher and Date	Title	Study component	Ref
IEEE, Conference Series, 2008	Ontological framework for trust & reputation for DBE	Feedback ontology for trust and reputation	[16]
IEEE Conference on Series, 2008	Application of Digital Ecosystems in the health domain	DES design methodology and factors associated	[17]
IEEE Transactions on Systems, Man, and Cybernetics, 2010	Application of Digital Ecosystem Design Methodology Within the Health Domain	Design of DHES for electronic records and management	[18]
IEEE Transactions on Industrial Electronics, 2011	A Service Search Engine for the Industrial Digital Ecosystems	Design a conceptual framework of a service-ontology-based semantic service search engine	[19]
Springer, Lecture Notes in Computer Science, 2014	Transformation of Digital Ecosystems: The Case of Digital Payments	Digital payment systems as digital ecosystems	[20]
Springer, Information and	Digital ecosystems and their implications	Importance of digital ecosystems	[21]

Communication Technologies in Tourism, 2021	for competitive strategy	and their advantages	
Emerald, International Journal of Tourism Cities, 2020	New digital tourism ecosystem: understanding the relationship between information sources and sharing economy platforms	Study of relationship between the use of traditional operators, online travel agencies	[22]
Science Direct, Journal of Hospitality and Tourism Management, 2020	A boundary objects view of Entrepreneurial Ecosystems in tourism	Conceptualization of Entrepreneurial Ecosystems (EEs) in tourism	[23]
MDPI, Land Journal, 2018	The Role of Tourism in the Ecosystem Services Framework	Ecosystem Service Framework and role of tourism in it	[24]

III. TECHNOLOGICAL DEVELOPMENTS IN NEPAL

The development of ICT in Nepal started with the establishment of Nepal Doorsanchar Company - a government-owned entity established in early 1913 [25]. In 1980 the digital exchange system was established making telecom services available to the general public. The major technological breakthroughs of Nepal are listed in table 2. The ICT development of Nepal was not up to the mark till 2005 and it is seen that from 2005 onwards the government of Nepal has concentrated its direction on the development of ICT [25] [26]. Currently, the country has introduced all the latest technological innovations in the sector of communication with a mobile penetration rate of 113% in 2017 and an internet penetration rate of 57% in 2017 shown in fig. 5 and 6 [26]. Further, the social site statistics show that Nepal has 24% active users with Facebook 91.03%, YouTube 5.52%, Twitter 1.15%, Pinterest 0.91%, LinkedIn 0.61%, Instagram 0.35%. The current ICT scenario of Nepal looks acceptable and the ICT services can be extensible used with effective planning in the Tourism Industry of Nepal [27] [28].

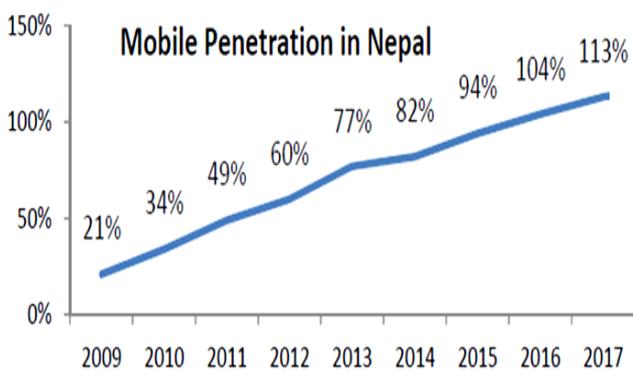


Fig. 5: Statistical data representing mobile penetration in Nepal [27]

The ICT scenario has slowly started developing in Nepal and there are immense research and development opportunities that need to be customized for Nepalese tourism and the business environment. Many notable scholars have worked to study the scope and application of digitalization in Nepal. Scholars like Anup Shrestha worked on E-tourism adoption model for Nepal [29], Bidur Devkota

covered the area of use of tweets in tourism [30], Shrestha and Jeong worked to propose an ICT framework for tourism [31], and Tan and Shrestha worked towards sustainable tourism in Nepal [32] have greatly emphasized the role of ICT in the Nepalese tourism industry. The abruptly growing digital use and electronic payment system will challenge the current digital system and the need to move and conceptualize DBE will be mandatory.

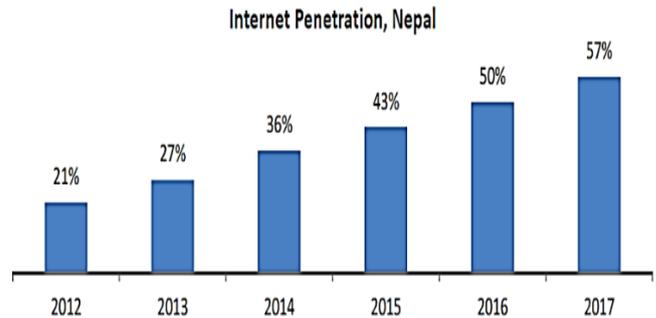


Fig. 6: Data regarding Internet penetration in Nepal [27]

Table 2: ICT Development in Nepal [25][26][27]

STAGES OF ICT DEVELOPMENT IN NEPAL	
1913	Nepal Doorsanchar Company
1971	Introduction of computer in the country for census (IBM 1401)
1974	Establishment of the Electronic Data Processing Center
1980	Digital Exchange System
1985	Distribution of Personal Computers in Nepal
1992	Establishment of Computer Association of Nepal
1996	Establishment of the Ministry of Science & Technology
1998	Telecommunications Act 1997 and Regulation
1998	Establishment of Nepal Telecoms Authority (NTA)
2000	Announcement of the first IT policy, "IT Policy 2000"
2001	Establishment of the National Information Technology Center
2002	e-Banking by Kumari Bank
2003	GSM and CDMA services. Formation of HLCIT
2004	Telecommunication Policy 2004
2004	Electronic Transaction ordinance 2004
2006	Electronic Transaction Act Oct, 2006
2007	3 G Network and Data Services
2009	Mobile wallet by e-Sewa
2010	Announcement of IT Policy 2067
2012	Mobile Banking
2017	4 G Mobile Network Service
2018	ICT Digital Frame Work

IV. DIGITAL TOURISM BUSINESS ECOSYSTEM: ANALYSIS AND DESIGN

Digital Tourism Business Ecosystem is a new field of study and this has limited the availability of standard tools and technologies for the development and analysis of the system in it. To work and analyses DTBE for Nepal, UML as a language is taken as a tool to represent the analysis and design artifacts of the system under consideration.

Table 3: Profile of Respondents Interviewed

Position	Sector	Major responsibility	Number
IT Director	Ministry of Finance	Governance	1
Engineer	MoCTCA	Governance	3
Officer	State Tourism	Governance	3
MD	Hotel	Plan, promote, regulate, administer business	3
Proprietors	Travel & Tourism	Promote, administer and manage	5
ED	Trekking	Arrange, administer and manage	2
IT Officers	Bank	Manage and Administer IT operations	3

Further, to model resource optimization and selection for DTBE, Analytical Hierarchical Processing (AHP) is proposed. The study is built by interviewing some of the selected personnel from different sectors of tourism and

come up with pre-analysis artifacts. The respondents used for the study are shown in table 3.

A. Tourism Governance and Business Management Scenario

This section deals with the general tourism governance model of Nepal and its related artifacts. Figure 7 depicts a generalized architecture of tourism governance of Nepal, which includes, Ministry of Culture, Tourism, and Civil Aviation (MoCTCA) as the central entity that implements its functions through the department of tourism. Nepal tourism board is connected to MoCTCA through the department of tourism. Similarly, the hotel, travel, and trekking agencies are connected to the tourism department through their respective associations. The tourist entity is connected to the tourism ministry through the instances of these organizations that make up the hotel, travel agency, and trekking agency. This generalized architecture provides us as the base for further analysis of the Digital Tourism Business Ecosystem Model for Nepal.

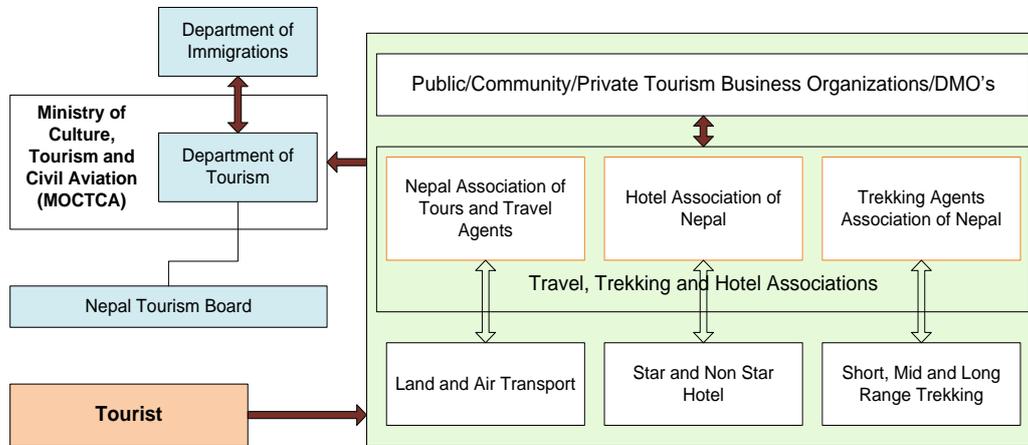


Fig. 7: Tourism Governance Architecture. Ref: [20][22][25]

B. Domain Analysis

Table 4: Problem Identification of Tourism Industry and Digitalization Scenario

Area	Problem Identified
Marketing & Promotion:	Poor promotional plans and inadequate Information on products, services, travel, changing market demands, limited global reach, Quality vs Content
Infrastructure:	Poor Infrastructure, bad roads, electricity and communication reach, no proper public infrastructure, lack of health infrastructure, and risk mitigation scenario
Management:	Lack of Proper Management of Tourism Infrastructure and Services. Lack of coordination between business-to-business entities, government-to-business entities, Lack of managing global forces and technology penetration, Lack of proper regulations to manage the dynamic and growing market, No cost, and quality standardization. Political instability and regulatory changes.
Health and Hygiene:	Lack of proper information on health, hygiene, and ecology, Poor quality of health services, No reach of health services in remote areas. Poor drug supplies
Risk and Mitigation:	No proper channels and mechanisms for information update in terms of natural hazards, change in biodiversity, ecology, and risk mitigation, No plans to mitigate emergencies and accidents occurring in the tourist sites.
Information Availability:	Very little data on websites/portals/books/brochures regarding tourist destinations in Nepal. Fragmented databases and information gaps in all sectors of Tourism.

	No real-time updates, repetitive and poor data quality, no integration of data sources, lack of digital integration of all tourism sectors at the national level
Communication System:	Poor internet at extreme locations, bad communication system, Power shortages, poor quality of communication, High cost, irregular and poor services.
Governance:	Poor communication channel among public/private partnerships in the tourism sector. Lack of strategic vision of Government in implementation of technology for business. Lack of financial support, Unskilled manpower, Corruption
Business to Business:	Competition, Lack of information sharing and proper mechanism for digital integration. Public trust, cooperation between private sector, local and community tourism sectors. Syndicate, Poor quality plans and policies for tourism.
Human Resource:	Lack of trained and skilled manpower in the tourist industry and ICT industry, Dependency on other nations (India and China), Brain drain and high cost
Digital Access:	No proper channels for digital payment, lack of Digital payment culture, Security and privacy, transaction limitation, legal issues, Integration issues in financial institutions
Policy, Legality & Regulations	Weak legal framework, poor tourism policies, no proper mechanism for legal disputes, specially in case of digital scams and cyber theft, Poor digital monitoring agency.
Culture and Society:	Less educated mass, mixed culture at different places, lack of awareness, language barriers, social barriers based on gender. No digital culture still in existence

The interviews, literature review, and background study indicate that the Nepal tourism industry is struggling with many problems. The problems range in all spheres starting from promoting agencies to service industries. The study indicates that even the Government of Nepal and tourism agencies have no aggressive strategic plans to uplift the tourism sector besides so much diversity and potential. The elementary requirements in terms of information on health and hygiene, places to stay, eat, and other vital information (update and access) are missing at large. The information sources like websites, web portals, tourism liaison offices, and extensions lack real-time updated information which is scattered, fragmented, and have a repetitive low quality of information. Table 4. summarizes the problems existing in the tourism sector of Nepal as shown above.

Table 5: Resolution for Tourism Industry and Digitalization Scenario

Formulate a policy that has ICT as the main component and revolves around the tourism business
Prioritize security, privacy, and confidentiality as the major concern of the digital economy
Educate the mass, provide training, workshop and promote digital culture in the country
Build a national network of tourism industry integrating all the small and big enterprises
Build a data center and utilize the current computing trends in AI, Social computing to enrich data.
Develop an R&D cell that works continuously to address growing demands of data and information
Build a model to standardize data and information after validation and verification of the sources.
Build infrastructure with quick data update and information on various tourism issues including risk.
Build at least basic infrastructure like roads, health posts, communication hubs, and information centers.
Make policies so that local businesses and government can benefit from global competitors
Utilize the technologies to promote geographical spaces, biodiversity, and ecological changes.
Create a special tourism management section that caters to quality and risk mitigation scenarios
Enforce E-commerce, e-business, and mobile technology in the tourism business.
Integrate all the fragmented databases and information clusters in the national grid of tourism
Build technological models for addressing the change in climate, natural hazards, biodiversity using active sensors technology, GPS systems, communication satellites.
Increase the potential of electric power using hydro sources, renewable sources, and backup systems
Build good roads and connect major tourism destinations, airports, cities, and travel points.
Build a strong communication network and avail high-speed data availability
Build a mechanism to coordinate between all tourism entities and monitor regularly

All these problems indicate that the foremost requirement of the tourism industry in Nepal is to have an Integrated Information System (IIS) that links up all the necessary industries in the tourism business and services [24]. The Integration model should encompass Federal, State, Municipal, and Rural tourism bodies along with public and private sectors. The implementation of ICT in the tourism industry is just an answer to the current needs of the business. As this industry is fast-growing around the world and there is an increase in competition and demands, a traditional ICT system will not be enough to manage the complex needs of the tourism industry. This requires a

different approach of ICT that can meet the current and future demands. This can be addressed with analysis, design, and development of the Digital Tourism Business Ecosystem. Analysis of feedbacks as the initial solution for the problem is listed in table 5. DTBE model requires an identification of the artifacts of tourism (governing bodies, business and service sectors, tourism consumers, environmental entities, social entities, cultural entities, internet and communication technologies, adaptive computing models, and social knowledge models) that serve as the basic elements of the system. The next phase includes identifying the relationship, cooperation, dependency, association, and relevance of entities with one another to create a system that can be self-generating, self-producing, and self-organizing. A DTBE is a concept derived from the natural ecosystem that follows the principle of natural evolution and survival, therefore, the DTBE model for Nepal must adhere to these principles of the digital business ecosystem.

C. Digital Tourism Business Ecosystem Models

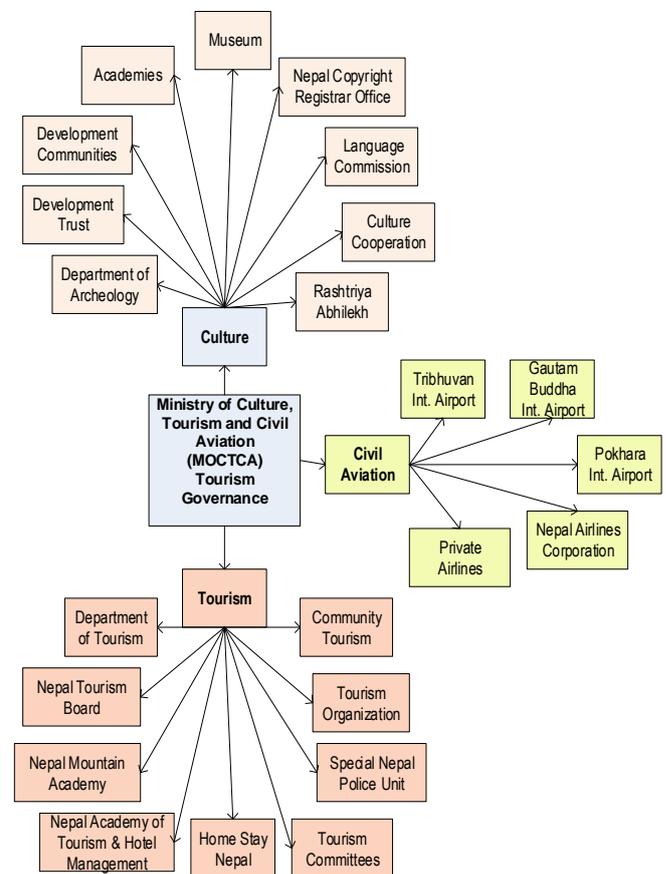


Fig. 8: Tourism Governance Taxonomy Layer 1

Building a taxonomy of concepts is a way of converting a generalized model into an equivalent digital conceptual class model of the system under consideration. Figure 8 represents the taxonomy of tourism governance of Nepal. It can be seen that MoCTCA has three important wings that include culture, tourism, and civil aviation. The culture has further had 9 sub-divisions that look at different aspects of cultural tourism and its related aspects in Nepal. Civil aviation has 5 sub-divisions that include airports, Nepal airlines cooperation, and private airline management. The tourism subdivision consists of 9 subdivisions in which the

department of tourism is the most important division. This division is the primary body that coordinates all the other bodies. Nepal tourism board is an independent body that comes under the department of tourism and is responsible to promote and provide necessary input in the growth of tourism in Nepal. Besides these, the other divisions have their own ToR and work to develop the overall tourism of Nepal.

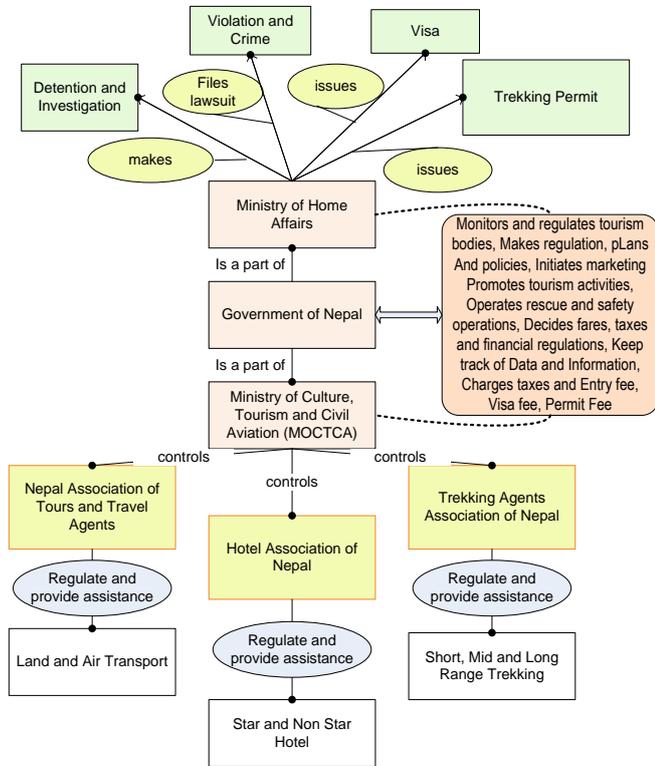


Fig. 9: Tourism Governance Taxonomy with associated Business Organizations

The Government of Nepal (GoN) is the apex body that is responsible to form policies, regulations and implement a strategy to promote and develop tourism in Nepal [24]. It regulates, monitors, and manages tourism-related activities through its different departments and authorized bodies. Figure 9 depicts GoN linked to MoCTCA and the Ministry of home affairs as the first entities that are responsible for the management and governance of tourism in Nepal. The Ministry of Home affairs is linked to the department of immigration that is responsible to check the validity of tourists and allow entry and exit in Nepal. Besides Visa, this body is responsible to provide trekking permits, check for immigration rules and file petitions in case some tourist violates the rules. Further, the MoCTCA is responsible to manage and look after the tourism-related activities in Nepal. The MoCTCA regulates and implements its rules, regulations, and policies through different government bodies and recognized travel, hotel, and trek associations. Tourists are the central entities of the tourism business and their needs and priorities are the base of the tourism industry. The analysis of tourist data in Nepal was used to build a taxonomy of tourist relationships and needs for the tourism industry. Figure 10 depicts the relationship of tourists with 12 different entities related to tourism business and management. These entities are directly in contact with tourists in the form of product, service, or supporting entities to provide the tourist with requested service in tourism

destination. Each entity has some information to share that forms the basis of tourist needs and helps tourists to make a relevant decision about a product or a service. These entities are real-world objects that are represented as equivalent concepts in the computer digital representation.

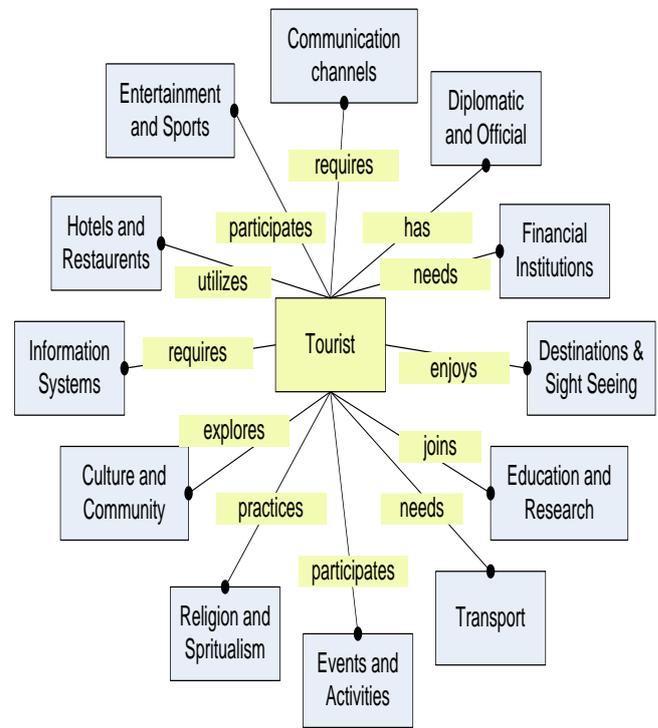


Fig. 10: Taxonomy tourism Concepts and Artifacts for Digital Tourism Business Ecosystem Model.

The changing scenario of tourism business and technological development has changed a tourist into a complex consumer who has immense power and choices for products and services in his hands [25]. Figure 11 represents a taxonomy of tourist needs and coevolution of digital technology with new digital demands in business models. As it can be seen from the figure that a new tourist has become a complex consumer with multifaceted needs and demands due to technology innovation. The needs have grown from socializing, sharing, telling stories, advertising, satisfaction measurement, to discovering and exploring places. A tourist consumer has immense reach and information to explore for better quality and price. The techno-oriented environment has created so many challenges in term of technology adoption that a business sector is unable to ignore it. The technological ability to pool services, empowered with digital media, web 2.0, and mobile technology has almost new dimensions of business and business models. There is a disruption of the traditional business model with a new form of supply chain and business models that demand interoperability, dynamic adjustment, reputation building, multichannel communication, analytical monitoring of 'tourist' Big data, and standardization. The figure below captures the tourist demands and the components that need to be addressed for the design of DTBE for Nepal. The human needs due to digitalization and changing business demands are serious aspects to look at and address in the ever evolving technological world. Those business who have ignored these changing aspects have either witnessed loss of

market of poor growth in their business. Tourism is the most critical industry that cannot ignore these changing business dynamics as it is not only related to the local business competition but is also under constant pressure from the global competitors. It can be seen that the last few years have brought a digital boom with the integration of social sites, payment systems, big data systems, and business analytics that keeps business houses forcing to adapt to changes or lose the advantage guaranteed by these systems. Intercultural digital penetration is a big challenge that is posed by digital technologies and forces local businesses to match up to global standards. Tourists visiting from developed countries or economies look for sophisticated demands and in case these are not existing in a tourism destination, it affects the marketing value and popularity index of the destination. Hence, the implementation as a Digital Tourism Business Ecosystem is capable to force these changes in the local market as well, as the local

business is also a part of the big integrated chain of digital business species. A good example of such enforced technology in Nepal is seen in the case of digital payment systems. Mobile payment systems like WeChat and Alipay were used by Chinese customers to make payments. The local business owners approached for partnership with Chinese tourism business personnel to arrange for these type of transactions as it was the need of the Chinese customer. This finally created pressure on the Government of Nepal and it allowed the local Banks and digital payment system to provide the solution for this problem. Hence, the global pressure forced the local businesses, government, and international business houses to find a solution to this problem and provide this service in Nepal. Thus proving that digital species enforce change or arrange for the change in a digital environment, which is a specialty of a Digital Business Ecosystem Model.

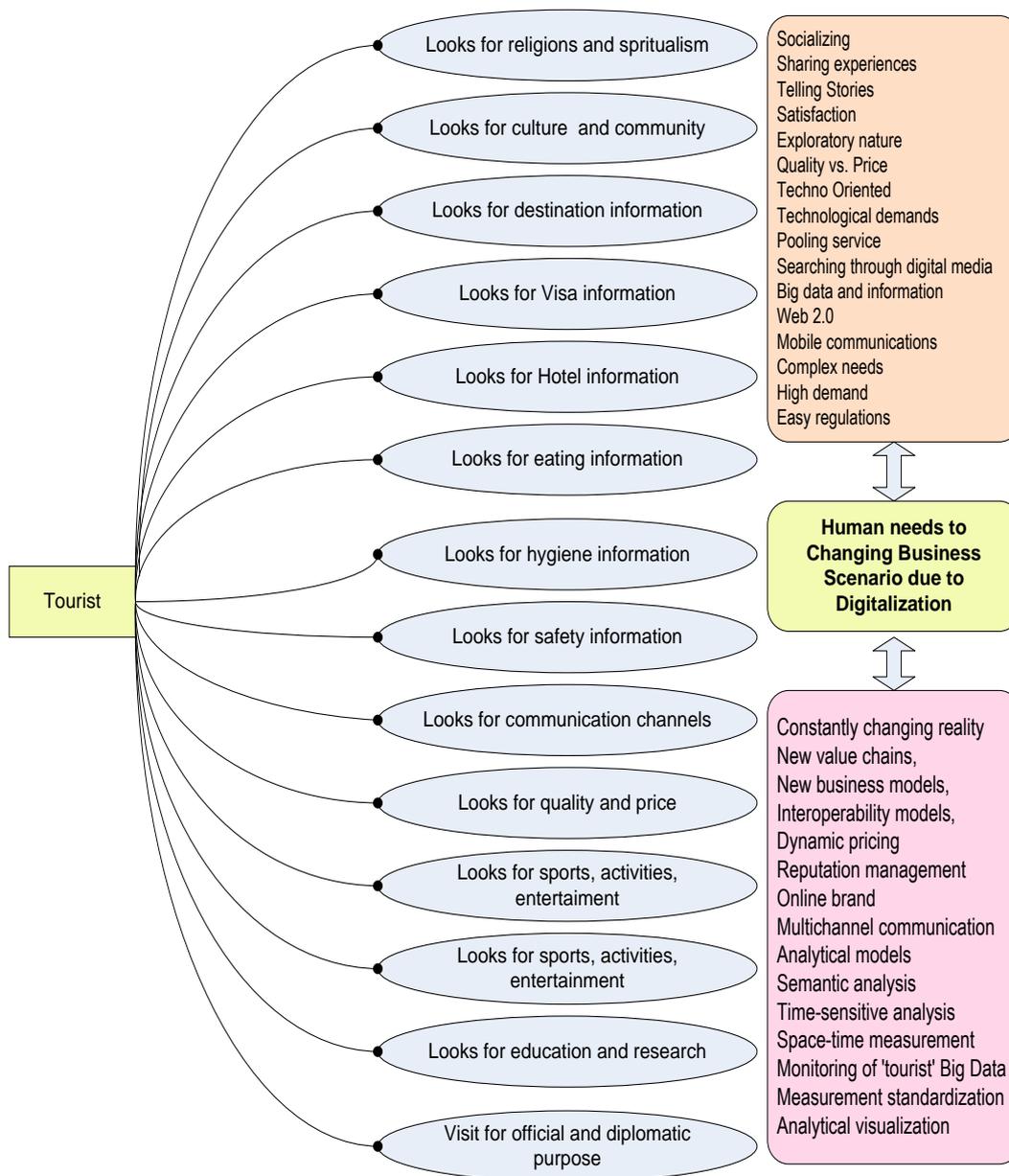


Fig. 11: Taxonomy of Tourist needs and Digital demands

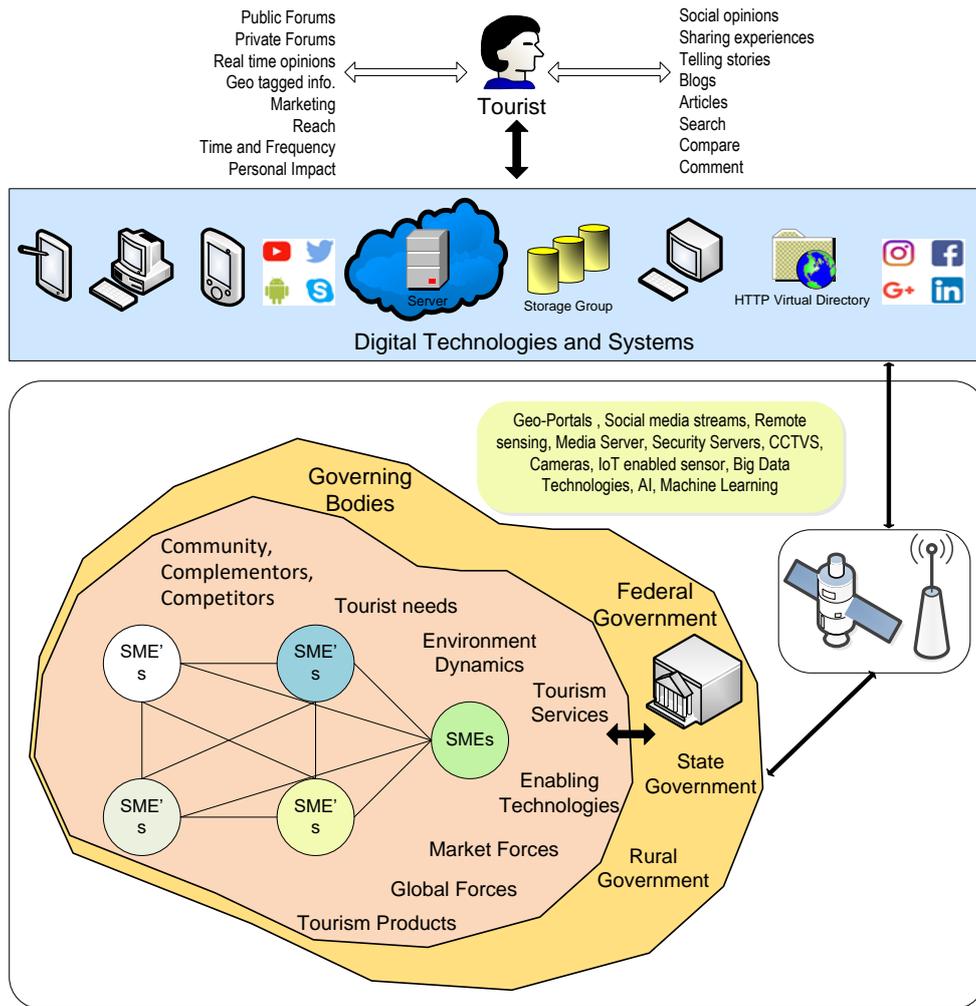


Fig. 12. Proposed Conceptual Framework of Digital Tourism Business Ecosystem

Digital Tourism Business Ecosystem Model for Nepal is a layered design process where the different levels of governance and management entities must be considered. Figure 12 proposes a Conceptual Framework for a DTBE which is shown as a layered design. The innermost layer depicts the big and small business organizations that are linked with one another through digital technology to share data and information and co-evolve with one another. This layer is populated with concepts that include community, complementors, competitors, tourist needs, environment dynamics, tourism services, enabling technologies, market forces, and global forces that make an impact on the tourism business. The business layer is the next layer, which consists of governance that controls and manages the tourism business of Nepal. This layer consists of Federal, State, Municipal, and Rural governing bodies. Coining policy, framing strategies, making laws, and monitoring the overall business of the country is on the shoulders of these bodies. The two layers are interlinked with one another and tourists through digital and communication mediums. The next layer consists of communication technologies that enable the other two layers to get connected through it.

This layer is represented as a rectangular boundary and a third layer that combines two business layers connected through communication channels and the current

technologies in existence. The uppermost layer depicts enabling tools and technologies that are used by tourist and tourism business and governance entities to communicate, utilize, explore, consume, manage, govern and administer the tourism product and services. As tourist is the central entity of the tourism business, the influencing factors and attributes associated with tourist are shown in the left and right side of the tourist entity. A Digital Tourism Business Ecosystem must consider all these factors in the current business scenario to survive and take a competitive advantage in the short and long term.

D. Digital Tourism Business Ecosystem Implementation Model

Implementation of DTBE is a big challenge and many crucial issues need to be considered while designing, mapping, and implementing it. The first important aspect to look at is identifying the species that consume the products and services from the environment based on some rules. The participating species must belong to some domain and must play an important role in the balance of an ecosystem. In the context of tourism, a tourist is a species that belongs to a consumer class and consumes tourism products and services by paying for them and participating in them. On the other hand, the tourism service providers and tourist products are another set of species that belong to the

producer domain and produce tourism products and services to be consumed by the species tourist. The producer class charges in favor of products and services consumed by the tourist and vice versa. In terms of DTBE, the producer class produces products and services that it advertises using digital media. The consumer identifies and books for the products and services through communication channels and digital media. The records of arrangement and schedules are all get stored in digital media and are used as a reference in the future. The consumer class tourist on a scheduled travel date uses this stored information to start with the trip and uses digital technologies to make payment, arrange for the destination, search information, and communicate at different levels. Similarly, the other species also use digital technologies and systems to track the tourist, booked

products and services, monitor, track and manage his records. The travel data of a tourist in his course of journey provides feedback to the service entities to discover information patterns, travel behavior, consuming patterns, and demographic correlation. On the other hand, tourist provide feedback, share experiences, rate product and services, and make recommendations for the tourism business sector to grow, making a consumer-producer chain complete as in biological ecosystems. Figure 13 identifies the core species and environment in a distinguished domain and shows how and it way they are dependent on each other. It also elaborates on the associated digital entities that are related to the consuming and producing species forming the interwoven structure of Digital Business Entities that on the whole represent a Digital tourism business ecosystem.

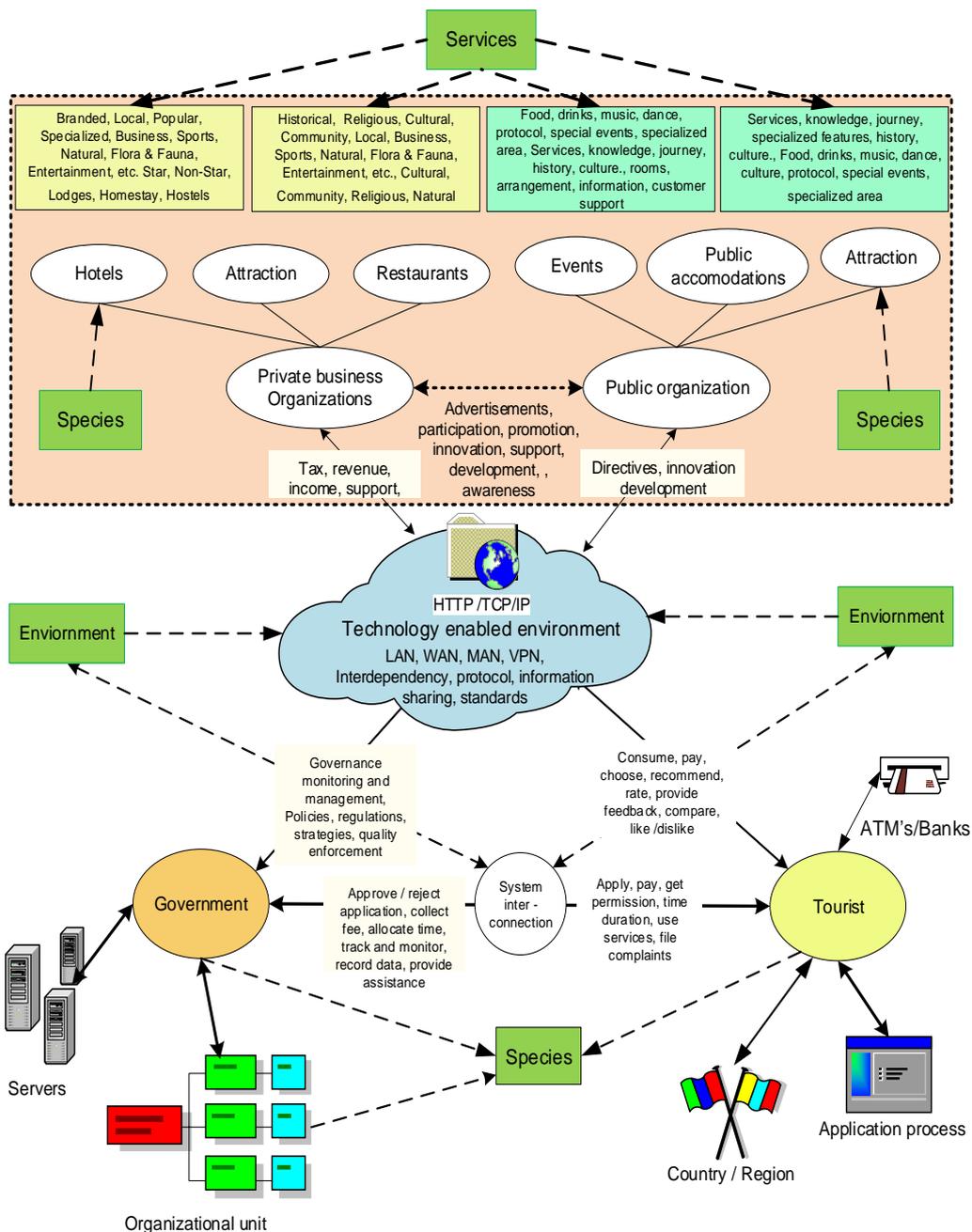


Fig. 13: An Analogy and Implementation Model for Digital Tourism Business Ecosystem

E. The Resource Selection Model for DTBE

Digital Business Ecosystems are crucial due to resource requirements. A proper analysis in terms of resource modeling is crucial to guarantee the success of an organization. Analytical Hierarchy Process Model is a good model that can help in multi-criteria decision-making regarding resource allocation. To extend our explanation of the concept we have used an example of the selection of the internet as a resource to make an optimal decision. Table 6 represents five top ISP of Nepal, which we utilize to demonstrate our concept. Table 7 represents a pairwise comparison of three criteria and table 8 represents Normalized Pair-wise Comparison Matrix.

Table 6: Representing 5 top internet service providers for Internet lease compared with three characteristics

Company	Speed	Time	Amount
World link	60 Mbps	12 Months	Rs. 26,000
Vianet	60 Mbps	13 Months	Rs. 19,140
Classic Tech Home	60 Mbps	14 Months	Rs. 18,000
Subisu	75 Mbps	12 Months	Rs. 22,290
Nepal Telecom	55 Mbps	12 Months	Rs. 18,400

Table 7: Pair-wise Comparison Matrix

	Speed	Time	Amount
Speed	1.00	9.00	9.00
Time	0.11	1.00	2.00
Amount	0.11	0.50	1.00
Sum	1.22	10.50	12.00

Table 8: Normalized Pair-wise Comparison Matrix

	Speed	Time	Amount	Criteria Weights
Speed	0.8182	0.8571	0.7500	0.8084
Time	0.0909	0.0952	0.1667	0.1176
Amount	0.0909	0.0476	0.0833	0.0740

Table 9: Criteria and Weights

Criteria	Weights
Speed	0.8084
Time	0.1176
Amount	0.0740

$\lambda \max = 3.0546$

$Consistency\ Index\ (C.I.) = (\lambda \max - n)/(n-1)$

Where n is the number of compared elements = 0.0273

$Consistency\ Ratio = Consistency\ Index\ (C.I.) / Random\ Index\ (R.I.)$, where RI for $n=3$ is 0.58

$= 0.047057072 < 0.10 \dots \dots \dots (1)$

It can be seen from Table 9 that, since the value of Consistency Ratio (CR) is 0.047057072 for the proportion of inconsistency CR is less than 0.10 which is the standard, we can assume that our matrix is reasonably consistent. So, we may continue with the process of decision-making using AHP. Based on the requirement of the peer, these criteria weights can be used by the decision-maker for further calculation. From the table, speed has been given 80%

weightage, the time has been given 11% weightage and the amount has been given 7% weightage, where speed represents the time to service, time is representing the time for which the internet lease is bought and amount describes the payable amount for buying the internet service. This model serves as a good tool to further enhance the cost-benefit analysis design of digital tourism business ecosystems.

F. Challenges of Digital Tourism Business Ecosystem

The design and implementation of the Digital Tourism Business Ecosystem is a challenging task. The first challenge to the system is in terms of government regulations and policies. As these systems are interoperable, a robust policy and regulations are required to deal with any disputes at the operational or managerial level. The nature of this system is that they are dependent on one another and tightly coupled to execute any business functions, hence a robust architecture with an uninterrupted service guarantee is the most important requirement as well as poses as a challenge. Clear operational, financial, legal guidelines and privacy must be guaranteed as a primary condition between these systems to be operational. Technical support, robust architecture, resource optimization, and resource allocation are some of the other primary challenges. Besides the above issues, education, mass training, promotion, and application of digital technologies in the tourism business is a mandatory requirement for proper implementation of DTBE.

V. CONCLUSION

The study brings out the need for a digital business ecosystem for the tourism industry of Nepal. The work successfully demonstrates different artifacts, taxonomies, and implementation aspects of a Digital tourism business ecosystem with relevance to changing business and technology development scenarios. The study is built on one-to-one interviews of ICT and Tourism industry experts of Nepal, which makes it realistic and fit to use in the current time. The work further, practically shows the relevance of Analytical hierarchical processing as a resource selection model for critical resources and how to optimize them. The design consideration taken care of during the study makes the research a good source of knowledge for DTBE designers. Overall, the paper identifies the needs of the digital ecosystem as a technology for future digital system implementation and sustainability. The work serves as an important input for further detailed analysis, design, and development of DTBE for Nepal.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare. The authors confirm that we have no affiliation with any organization with a direct or indirect financial interest in the subject matter discussed in the manuscript.

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