



Kurdistan Rural Information System Platform, as a New Rural Innovation Paradigm: Local Decision-Makers Perspective

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RESEARCH ARTICLE

Abstract

Background: This study aimed to achieve objectives through SWOT analysis and focus group discussion, identifying internal and external factors through the local decision-makers in Kurdistan Region, to explore the way to describe and analyze Kurdistan Rural information System Platform (KRISP). Problems with information in rural areas still exist in the Kurdistan region administration. The aim of this study is an attempt to develop a digital platform that will help rural communities realize their full potential and contribute to a resilient and successful digital future. The primary objectives of this project are how to design and implement an agricultural information system to collect rural data from various areas by various farmers and make it available online so that future users may eventually search for and obtain the essential data. The first category is concerned with knowledge sharing, information exchange, self-improvement, and self-improvement for grassroots extension practitioners. The study made use of qualitative data, with fixed questions. for the analysis. The achievement of primary data was also collected using a FGD's implemented in Sulaimani governorates. The period of data collection from different study areas starting from June 2023 to September 2023 and were used in this study to collect qualitative data from a variety of government sectors (decision-makers) from various organizations were included in group discussions and gatherings to address the issues highlighted in this study.

Keywords: rural innovation, rural management, thematic analysis

INTRODUCTION

There are many definitions regarding rural areas conducted; According to the Food and Agricultural Organization (FAO) definition of Rural area is a "Place has a fundamental role in defining what constitutes a rural area, it is determined in relation to an urban region". An appropriate definition will be able to describe how different parts of rural areas differ from one another. In addition to being able to differentiate between urban and rural areas. This entails developing a terminology that may characterize rural areas as a continuum as opposed to grouping them all under a single heading (FAO, 2018). "Rural refers to any area, population, and kind of dwelling that is not urban". Due to varying national coverage, the population's total may not be equal to the sum of its urban and rural parts (World bank, 2020). It is useful to use the definition of "rural" as the starting point for suggestions and laws that will have an impact on underserved communities (Couper 2003). The two geographical parameters of density (or population size) and distance-to-density (or distance to an urban center) are frequently used to describe rurality (Banack and Pohler, 2023). With digitization,

Received: 15 February 2024

Accepted: 13 March 2024

Published: 15 May 2024

DOI:

10.15835/buasvmcn-hort:2024.0004



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the connection between swift social change and technological advancements is highlighted since it permeates all social sectors and affects practically every aspect of daily life, demonstrating that technology and society are not separate. Digitalization has a significant influence on society and encourages convergence in several industries (Stojanova et al. 2022). Rural communities are still geographically and technologically remote from urban centers. One of the longest-running arguments about rural development and technological issues (Cowie et al. 2020). Rural innovation (RI) is a theoretical area that has only been tangentially explored (Barrera- Perales and Burgos, 2022). The prosperity has been largely attributed to the external forms of change that have emerged as we have grown increasingly insulated from its risks (Valverde, 2016). The rural innovation, its creation, and its dissemination are at the heart of these processes of development and change (Madureira and Torre, 2019). Over time, innovations find their way into the social system through a process known as diffusion. The diffusion, spread, or adoption of new information or a new product can be seen as social change (Räisänen and Tuovinen, 2020). Even while access metrics indicate that rural areas are connecting, the quality of the connection is still an issue, and in this case, the digital divide continues to be a key factor separating urban and rural areas. (Muinuddin, 2021). Rural areas have had difficulty keeping up with the quick advancements in broadband access since they generally have lower rates for internet use and adoption (Obgo et al. 2018). Rural areas are isolated and typically have fewer connections. In rural regions, internet access can offer information and services that might not otherwise be available. However, there are still some problems that are difficult to resolve. Faster internet technologies, for instance, are becoming available, but they will cost more for rural businesses and people than for those who live and work in cities. Due to where they live, people in rural areas could also have fewer options when choosing a broadband provider (Räisänen and Tuovinen, 2020). Network infrastructure deployment in rural areas is usually more expensive than in urban areas. Furthermore, demand is typically smaller in rural areas. Network deployment to a residence outside of a village or town is far more expensive than network deployment within a town or village. Low-income and rural residents typically struggle with access issues due to spotty or nonexistent connectivity. Due to obstacles including low user density, poor income, and remote, difficult-to-reach rural locations, access to the internet in these places is difficult (Villapol et al. 2018). Rural areas lack equal chances considering digitalization compared to urban areas since infrastructure is frequently weak, internet connections are sluggish, and fast broadband connections are more costly. The "Information System" and "Information Technology" share the word "information," they are often used interchangeably. Information Technology is a subset of information systems, which are made up of people, machines, processes, and information technology itself (Farooq et al. 2019). Information systems are a group of interconnected elements that work together to gather, analyze, store, and distribute data to assist organizational decision-making, coordination, control, analysis, and visualization (Bourgeois, 2014). Rapid development of the rural information infrastructure. Currently, information technology (IT) plays a huge part in human activity. According to (Asniarti and Muda, 2019). IT has been a critical enabler for business activities that significantly contribute to the fundamental changes in structure, operations, and management organization. The word "ICT" is used to refer to a wide range of technologies, including radio, satellite, mobile, and electronic money transactions 2015's (Dlodlo and Kalezhi, 2015). The main applications and facilities of information and communication technologies in developing countries are lacking, especially in rural areas where people lack access to and approach to use such technology and obtain information about the socioeconomic conditions of various countries. This is one of the differences between developed and developing countries (Chhachhar, 2013). A significant government agenda item is rural development. Government and non-government organizations use information and communication technologies (ICT) to develop rural and urban areas (Aditi and Ajankar, 2021). In industrialized countries, ICT has been shown to be crucial to the development of geographically dispersed rural populations, and it is gaining appeal in underdeveloped countries (Pramanik et al. 2017). Government management personnel must disseminate and promote production technology information. Since the Internet is used for most of the information distribution nowadays, less paper waste and pollution from the environment can be caused. Network file transfers are more effective, and archive queries are more practical (Jiang, 2022). The platform for village information management modifies the structure of information distribution and gives average villagers, a way to get information and get in touch with leaders at the grassroots level by ensuring information openness and positive interactions between villagers and the government. It enhances villagers' engagement in rural management (Ye and Yang, 2020). There is the remote area Considering its multifaceted nature and significant in sustainable rural development (Burja and Burja, 2014). Since sustainable development (SD) and RD are closely related, rural development should likewise incorporate the principles of sustainable development. Numerous scholars stress that a sectoral shift is to blame for the decline that many rural areas in affluent nations are going through. Conversely, there is a suggestion that digital technologies can assist rural communities in overcoming these obstacles (Stojanova et al. 2022). However, problems with information isolation and information separation still exist in the Kurdistan region administration, notably in all its ministries related to rural areas. The rural area of KRG. still lacks a database for (collecting, processing, and analyzing data as a type of information service). To protect farmers from being misled and hurt by inaccurate information, as well as to ensure they may obtain information at the lowest possible cost, it is always difficult to check the information's legitimacy, accuracy, integrity, and timeliness. The aim of this study is an attempt

to develop a digital platform that will help rural communities realize their full potential and contribute to a resilient and successful digital future. It's reflection of committed efforts to comprehend the requirements and difficulties that are particular to rural areas while creating digital platforms that improve the accessibility of information and services for rural residents. The primary objectives of this project are how to design and implement an agricultural information system to collect rural data from various areas by various farmers and make it available online so that future users may eventually search for and obtain the essential data. The first category is concerned with knowledge sharing, information exchange, self-improvement, and self-improvement for grassroots extension practitioners. This research also tries to emphasize the importance of agricultural information systems in agricultural progress. It also evaluates the systems' strengths and weaknesses and makes recommendations for improving their functionality.

MATERIALS AND METHODS

Geographically, the Iraqi Kurdistan Region is in northern Iraq, in the southern Kurdistan region (northeastern Iraq) (Hawez et al. 2020). Kurdish Regional Government (KRG) oversees several institutions and runs Iraqi Kurdistan as a semi-autonomous area. Kurdistan is a federal region (Baban and Askari, 2019). According to (Harun et al. 2015), the region has a 42,812 km² area. The four provinces that make up the IKR are Erbil (the region's capital), Sulaymaniyah, Duhok, and Halabja (Hawez et al. 2020); (Al-Quraishi et al. 2021). The Kurdish name for Sulaymaniyah Province is (Silêmanî) (Ahmed, 2016). Sulaymaniyah is a province in the IKR, which is a region in northern Iraq (Amin Al Manmi et al. 2019); (Mohammed and Rasul, 2019); (Neima and Hassan, 2020); (Hama Sharef and Oguz, 2020); (Al-Quraishi et al. 2021); (Rashid, 2021); (Qader et al. 2023); (Ways and Ibrahim, 2023). The Sulaimani Governorate is situated in the eastern region of Iraq's Kurdistan Region, close to the Iranian border (Neima and Hassan, 2020); (Tahir and Rashid, 2023). Sulaimani Governorate is situated southeast of Iraqi Kurdistan and in the northeast of Iraq (Mohammed and Rafaat, 2022). The largest province, comprising two-thirds of the IKR, is Sulaymaniyah (Ahmed, 2016); (Baban and Askari, 2019); (Alkaradaghi et al. 2019); (Mohammed and Rafaat, 2022); (Qader et al. 2023) Figure 1. Show the Location of the study area in Sulaimani Governorate, Kurdistan Region of Iraq.

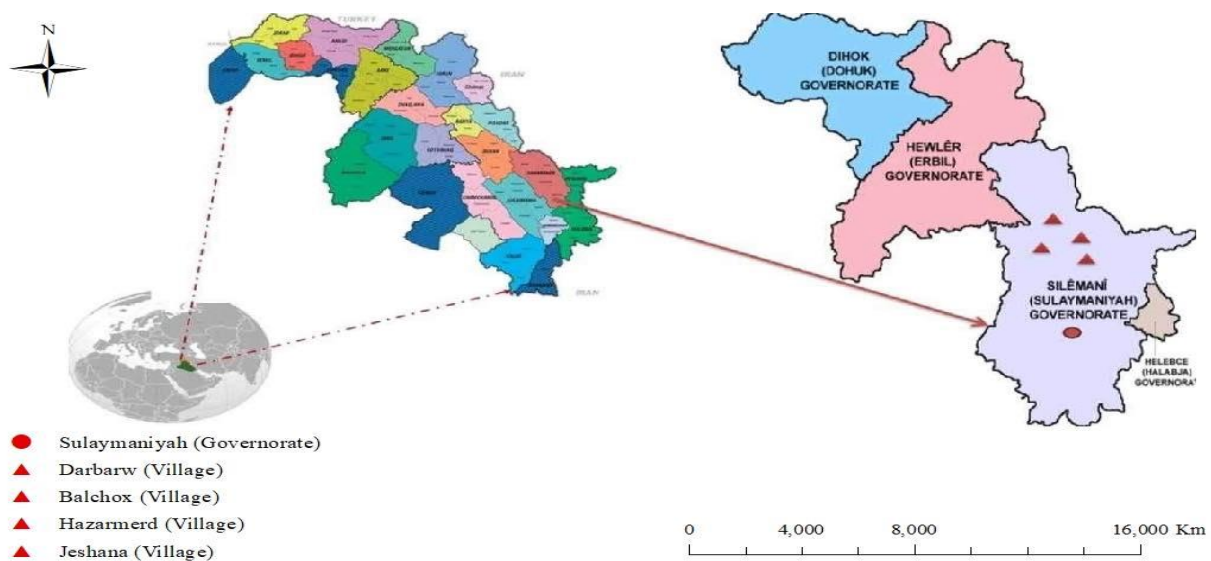


Figure 1. Location map of the study area in Sulaimani Governorate, KRG- Iraq. Via (Harun, 2014).

The methodology for this study includes both primary and secondary data collection techniques, along with qualitative and quantitative analysis strategies. SWOT Analysis and Thematic analysis were employed in this study. This research focuses on the strengths and possibilities to provide an electronic government model for the KRISP while considering the diverse demands of the direct actors, legislation, and rural developments. The conceptualization and identification of the platform's functional needs, done in a way that meets the expectations of the numerous direct actors, begins with an understanding of the KRISP's capabilities and possibilities. To identify and model the processes. The SWOT is a qualitative analytical tool that many firms are familiar with and frequently use, its analysis tool was first developed using company management and organizational development techniques

that have been used in the United States since the 1960s (Knierim and Nowicki, 2010), (Lin and Chiang, 2022),

Thematic analysis is a common and useful method for examining qualitative data (Sharma et al. 2023). The chosen tool obtained firsthand inputs that supported the inductive approach of a thematic analysis because participants shared their perspectives on the digitization of their enterprises (Zulu et al. 2023). It has been used in a variety of research related to social issues and settings. Particularly, organizational knowledge management and education have benefited from its application can be approached in a variety of methods (Ozuem et al. 2022); (Perera, 2023); (Alhaou, 2023). Researchers can present their interpretation of a qualitative dataset by using TA, a potent analytical technique, to identify patterns based on themes and determine the significance of qualitative data (Kampira, 2021); (Christou, 2022); (Yanto, 2023). The quality and richness of the data are crucial factors in qualitative analysis. Rich qualitative data that is gathered will therefore make in-depth and sophisticated analysis easier (Cernasev and Axon, 2023). A well-crafted theme analysis elucidates and elucidates the data rather than merely summarizing it (Tahir, 2023), methodically go through its six steps: construction of transcripts, familiarization with the data, quotation selection, identification of keywords, selection of codes, development of themes, conceptualization through interpretation of keywords, codes, and themes, and, at the end, the creation of a conceptual model (Byrne, 2021); (Naeem et al. 2023), Figure 2.

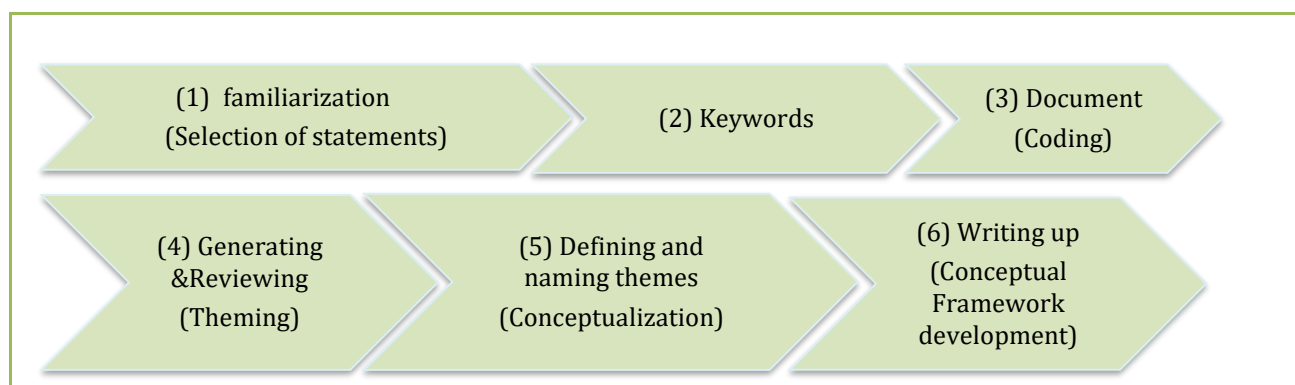


Figure 2. Various steps are involved in a Thematic analysis process.
Source: (Sharma et al. 2023) and (Naeem et al. 2023)

Focus group discussions (FGDs) were applied for collecting primary data from this research which was defined as when people with comparable backgrounds or experiences are brought together to explore a particular topic of interest. They are questioned about their views, attitudes, beliefs, opinions, or ideas in this type of qualitative research. Participants are permitted to converse with other group members during focus group talks, which, in contrast to other research methodologies, promotes conversation amongst participants. It often entails group interviews, with typically 6 participants in the group. A moderator (interviewer) guides the discussion, which is loosely organized and covers a range of interesting subjects. Additionally, as FGDs were structured and directed, but also expressive, they yielded a lot of information in a relatively short time. Therefore, FGDs were a good way to gather in-depth information about a rural community's thoughts and opinions on a topic. The course of the discussion is usually planned, and most moderators rely on an outline, or guide, to ensure that all topics of interest are covered. The study made use of qualitative data, with fixed questions. for the analysis. the achievement of the established objectives of this study, primary data were also collected using a FGD's implemented in Sulaimani governorates. The period of data collection from different study areas starting from June 2023 to September 2023 and were used in this study to collect qualitative data from a variety of government sectors (decision-makers) from various organizations were included in group discussions and gatherings to address the issues highlighted in this study. There were around 6 decision-makers from the General Directorate of Agriculture in Sulaimani Governorate who participated in this study in the form of FGDs in the primary data collection process (Table 1).

Table 1. The coding of participants and their locations.

Title	Code
Decision Maker- Deputy Director General of Agriculture in Sulaimani Governorate	DM-GA
Decision Maker-Head of Planning and Monitoring Department	DM-PM
Decision Maker-Head of Livestock Department	DM-LI
Decision Maker- Director of Horticulture	DM-HO
Decision Maker-Head of Agricultural Services Department	DM-SE
Decision Maker-Chief Engineer advanced\ Department of Plant Protection	DM-PL

Decision makers group including: (Deputy Director General of Agriculture in Sulaimani Governorate, Head of Planning and Monitoring Department, Head of Livestock Department, Director of Horticulture, Head of Agricultural Services Department, Chief Engineer advanced\ Department of Plant Protection). The participants were coded according to their job titles and locations as shown in Table 1.

RESULTS AND DISCUSSIONS

For this study, gathering primary data required to explore and understand the current situation of the Kurdistan Rural Information System Platform (KRISP) in the rural area of Sulaimani Governorate about the data and information in the rural area and agriculture sector may be aided by this comparison with SWOT analysis (Figure 3). Therefore, separating the answer for each objective may allow us to reach an accurate conclusion. Besides that, different sessions of FGDs for 6 decision makers were conducted.

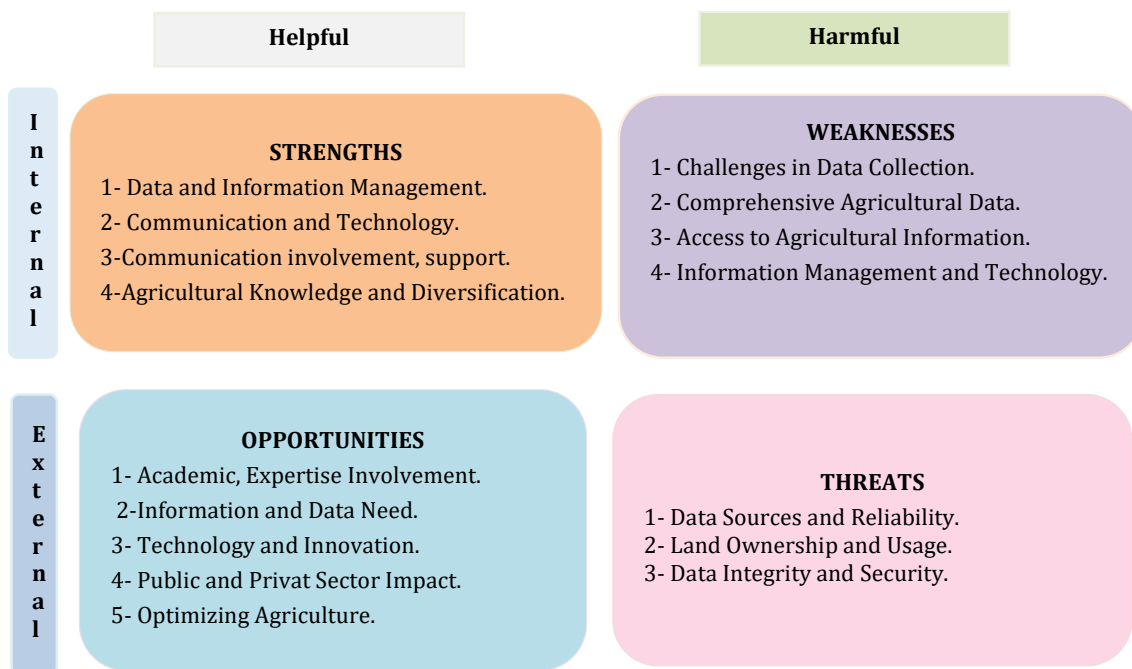


Figure 3. participants conducting through SWOT Analysis by FGDs.

For a thematic analysis, several themes pertaining to agriculture, data, technology, and farmer support were based on the codes that have been provided. Here are themes that conclude and conceptualized from SWOT analysis:

Strengths

The participant-provided codes support the analysis of the study's themes and allow for the identification of points. Nowadays, the agricultural industry exhibits many strengths that contribute to the advancement of rural areas within the region. Consequently, policymakers have recognised this as a vital factor in initiating a new way aimed at supporting and developing the growth of these rural regions, as evidenced by the establishment of the KRASP initiative. Additionally, addressing longstanding concerns that have remained throughout the data collection process. The importance of technology in the administration, retrieval, modification, and removal of a database includes agricultural operations, encompassing activities related to plants, animals, land, and human everyday tasks.

To determine several themes from participants strengths in thematic analysis pertaining to information management and agriculture based on the codes that have been provided. Listed below are the themes:

1 - Data and Information Management

The value of comprehensive information in the agriculture sector is the need for up-to-date, reliable information. Nowadays, the requirement to keep current and fix issues with the census is because of the role technology plays in

organizing and providing access to agricultural data. Also, information about local production, including livestock and agricultural projects.

2 - Communication and Technology

The contribution of technology to increased accessibility and accuracy of data. Using structured and effective communication techniques plays an important role in the possible advantages of using contemporary communication technology in the farming process.

3 - Communication involvement and support

Farmers' unions may be able to help with agricultural initiatives, and the growth of associations for the advancement of crop farming and their capacity can lead to assistance projects. In addition, the focus is on stakeholder consultation for project execution and support, including associations and unions of farmers.

4 - Agricultural knowledge and diversification

The requirement for understanding a broad spectrum of agricultural farming. Additionally, the local production and livestock projects provide knowledge of the natural pasture areas found in villages and indicate the significance of sustainable development agriculture. Figure 4 shows the conceptual theme map of Strength by local decision maker participants.

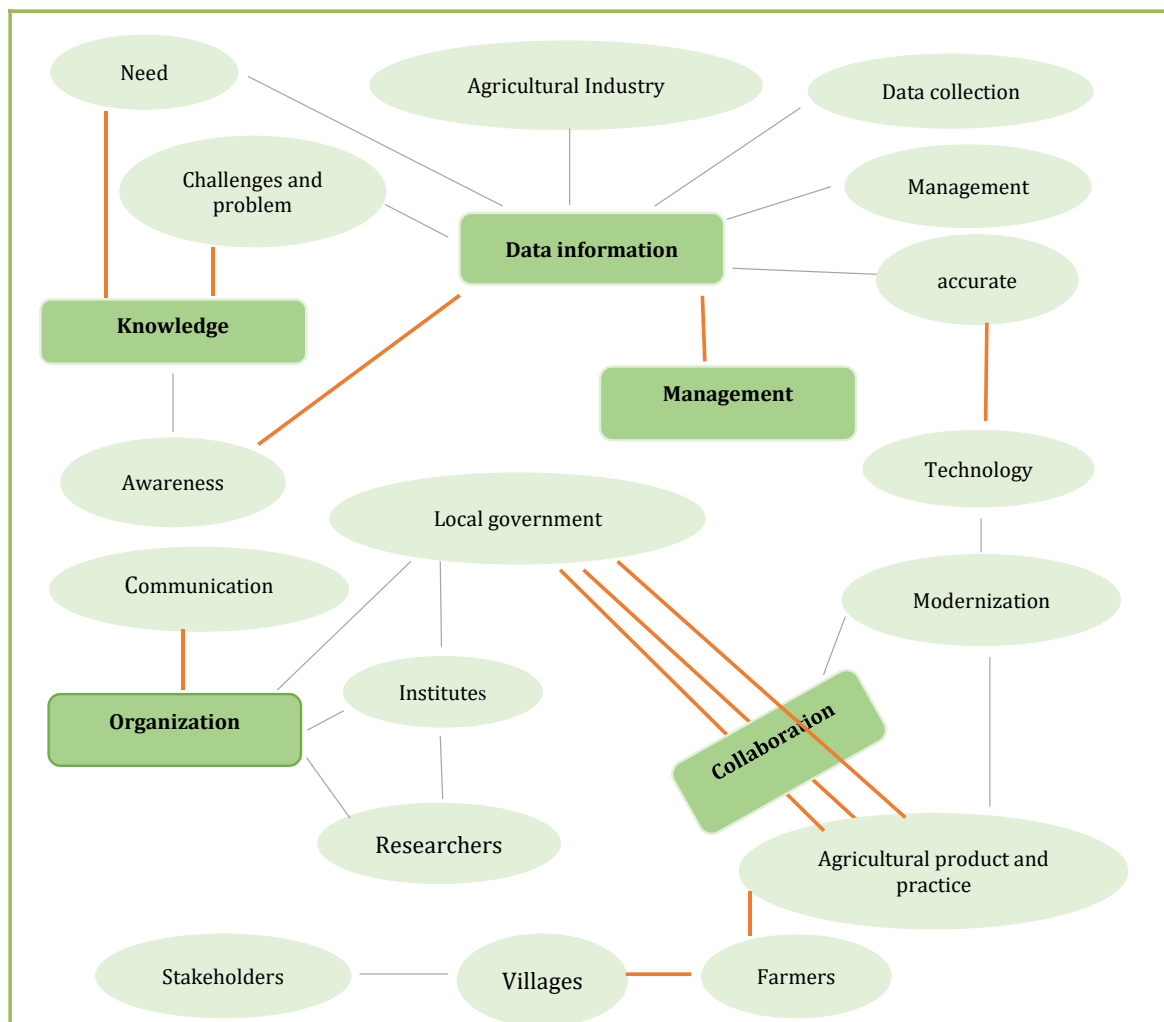


Figure 4. Map of strengths in conceptual themes (Diagram)

Weaknesses

These conceptual themes cover a range of topics related to technology adoption, coordination, obstacles during

data collection, and management in the agricultural industry. Analyzing the data in these categories might shed light on the potential and problems associated with managing and disseminating agricultural data. In the relationship among codes from participant analysis, there are themes that are pointed out as weaknesses of KRASP, as follows:

1 - Challenges in Data Collection

Insufficient funding for collecting data is inconsistently provided, requiring the participation of several people. The concealment of data by villagers during data collection is one of the obstacles. There are many reasons (historical, political, and social) behind these habits of mistrust and the insufficient guarantee of the gathered data.

2 - Comprehensive Agricultural Data

Regionally, the collection of data information about the quality of agricultural products is impossible; it may act as a central for data hubs to gather all agricultural data. The concept of gathering information on farmers, fields, and whether they are suitable for farming.

3 - Agricultural information system

The ability to plan crops on a yearly and recurring basis for databases. Additionally, the necessity for healthy production is limiting the use of pesticides and fertilizers in agriculture. The requirement to research specifics on quarantine regulations and agricultural illnesses. Techniques for obtaining data from the database center to the communities, ensuring the system's statistics are accurate. And sustainability factors to ensure long-term project viability. Also, issues arise from a lack of cooperation amongst government agencies, groups, and farmers. In the inexperience of farmers with technology and communication gadgets. Furthermore, there is weakness in certain rural areas' communication infrastructure, particularly Internet connectivity. The requirement to research specifics on quarantine regulations and agricultural illnesses. Figure 5 shows their Weaknesses for thematic analysis.

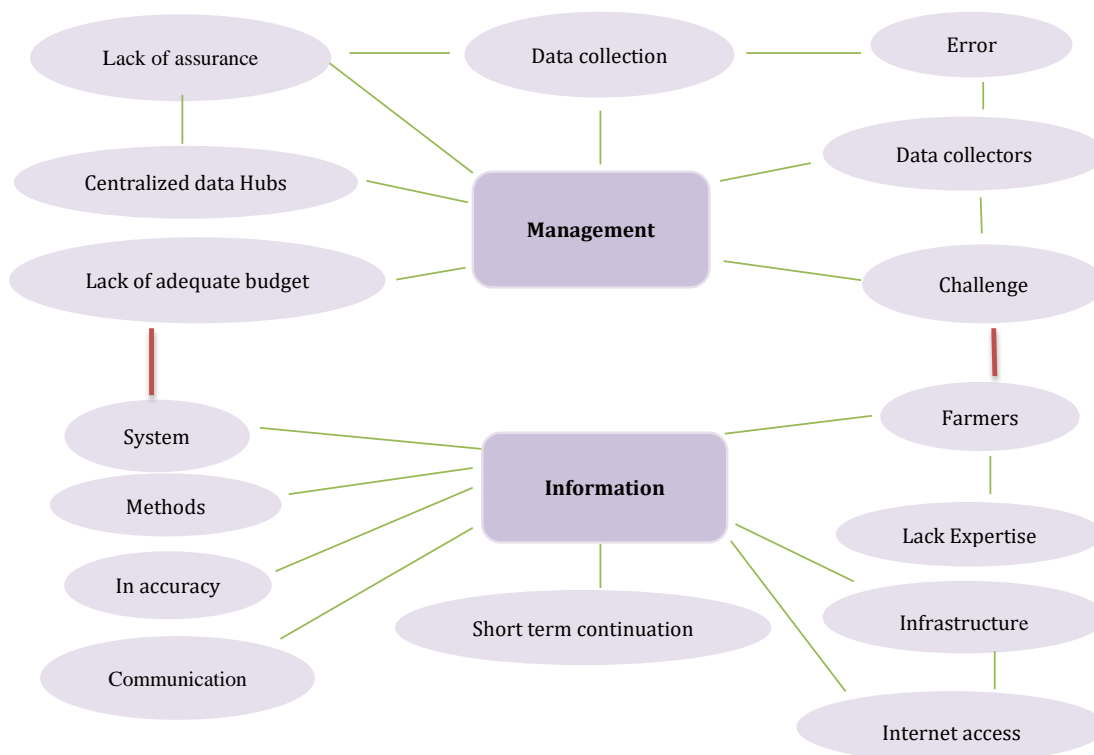


Figure 5. Map of weakness in conceptual themes (Diagram)

Opportunities

These conceptual themes regarding opportunities cover a range of topics related to the agricultural project, such as its possible advantages, information requirements, technological elements, and the contribution of academics to its success. By examining the data in these topic areas, one can gain an understanding of the project's objectives, difficulties, and possibilities, as well as the complex dynamics of cooperation, technological adoption, and data use

in the agriculture sector. The identification of themes was conducted based on the codes related to the availability of information and the importance of obtaining information. Here are the themes presented by Opportunities for optimising KRASP:

1 - Academic Involvement and Expertise

The role of Academics in Providing Expertise and Guidance, and the Importance of Having Access to Accurate and Reliable Agricultural information.

2 - Information and Data Need

The necessity for obtaining statistical data and information is the importance of having access to trustworthy and accurate agricultural information.

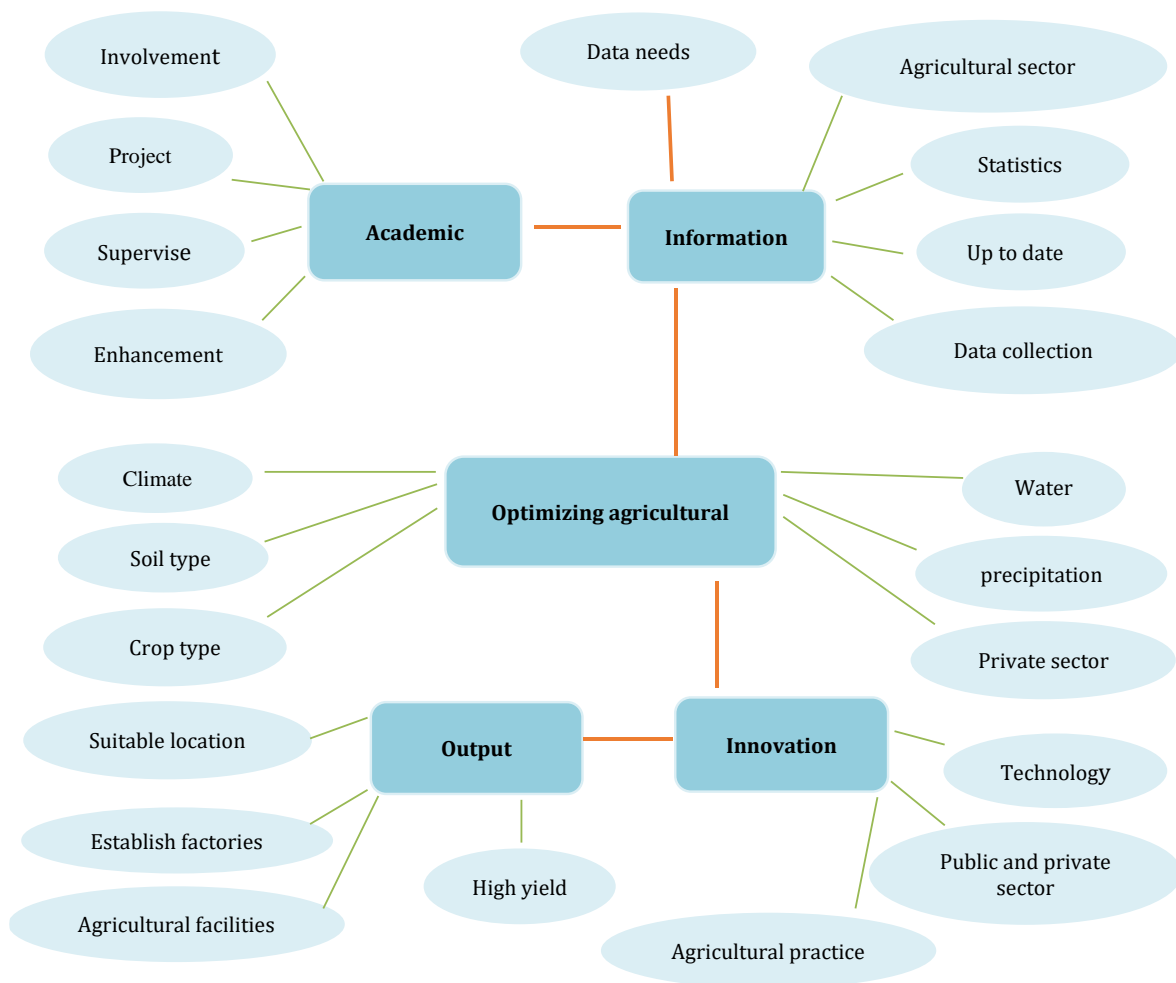


Figure 6. Map of opportunities in conceptual themes (Diagram)

3 - Technology and Innovation

The potential advantages of technology in terms of enhancing accessibility and data accuracy. Identify the suitable factors, such as soil, climate, and water availability, in regionally high-yielding locations for establishing new plants and factories for agricultural facilities.

4 - Public and Private Sector Impact

The sector of agriculture, both public and private, has opportunities to implement and apply the KRASP to have real data for analysing statistics for the executive and legislator from a macro point of view; the significance of accurate statistics for governmental organizations. Furthermore, there is potential for the private sector to guarantee crop

security. How the system advertises and markets the products of farmers.

5 - Optimizing Agriculture

Encompassing several themes of agricultural projects, including its potential benefits, essence of information's, technological aspects of analysing data, and role of academics. These thematic categories can provide views on project goals and challenges to opportunities; Figure 6 show the opportunity them for Thematic analysis.

Threats

Based on the provided codes, it can distinguish themes related to information, such as land issues and the security of data in the context of rural data collection. These conceptual themes cover a range of topics linked to gathering agricultural data, including data accuracy, land-related problems, and data security difficulties. Examining the information contained in these theme areas can shed light on the problems and possible fixes related to agricultural information management.

1 - Data Sources and Reliability

Reliable information in rural data collection is one of the concerns, and the accuracy of the data belongs to the authorities and security forces involvement. Obtaining data from villagers is dependent only on headmen and farmers sharing information. The necessity of data provided by farmers being supplemented with information from pertinent authorities and security forces. Concerns regarding the accuracy and consistency of data gathered from a small number of sources.

2 - Land Ownership and Usage

The land issues in many rural areas make it misleading to obtain inaccurate information provided by farmers. Thus, those villagers are using lands for agricultural activities who do not own land themselves, indicating that the data is nonpotential. Most areas still have unresolved land issues. Farmers' failure to provide pertinent information about the ownership and use of their land, sometimes through informal arrangements of agricultural land by people who do not own it themselves.

3 - Data Integrity and Security

The last one is leakage of data and security weaknesses in the process of data collection for the KRASP project. Anxieties concerning weaknesses in security and data leaks. Also, the significance of protecting sensitive information by preserving agricultural data. In addition, there is the necessity of strong data security protocols to guarantee the accuracy of the gathered information. Figure 7 shows the threats from thematic analysis.

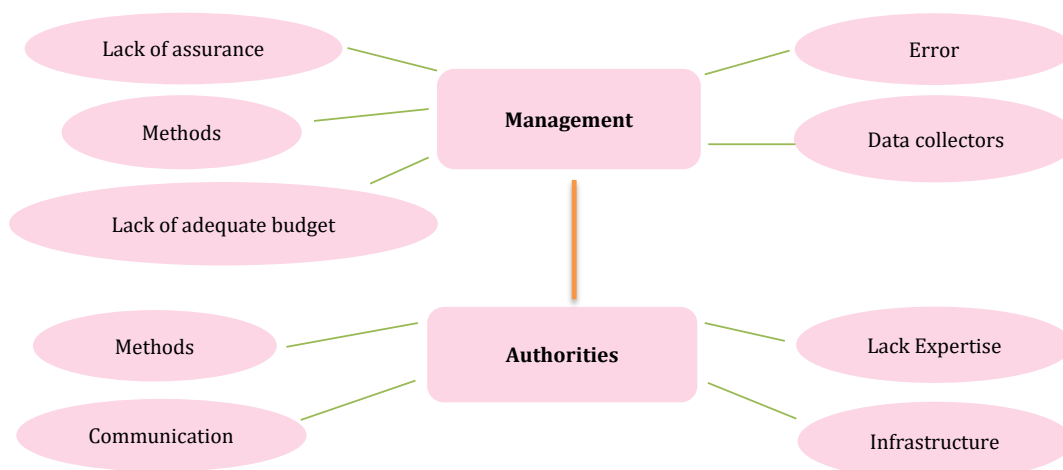


Figure 7. Map of threats in conceptual themes (Diagram)

CONCLUSIONS

The primary goals of this study were to address the major questions raised by the design SWOT analysis and to reach a conclusion based on focus group discussions. The internal and external factors sections were then concluded using theme analysis. The technological significance for the management and change of the necessity for trustworthy information is what makes information valuable in the agriculture industry. The potential benefits of integrating communication technology into farming is the utilisation of organised and efficient communication methods. Inadequate financing for data collection is also infrequently supplied, and one of the challenges is locals hiding data while it is being collected. The role of academics in its success, are all covered by these conceptual concepts about external factors and opportunities. Accurate and trustworthy agricultural information is crucial, and scholars play a key role in offering knowledge and direction. There are still unresolved land concerns in most locations. The final problem is data leakage and security flaws in the KRASP project's data collection procedure.

Author Contributions: RS analyzed the collected data and wrote the draft of the manuscript. RH and AJ idealized the work. RS performed the Focus Group Discussions with a local decision maker and gathered the data. Finally, the final draft went through reviewing and obtained approval from three authors.

Funding Source: This study did not get funding.

Conflicts of Interest

The authors declare that they do not have any conflict of interest.

REFERENCES

1. Aditi Rajesh Nimodiya, Shruti Sunil Ajankar. ICT in Rural Development: Application and Challenges - A Review. *International Journal of Scientific Research in Science and Technology*. 2021;464-472. doi:10.32628/ijrst218664.
2. Ahmed, H. M. Ethnopharmacobotanical Study on the Medicinal Plants Used by Herbalists in Sulaymaniyah Province, Kurdistan, Iraq. *Journal of Ethnobiology and Ethnomedicine* 2016; 12 (1). <https://doi.org/10.1186/s13002-016-0081-3>.
3. Alahou, G. Thematic Analysis and Its Interdisciplinary Interest: *Conatus* 2023; 8 (1), 29-53. <https://doi.org/10.12681/cjp.30938>.
4. Alkaradaghi K, Ali SS, Al-Ansari N, Laue J, Chabuk A. Landfill Site Selection Using MCDM Methods and GIS in the Sulaimaniyah Governorate, Iraq. *Vols. 11, Sustainability*. 2019; p. 4530.
5. Al-Quraishi, A. M. F.; Gaznayee, H. A.; Crespi, M. Drought Trend Analysis in a Semi-Arid Area of Iraq Based on Normalized Difference Vegetation Index, Normalized Difference Water Index and Standardized Precipitation Index. *Journal of Arid Land* 2021; 13 (4), 413-430. <https://doi.org/10.1007/s40333-021-0062-9>.
6. Amin Al Manmi, D. A. M.; Abdullah, T. O.; Al-Jaf, P. M.; Al-Ansari, N. Soil and Groundwater Pollution Assessment and Delineation of Intensity Risk Map in Sulaymaniyah City, NE of Iraq. *Water* 2019; 11 (10), 2158. <https://doi.org/10.3390/w1102158>.
7. Asniarti, Asniarti A, Muda I. The Effect of Computer Assisted Audit Tools on Operational Review of Information Technology Audits. *Proceedings of the 1st International Conference on Social Sciences and Interdisciplinary Studies (ICSSIS 2018)*. 2019; doi:10.2991/icssis-18.2019.5.
8. Baban, D.; Askari, P. A. A. Future Sustainable Energy Solutions for Sulaymaniyah, 2019. <https://doi.org/10.13140/RG.2.2.28194.58568>.
9. Barrera-Perales OT, Burgos AL. Conceptual distinction between agricultural innovation and rural innovation: implications for scientific research and public policy. *Vols. 13, Innovation and Development*. 2022; pp. 471-92.
10. Banack C, Pohler D. *Building Inclusive Communities in Rural Canada*. University of Alberta; 2023.
11. Bourgeois DT. *Information Systems for Business and Beyond*. Saylor Academy; 2014.
12. Burja C, Burja V. Sustainable development of rural areas: a challenge for Romania. *Environmental Engineering and Management Journal*. 2014;13(8):1861-1871. doi:10.30638/eemj.2014.205.
13. Byrne D. A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Quality & Quantity*. 2021;56(3):1391-1412. doi:10.1007/s11135-021-01182-y.
14. Cernasev A, Axon DR. Research and Scholarly Methods: Thematic Analysis. *JACCP: Journal Of the American College of Clinical Pharmacy*. 2023.6(7):751-755. Doi:10.1002/Jac5.1817.

15. Chhachhar AR, Makhijani HB, Khushk GM. Information and Communication Technologies for Rural Development in Developing Countries. ResearchGate. 2013 August ;1-6. https://www.researchgate.net/publication/255979947_Information_and_Communication_Technologies_for_Rural_Development_in_Developing_Countries.
16. Christou PA. How to use thematic analysis in qualitative research. *Journal of Qualitative Research in Tourism*. 2022;3(2):79-95. doi:10.4337/jqrt.2023.0006.
17. Couper I. Rural hospital focus: defining rural. *Rural and Remote Health*. 2003 July 17. doi:10.22605/rrh205.
18. Cowie P, Townsend L, Salemin K. Smart rural futures: Will rural areas be left behind in the 4th industrial revolution? *Journal of Rural Studies*. 2020 October; 79:169-176. doi: 10.1016/j.jrurstud.2020.08.042.
19. Dlodlo N, Kalezhi J. The internet of things in agriculture for sustainable rural development. 2015 International Conference on Emerging Trends in Networks and Computer Communications (ETNCC). 2015; doi:10.1109/etncc.2015.7184801.
20. FAO. Guidelines on defining rural areas and compiling indicators for. FAO. 2018 [accessed 2024February12]. <https://www.fao.org/3/ca6392en/ca6392en.pdf><https://www.fao.org/3/ca6392en/ca6392en.pdf>.
21. Farooq Q, Fu P, Ahmad S, Zhang Y, Hao Y. Assessing Human Factor in the Adoption of Computer-Based Information Systems as the Internal Corporate Social Responsibility. *SAGE Open*. 2019 August; 9(3):215824401986885. doi:10.1177/2158244019868858.
22. Hama Sharef, S.; Oğuz, H. Assessment Of Bioclimatic Comfort Zones Using The Rayman Model: A Case Study Of Sulaimani - Iraq. *Turkish Journal Of Forest Science* 2020; 4 (2), 408-423. <https://doi.org/10.32328/Turkjforsci.789104>.
23. Harun, R.; Muresan, I. C.; Arion, F.; Dumitras, D. The State Fact of the Rural Area of the Kurdistan Regional Government. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Horticulture* 2015; 72 (1). <https://doi.org/10.15835/buasvmcn-hort:10506>.
24. Hawez, D.; Mizzouri, N.; Aziz, S.; Mustafa, J.; Manguri, S. Groundwater Characteristics Assessment in Kurdistan Region Provinces-Iraq: A Review. *The Journal of the University of Duhok* 2020; 23 (2), 546-583. <https://doi.org/10.26682/csjuod.2020.23.2.45>.
25. Jiang L. Construction of Rural Public Management and Social Service Platform Based on .NET Technology. *Atlantis Highlights in Intelligent Systems*. 2022;1554-1560. doi:10.2991/978-94-6463-030-5_156.
26. Kampira AK. A Brief Introduction to Thematic Analysis. ResearchGate. 2021 April ;1-16. https://www.researchgate.net/publication/351051073_A_Brief_Introduction_to_Thematic_Analysis. doi:10.13140/RG.2.2.25899.57128.
27. Knierim, A.; Nowicki, P. SWOT Analysis: Appraisal of a New Tool in European Rural Development Policies. *Outlook on Agriculture* 2010; 39 (1), 65-72. <https://doi.org/10.5367/000000010791169970>.
28. Lin, C.-T.; Chiang, C.-Y. Kampira AK. A Brief Introduction to Thematic Analysis. ResearchGate. 2021 April; 1-16. *Sustainability* 2022, 14 (9), 5144. <https://doi.org/10.3390/su14095144>.
29. Madureira L, Torre A. Innovation processes in rural areas. *Regional Science Policy & Practice*. 2019;11(2):213-218. doi:10.1111/rsp3.12215.
30. Mohammed, O. K.; Rasul, H. Q. Assessment of the Affecting Elements on the Quality of Life and Human Well-Being in Congested Urban Centers; Case Study: Sulaymaniah City. *Tikrit Journal of Engineering Sciences* 2019; 26 (2), 49-58. <https://doi.org/10.25130/tjes.26.2.07>.
31. Mohammed; T.; Rafaat, J. Evaluation of Forage Crops Production and Quality of Two Different Rangelands in Sulaimani Governorate. *Tikrit Journal for Agricultural Sciences* 2022; 20 (2), 35-46. <https://doi.org/10.25130/tjas.20.2.4>.
32. Moinuddin S. Contours of Internet Access in Rural-Urban Landscapes in India. *Regions*. 2021; doi:10.1080/13673882.2021.00001100.
33. Naeem, M.; Ozuem, W.; Howell, K.; Ranfagni, S. A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research. *International Journal of Qualitative Methods* 2023; 22. <https://doi.org/10.1177/16094069231205789>.
34. Neima, H.; Hassan, K. Trends in Livestock Production and Red Meat Industry in Sulaymaniyah Governorate, Kurdistan Region of Iraq: A Review. *Journal of Animal and Poultry Production* 2020; 11 (5), 189-192. <https://doi.org/10.21608/jappmu.2020.102723>.

35. Ogbo E, Brown T, Sicker D. Is Broadband Speed a Barrier to Internet Use in Rural Communities? An Assessment of Mobile Infrastructure and Internet Use Habits in Urban and Rural Nigeria. *SSRN Electronic Journal*. 2018; doi:10.2139/ssrn.3142323.
36. Ozuem, W.; Willis, M.; Howell, K. Thematic Analysis Without Paradox: Sensemaking and Context. *Qualitative Market Research: An International Journal* 2022; 25 (1), 143-157. <https://doi.org/10.1108/qmr-07-2021-0092>.
37. Perera, K. Applying Thematic Analysis to Analyze Qualitative Data: A Researcher's Experience. *International Journal of Research and Innovation in Social Science (Ijriss)* 2023.
38. Pramanik J, Sarkar B, Kandar S. Impact of ICT in Rural Development: Perspective of Developing Countries. *American Journal of Rural*. 2017 September 28;5(4). <https://pubs.sciepub.com/ajrd/5/4/5/index.html>. doi:10.12691/ajrd-5-4-5.
39. Qader, S. H.; Utazi, C. E.; Priyatikanto, R.; Najmaddin, P.; Hama-Ali, E. O.; Khwarahm, N. R.; Tatem, A. J.; Dash, J. Exploring the Use of Sentinel-2 Datasets and Environmental Variables to Model Wheat Crop Yield in Smallholder Arid and Semi-Arid Farming Systems. *Science of The Total Environment* 2023; 869, 161716. <https://doi.org/10.1016/j.scitotenv.2023.161716>.
40. Räisänen J, Tuovinen T. Digital innovations in rural micro-enterprises. *Journal of Rural Studies*. 2020 January;73:56-67. https://www.researchgate.net/publication/338319893_Digital_innovations_in_rural_micro-enterprises. doi: 10.1016/j.jrurstud.2019.09.010.
41. Rashid, H. M. Modeling Groundwater Potential Zones across Sulaimani Governorate Using Geographic Information System and Multi-Influencing Factor Techniques. *UHD Journal of Science and Technology* 2021; 5 (1), 13-20. <https://doi.org/10.21928/uhdjst.v5n1y2021.pp13-20>.
42. Sharma, R. K.; Bharathy, G.; Karimi, F.; Mishra, A. V.; Prasad, M. Thematic Analysis of Big Data in Financial Institutions Using NLP Techniques with a Cloud Computing Perspective: A Systematic Literature Review. *Information* 2023; 14 (10), 577. <https://doi.org/10.3390/info14100577>.
43. Stojanova S, Cvar N, Verhovnik J, Božić N, Trilar J, Kos A, Stojmenova Duh E. Rural Digital Innovation Hubs as a Paradigm for Sustainable Business Models in Europe's Rural Areas. *Sustainability*. 2022;14(21):14620. doi:10.3390/su142114620.
44. Tahir, A. Community-Based Approach for Agricultural Water Management of. 2023.
45. Tahir, T.; Rashid, R. Community-Based Approach for Agricultural Water Management of Summer Crops. *Revista de Ciências Agroveterinárias* 2023; 22 (1), 133-145. <https://doi.org/10.5965/223811712212023133>.
46. Valverde S. Major transitions in information technology. *ResearchGate*. 2016 August. https://www.researchgate.net/publication/305418676_Major_transitions_in_information_technology. doi: 10.1098/rstb.2015.0450.
47. Villapol ME, Liu W, Gutierrez J, Qadir J, Gordon S, Tan J, Chiaraviglio L, Wu J, Zhang W. A Sustainable Connectivity Model of the Internet Access Technologies in Rural and Low-Income Areas. *Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering*. 2018 July; 93-102. doi:10.1007/978-3-319-94965-9_10.
48. Ways, O. T. A.; Ibrahim, H. M. Estimation of Water and Energy Saving by Rainwater Harvesting: Sulaimani City as a Case Study. *Journal of Engineering* 2023; 29 (4), 30-60. <https://doi.org/10.31026/j.eng.2023.04.03>.
49. World Bank WB. World Development Indicators | Databank. world Bank. 2020 [accessed 2024 February 12]. <https://databank.worldbank.org/source/world-development-indicators>.
50. Yanto, E. S. The What and How of Essential Thematic Analysis. *The Qualitative Report* 2023; <https://doi.org/10.46743/2160-3715/2023.6744>.
51. Ye L, Yang H. From Digital Divide to Social Inclusion: A Tale of Mobile Platform Empowerment in Rural Areas. *Sustainability*. 2020;12(6):2424. doi:10.3390/su12062424.
52. Zulu, S. L.; Saad, A.; Ajayi, S.; Unuigbo, M.; Dulaimi, M. A Thematic Analysis of the Organisational Influences on Digitalisation in Construction Firms. *Journal of Engineering, Design and Technology* 2023; <https://doi.org/10.1108/jedt-10-2022-0513>.