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Use of Pirated Software in the Government Sector: An Empirical Study of Microsoft Windows and Office Suite in Local Governments of Nepal

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Abstract

This study surveys IT administrators in local governments (LGs) across Nepal to understand the prevalence of pirated software use, specifically focusing on Microsoft Windows OS and Microsoft Office Suite. Data were collected via Google Forms to assess the extent of pirated software usage. The findings reveal that while some LGs have policies and future initiatives to promote the use of genuine software, financial constraints still remain a significant barrier. And despite awareness of the risks associated with pirated programs, all LGs continue to rely on them in some form, either in municipal offices, wards or schools. These results emphasize the need for a strategic shift toward using genuine licensed software to enhance digital security in Nepal's public sector.

Keywords: *Digital Security, Local Governments, Microsoft Windows, Microsoft Office, Pirated Software*

1. Introduction

Software piracy is a prevalent issue across the globe but is rampant in many developing countries, often driven by financial, educational, and policy-specific reasons (Andrés & Goel, 2012). Studies have shown that the use of pirated software can impact the economy negatively by reducing economic growth over the medium term, which is especially pronounced in low-income countries (Andrés & Goel, 2012). According to research conducted by procuring samples of various pirated software from 11 different countries, consisting of both developing and developed countries, up to 63% of the samples showed the presence of some form of malware (Kumar et al., 2016). Yet, unlicensed software is still used around the globe at alarming rates, accounting for 37 percent of software installed on personal computers which is only a 2 percent drop from 2016 to 2017 (2018 BSA GLOBAL SOFTWARE SURVEY, 2018). This has a direct negative impact on companies, organizations, and personnel using pirated software, as addressing the malware associated with unlicensed software can cost more than $10,000 per infected computer (2018 BSA GLOBAL SOFTWARE SURVEY, 2018). According to a study by the Business Software Alliance, malware from unlicensed software costs companies worldwide nearly $359 billion a year (2018 BSA GLOBAL SOFTWARE SURVEY, 2018)

In Nepal, according to a study published by the Institute for Integrated Development Studies (IIDS), the IT service export industry is valued at approximately USD 515 million, with over 106 IT export services

companies, 14,728 IT freelancers in software development and technology, and 51,781 ITeS freelancers engaged in exporting IT services through various digital platforms (Unleashing IT: Advancing Nepal's Digital Economy, 2023). The total IT service export reached USD 515 million in 2022, representing a growth of 64.2% since 2021 (Unleashing IT: Advancing Nepal's Digital Economy, 2023). This has led to a total contribution of 1.0% in GDP and 2.9% in FOREX reserves (Unleashing IT: Advancing Nepal's Digital Economy, 2023).

While the private sector seems to be enjoying a significant boom in the IT industry, the author's firsthand experience working at two different local governments (LGs) in Nepal has been quite different, with rampant use of pirated/cracked software due to various constraints, including lack of education on legal repercussions and the negative impact of piracy, budget constraints for software licensing, and the inability of government offices to directly acquire international payment cards.

There have been numerous studies on the use of pirated software from the viewpoint of end-users, the software industry, and the impact this has caused on the broader economy. But to the best of my knowledge, current existing literatures and studies haven't seemed to conduct any research on the prevalence of pirated software use in the government sector in any country, probably because governments, their institutions, and entities are seen as the upholders of the law themselves.

Given this context and background, this research aims to assess the current prevalence of pirated software in local governments of Nepal, focusing mainly on Microsoft Windows OS, and Microsoft Office Suite. By identifying the current situation and usage pattern of these software across local governments of Nepal, this study aims to fill a critical research gap and contribute insights into the digital governance challenges facing Nepal's local governments. This research also aims to provide genuinely applicable recommendations for addressing these prevalent issues and help local governments in Nepal move towards a compliant, secure software practice environment.

Figure 1: Study Area (Map of Nepal) with provinces

1.1. Literature review

According to 2018 BSA global software survey, the majority of unlicensed software, with a stunning economic worth of USD 16.4 billion, is found in the Asia-Pacific area (2018 BSA GLOBAL SOFTWARE SURVEY, 2018). The same survey noted that within the region, USD 6.8 billion worth of unlicensed commercial value comes from China alone. According to the times of India, Piracy levels in India still remain at 60% with $2.9 billion worth of unlicensed software and even the government departments using pirated software with no strict law to prevent them ("Government Offices with Pirated Software Cyber-Vulnerable," 2017). According to a news article by Inquirer.net, there is a similar situation in Philippines too, where the office of the US Trade Representative has flagged the Philippines for not having "effective policies and procedures" to make sure that its government agencies do not use pirated software ("Gov't Use of Pirated Software Raises Concerns," 2019).

While there have been various studies regarding use of pirated Software across user groups, industries, and trends, as well as its effects, to the best of author's knowledge and research, no research specifically addresses the use of pirated software in government sector. And this study aims to bridge the gap by providing valuable insights into the prevalence of pirated software in Local Governments of Nepal.

Trends

A study conducted by Andrés et al., suggests that software piracy reduces economic growth over the medium term but the relationship is non-linear which means that the rate of decrease in economic growth diminishes with piracy increase and this effect is especially pronounced in low-income countries (Andrés & Goel, 2012). Another study conducted to find a relationship between Globalization and software piracy within and across 103 countries within a period of 14 years have indicated that while globalization is significantly associated with a decrease in software piracy within and between countries, it is less pronounced in Asian counties and more pronounced in Latin American Countries (Schmuhl & Na, 2019).

In Sri Lanka, a study conducted amongst Students at Rajarata University of Sri Lanka revealed that 96% of students used pirated software (Pg & Rmmd, n.d.).

Causes

According to a study conducted by Mishra et al., amongst 162 IT managers in Turkey, results have indicated that piracy among organizations of all sectors the most prevalence causes are economical and personal attitudes (Mishra et al., 2007). Similarly, a study by Bryan found that software piracy is significantly correlated to GNP per capita, income inequality, and individualism (Husted, 2000). Another study by Liao et al. concludes that the intention to use pirated software is positively influenced by perceived psychological risk and the user's attitude but the perceived risk of prosecution negatively impacts the intention to use pirated software (Liao et al., 2010). Similarly, another study also found that pricing of original software is a driver for lenient attitudes to software piracy and keeping the price of original software at a reasonable level might help to deter software piracy (Lau, 2003).

A study conducted in Africa, highlights that Software piracy is positively linked to inclusive human development, driven by factors like literacy rates, especially when considering the Inclusive Human Development Index (IHDI) and literacy rates (Asongu & Andrés, 2017). A study by Banerjee in 2000 concludes that as pirated software becomes more reliable and more people use it, piracy increases which also affects the regulation of piracy (Banerjee, 2003).

In China, a study by Zhang et al. indicated that sharing of cultural value and perceived usefulness influence

the attitude toward pirated software of individuals, and then affect piracy intention but social ethical climate and value-added service had no obvious effect in the produce process of piracy intention (Zhang et al., 2015).

In Sri Lanka, a study conducted amongst students of Rajarata University concluded that Computer Experience, Attitudes, Awareness of software and Social Influence positively affected to the use of pirated software while Moral obligation affected negatively (Pg & Rmmd, n.d.).

Another study suggests that the East Asian miracle has been due to weaker Intellectual property rights (IPR) regimes at the early stages of development suggests at least in the short-run less stringent IPR regimes on scientific-related software will substantially boost contributions to and dissemination of knowledge through scientific and technical publications (Asongu, 2014).

Security Risk

A Study conducted by S. Kumar et al. by examining 194 personal computers from 11 countries concluded that 63% of samples showed the presence of malware. The study highlighted the link between pirated software and malware and possibility of cyber-criminals using distribution of pirated software to spread malware (Kumar et al., 2016). Another Study conducted by Asif et al. by collecting 750 pirated software samples from Southeast Asian countries concluded that malwares from this pirated software affected firewall and user account control configurations. This poses substantial security risk to end users, as the malware has the potential to steal information or create malicious backdoors (Iqbal et al., 2024).

Possible Interventions

An exploratory study by Pykäläinen et al. among business software firms in China suggests an open-source strategy, where firms open-source their products and offer related services to end users along with freely available products, as a potential anti-piracy strategy (Pykäläinen et al., 2009).

Another study by Asongu et al. suggests that the effectiveness of intellectual property rights (IPR) systems in reducing piracy may vary depending on the technology in use. They note that the success of anti-piracy initiatives is closely tied to existing piracy levels within a country, implying that policies should be tailored based on whether a nation has high, intermediate, or low piracy levels (Asongu, 2021).

1.2. Objectives of the Study

Main Objectives of this study include:

1. To assess the prevalence of pirated software in Local Governments of Nepal, focusing on Microsoft Windows OS and Microsoft Office suite programs.
2. To identify software usage patterns in LGs if they procure genuine licenses, rely on cracks/patches or face activation errors.
3. To check current local government policies and practices, such as budget allocation for genuine software, clauses in procurement processes, and verification of licensed software in both municipal offices and government schools.
4. To evaluate the awareness among LG ITO/System Administrators regarding the legality of software piracy in Nepal
5. To determine if LGs have any initiatives or future plans to adopt genuine software and reduce reliance on pirated programs.
6. To fill the research gap by providing insights into piracy related information within the government

sector.

For the purpose of this study, the authors have prepared these major 11 questions to be addressed in the survey based on the above objectives:

1. How many LGs allocate budget to procure genuine licensed Software?
2. Identify LGs that specifically don't allocate budget to procure genuine licensed Software but procure through other administrative, miscellaneous expenses titles
3. How many LGs mention a clause to ensure only genuine software is installed while procuring new computer hardware?
4. How many LGs verify if the shipped software is genuine and licensed after procuring new computer hardware?
5. How many LGs have seen a product activation failure error in their computers?
6. How many LGs procure a genuine license in case of a product activation failure error?
7. How many LGs just apply cracks/patches to keep using the software?
8. How many ITO/System Administrators are knowledgeable about piracy being illegal in Nepal?
9. How many LGs mention a clause to ensure only genuine software is installed while procuring new computer hardware in government-funded schools?
10. How many LGs verify if the shipped software is genuine and licensed after procuring new computer hardware in government-funded schools?
11. How many LGs have further policy/initiatives to ensure use of genuine software only?

2. Materials and Methods

This section presents the methodology used for obtaining the final result.

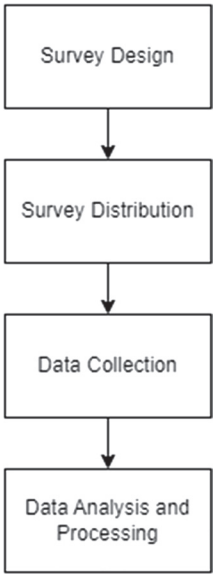

Figure 2: Methodology of the Study

The above figures shows four major steps involved in the methodology which include: i) Survey Design, ii) Survey Distribution, iii) Data Collection & iv) Data Analysis and Processing.

1. Survey Design

In this phase, a descriptive survey was designed to address the research objectives. The survey included both open-ended questions for qualitative insights and closed-ended questions for quantitative insights which were carefully crafted to gather detailed information from respondents, including factors influencing software choices and their perceptions of software licensing.

2. Survey Distribution

The survey was distributed digitally through various channels to ensure maximum reach. Google Forms was used to create the survey, which was shared via email, text messages, and instant messaging platforms like WhatsApp and Viber.

3. Data Collection

This phase of Data Collection included monitoring survey submissions and sending reminders through follow-up calls, text messages and messages through instant messaging platforms.

4. Data Analysis and Processing

After data collection, quantitative data will be processed to calculate frequencies and identify patterns. All ethical guidelines, including a strict focus on privacy, was followed throughout the data collection and will be followed throughout the analysis process.

2. Results and Discussion

This Section presents the major findings of our study.

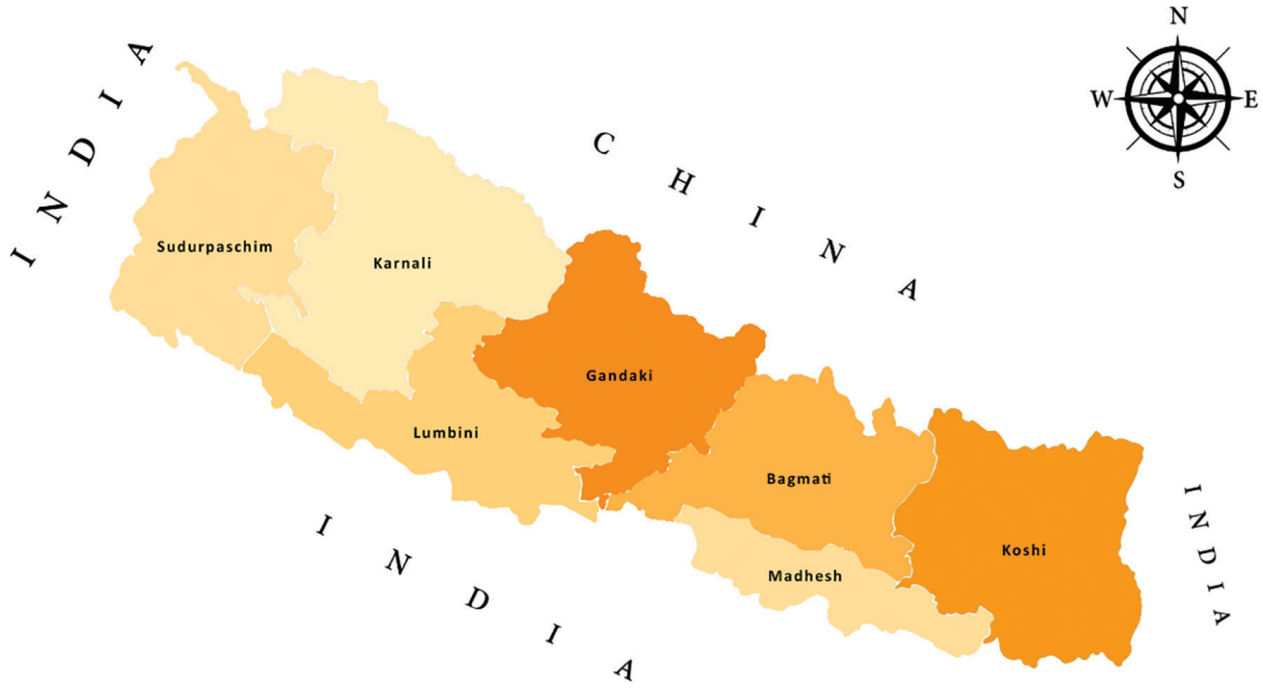

Figure 3: Province-wise Map of Nepal Showing Color Intensity Based on Survey Response Distribution

Table 1: Province-wise survey response distribution data

S.N.	Provinces	Survey Responders
1	Bagmati	37
2	Gandaki	43
3	Karnali	20
4	Koshi	40
5	Lumbini	27
6	Madhesh	24
7	Sudurpaschim	24
Total		**215**

From the above table, we can clearly see that, while this survey was distributed digitally through various channels to ensure maximum reach, only 215 out of 753 (overall 28.55%) LGs participated in this survey. This might be because of the legality and ethical questions that might arise due to the use of pirated software/ piracy being illegal in Nepal (*The Electronic Transactions Act, 2063*, 2008).

Table 2: Local Government Category wise survey response distribution data

Local Government Category	Actual Local Governments	Survey Responders	Percentage
Metropolitan	6	5	83.33
Sub-Metropolitan	11	2	18.18
Municipality	276	78	28.26
Rural Municipality	460	130	28.26
Total	**753**	**215**	**Average: 28.55 %**

From the above figures of local government category-wise survey response distribution data, there is an uneven response from various categories of local governments, with 5 metropolitan cities responding out of 6, totaling an 83.33% response rate among metropolitan cities, while only 2 out of 11 sub-metropolitan cities have responded, totaling an 18.18% response rate. This leads to an average overall response rate of 28.55% for the survey.

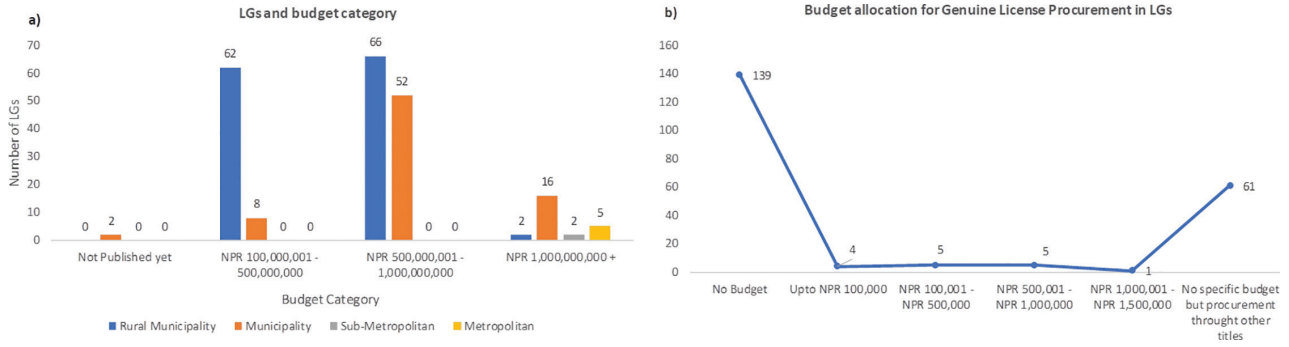

Figure 4: LGs' Budget and allocation for Genuine License Procurement

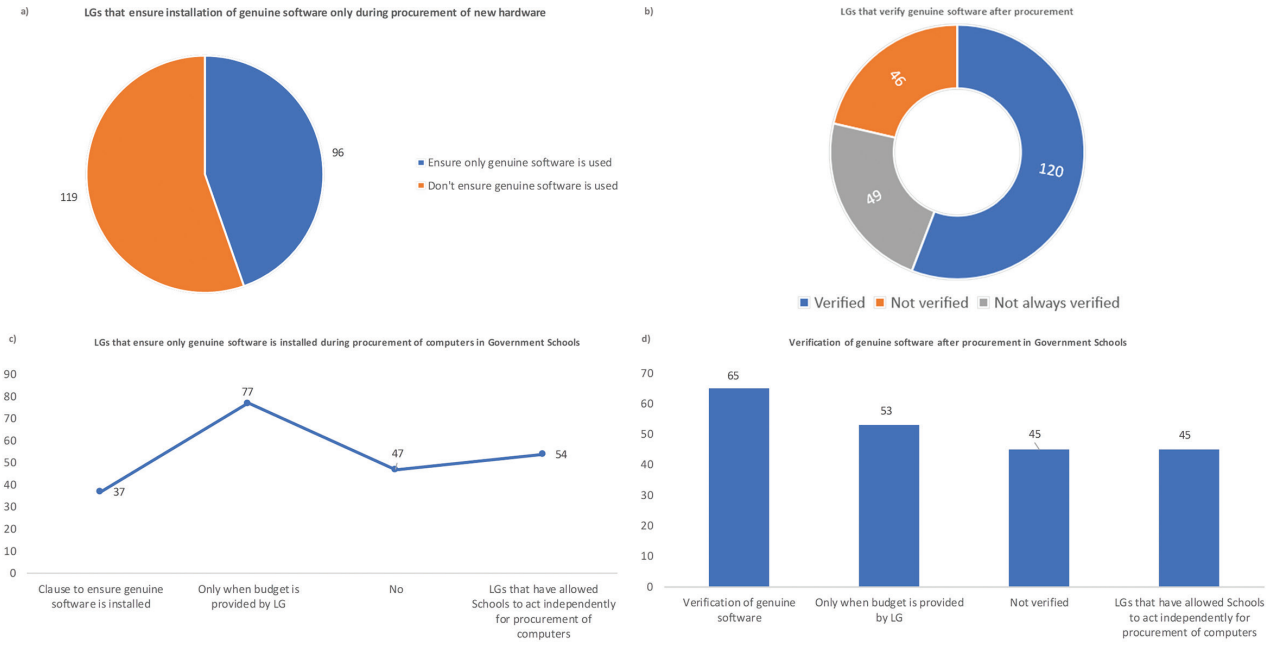

Figure 5: LGs and Government Schools software verification

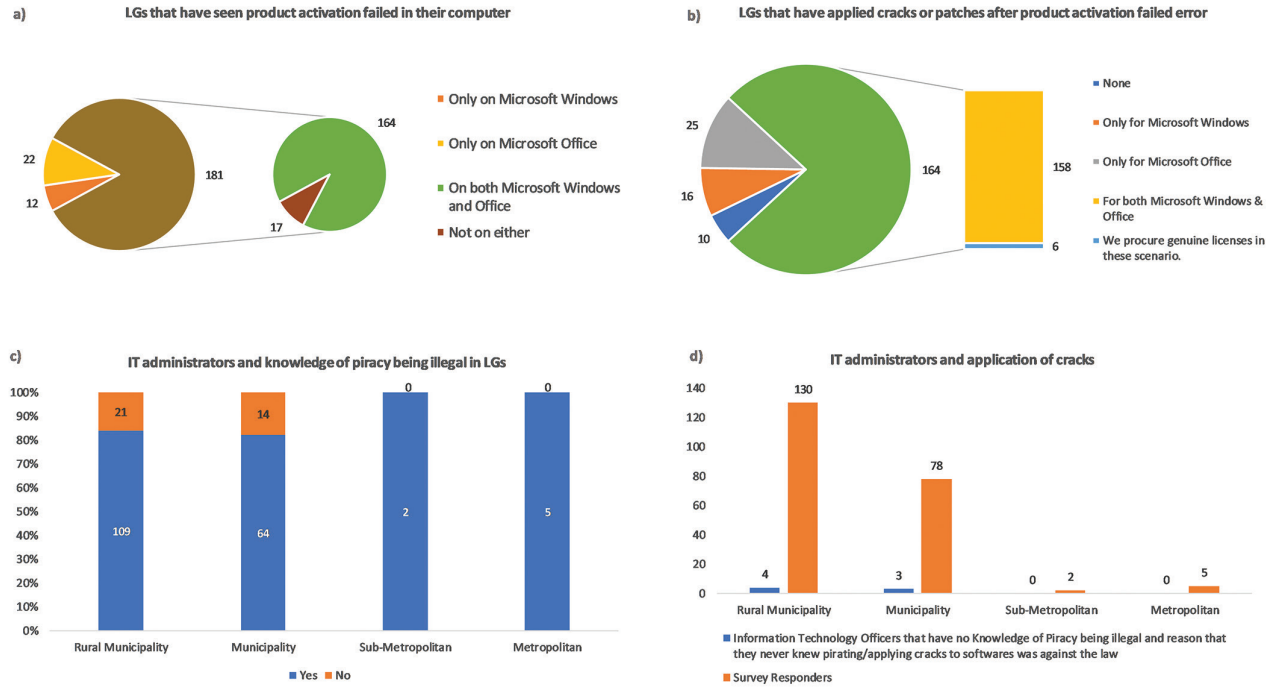

Figure 6: Product activation failure, patch application and knowledge of piracy being illegal

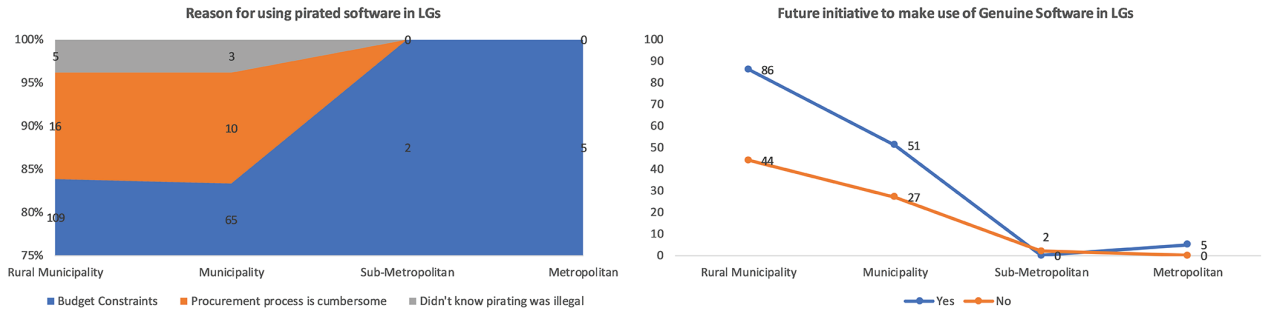

Figure 7: Reasons for using pirated software and future initiatives in LGs

Table 3: Major Questions addressed in the survey

S. N.	Questions	Result	LG category wise result			
			Rural Municipality	Municipality	Sub-Metropolitan	Metropolitan
1	LGs that allocate budget to procure genuine licensed Software	15	8	6	0	1
2	LGs that specifically don't allocate budget to procure genuine licensed Software but procure through other administrative, miscellaneous expenses titles	61	32	25	0	4
3	LGs mention a clause to ensure only genuine software is installed while procuring new computer hardware	96	61	30	1	4
4	LGs verify if the shipped software is genuine and licensed after procuring new computer hardware	120	69	45	1	5
5	LGs that have seen a product activation failure error in their computers	198	121	72	2	3
6	LGs procure a genuine license in case of a product activation failure error	6	4	1	0	1

S. N.	Questions	Result	LG category wise result			
			Rural Municipality	Municipality	Sub-Metropolitan	Metropolitan
7	LGs that just apply cracks/patches to keep using the software	41	27	14	0	0
8	IT Administrators/ITOs that are knowledgeable about piracy being illegal in Nepal	180	109	64	2	5
UGSLGO = Q3, Q4, Q6, Q8 =		5	4	0	0	1
9	LGs mention a clause to ensure only genuine software is installed while procuring new computer hardware in government-funded schools	37	24	11	1	1
10	LGs verify if the shipped software is genuine and licensed after procuring new computer hardware in government-funded schools	65	41	21	0	3
UGSS = Q9, Q10 =		33	23	9	0	1
UGSLGO, UGSS =		**0**	**0**	**0**	**0**	**0**
11	LGs have further policy/ initiatives to ensure use of genuine software only	142	86	51	0	5

As mentioned in the Introduction and methodology section, the author has prepared 11 major questions to be addressed in the study, out of which 8 questions would shed light on the current practice of LGs of Nepal, while Use of Genuine Software in Local Government Offices (UGSLGO) is the intersection of Question 3 (Q3), Question 4 (Q4), Question 6 (Q6), and Question 8 (Q8), and it would give the result of LGs that are actually only using genuine Microsoft Windows and Microsoft Office Suite that can be expressed as:

UGSLGO = Q3, Q4, Q6, Q8

From the above equation, this study has determined that only 5 out of 215 (2.32%) LGs use genuine software in their offices, which means 97.67% LGs use pirated software in their offices.

Additionally, this study has also considered the use of genuine software in government schools termed as Use of Genuine Software in Schools (UGSS) as the intersection of Question 10 (Q10) and Question 11 (Q11) that can be expressed as:

UGSS = Q9, Q10

From the above equation, this study has determined that only 33 out of 215 (15.35%) LGs make use of genuine software while 84.65% of LGs' schools use pirated software.

These two equations provide us with the number of LGs that make use of genuine software in Local Government office and Schools. To find the combined result, we can intersect the value of both these can be expressed as:

UGSLG = UGSLGO, UGSS

Finally, after considering all these equations and findings, the study concludes that none of the 215 responding LGs use only genuine software in 100% of their operations, whether in municipal, ward offices or schools. This indicates that all the responding LGs in Nepal rely on pirated software in some form, either in their offices or government-funded schools.

3.1 Limitations of the Study

This research has several limitations that should be acknowledged, mainly regarding the responses from local governments in the survey which are as followed:

1. Out of a total of 753 local governments in Nepal, only 215 (28.55%) participated in the survey. This relatively low response rate may limit the generalizability of the findings and may not adequately represent the software usage patterns across all local governments in Nepal.
2. The response rate among various categories of local governments varied significantly among different categories of local governments which might indicate potential biases, as the experiences and software usage practices of unrepresented local governments may differ from those of that participated.
3. This survey was conducted due to the lack of available first-hand/primary data from any government or other trusted institutions. And as the survey relied on self-reported data, there is a possibility of bias which could lead to an underestimation of the prevalence of such software.
4. Differences in the understanding of software licensing and what constitutes pirated software among respondents may also affect the accuracy of the responses.
5. Although the survey aimed to gather detailed data, the questions may not cover all aspects of software usage and licensing perceptions, which might lead to the overlooking of some critical factors influencing software choices and reporting.

3.2. Future Research Directions

Since this study provides a primary understanding and view of pirated MS Windows and MS Office Suite usage patterns in LGs across Nepal, future research can focus on the following aspects:

1. Future studies with significant resources at their disposal should focus on expanding the sample size of responding local governments through on-site visits or other means.
2. This study primarily focuses on pirated MS Windows and MS Office Suite usage patterns in LGs across Nepal. Further research can explore other entities of the Nepali government, including but not limited to federal and provincial government ministries and other related offices.
3. Future research can also analyze the usability, feasibility, and potential benefits of transitioning to open-source software in LGs across Nepal.
4. Further studies can examine the implications of using pirated software, focusing on but not limited

to the risks associated with its usage.

3. Conclusions

From this study, the results have shown that all of the LGs in Nepal are currently using Microsoft Windows, Microsoft Office Suite, and Windows Defender in their offices for daily activities. While some LGs have used FOSS alternatives like Linux, LibreOffice, and other software, no LGs are using only these alternatives. This study has shown that while only a handful of LGs practice using genuine software in their offices, no LGs were found that regulate or make use of only genuine software within their municipal, ward offices and government-funded schools, which is a major concern for data safety and digital security. Additionally, while 66.06% of the LGs said they had some policy/initiatives to ensure the use of only genuine software in LGs, a major reason behind using pirated software was budget/financial constraints.

The results of this study present a bleak picture, where all the LGs in Nepal use pirated software in some form. This study also affirms previous studies showing that piracy is rampant across many developing countries (Andrés & Goel, 2012) (Goff, n.d.) which has been proven true in-case of nepal. While the currently enforced Electronic Transaction Act exclusively mentions that piracy is illegal (*The Electronic Transactions Act, 2063*, 2008), piracy remains rampant across LGs in Nepal. This issue can probably be mitigated through a combination of various means, including an increase in the budget for genuine software license procurement, direct partnerships with software manufacturers, and regular audits of computers being used in LGs. Since this study primarily focuses on the use of pirated Microsoft Windows, and Microsoft Office Suite further research could explore other commonly used day-to-day software and the general knowledge of non-IT-related employees to gain deeper insights into the use of pirated software.

This study highlights the critical need to implement comprehensive strategies in Nepal's LGs to adopt genuine licensed software or Free and Open-Source Software (FOSS) alternatives to the currently pirated software. This shift would not only ensure legal compliance but also play a major role in building a reliable digital environment and enhancing data security.

Acknowledgements

The authors of this study would like to express sincere gratitude to all the respondents (Information Technology Officers, IT Administrators, and System Administrators) from the Local Governments who participated in this survey.

Conflict of Interest

As one of the authors was working as an Information Technology Officer in a Rural Municipality of Nepal, during this study, it is declared that the personal views or work of the author have not influenced this study in any way. The data reported from the municipality is presented honestly and without bias.

Furthermore, no software company, distributor, retailer, or regulatory agency has sponsored this study. The study has been entirely conducted by the authors, in their own time and at their own expense.

References

2018 BSA GLOBAL SOFTWARE SURVEY Software Management: Security Imperative, Business Opportunity. (2018). Business Software Alliance. https://gss.bsa.org/

Andrés, A. R., & Goel, R. K. (2012). Does software piracy affect economic growth? Evidence across countries. *Journal of Policy*

Modeling, *34*(2), 284–295. https://doi.org/10.1016/j.jpolmod.2011.08.014

Asongu, S. A. (2014). Software Piracy and Scientific Publications: Knowledge Economy Evidence from Africa. *African Development Review*, *26*(4), 572–583. https://doi.org/10.1111/1467-8268.12113

Asongu, S. A. (2021). Global Software Piracy, Technology and Property Rights Institutions. *Journal of the Knowledge Economy*, *12*(3), 1036–1063. https://doi.org/10.1007/s13132-020-00653-1

Asongu, S. A., & Andrés, A. R. (2017). The impact of software piracy on inclusive human development: Evidence from Africa. *International Review of Applied Economics*, *31*(5), 585–607. https://doi.org/10.1080/02692171.2017.1296414

Banerjee, D. S. (2003). Software piracy: A strategic analysis and policy instruments. *International Journal of Industrial Organization*, *21*(1), 97–127. https://doi.org/10.1016/S0167-7187(01)00090-X

Goff, M. (n.d.). *Software Piracy Statistics – 2025 Outlook* [Software Piracy Statistics – 2025 Outlook]. Retrieved October 26, 2024, from https://www.revenera.com/blog/software-monetization/software-piracy-stat-watch/

Government Offices with pirated software cyber-vulnerable. (2017, May 16). *The Times of India*. https://timesofindia.indiatimes.com/city/hyderabad/government-offices-with-pirated-software-cyber-vulnerable/articleshow/58693509.cms

Government use of pirated software raises concerns. (2019, October 29). *Inquirer*. https://business.inquirer.net/282164/govt-use-of-pirated-software-raises-concerns

Husted, B. W. (2000). The Impact of National Culture on Software Piracy. *Journal of Business Ethics*, *26*(3), 197–211. https://doi.org/10.1023/A:1006250203828

Iqbal, A., Aman, M. N., Rejendran, R., & Sikdar, B. (2024). Unveiling the Connection Between Malware and Pirated Software in Southeast Asian Countries: A Case Study. *IEEE Open Journal of the Computer Society*, *5*, 62–72. https://doi.org/10.1109/OJCS.2024.3364576

Kumar, S., Madhavan, L., Nagappan, M., & Sikdar, B. (2016). Malware in Pirated Software: Case Study of Malware Encounters in Personal Computers. *2016 11th International Conference on Availability, Reliability and Security (ARES)*, 423–427. https://doi.org/10.1109/ARES.2016.101

Lau, E. K. W. (2003). An empirical study of software piracy. *Business Ethics: A European Review*, *12*(3), 233–245. https://doi.org/10.1111/1467-8608.00323

Liao, C., Lin, H.-N., & Liu, Y.-P. (2010). Predicting the Use of Pirated Software: A Contingency Model Integrating Perceived Risk with the Theory of Planned Behavior. *Journal of Business Ethics*, *91*(2), 237–252. https://doi.org/10.1007/s10551-009-0081-5

Mishra, A., Akman, I., & Yazici, A. (2007). Organizational software piracy: An empirical assessment. *Behaviour & Information Technology*, *26*(5), 437–444. https://doi.org/10.1080/01449290500483577

Pg, M., & Rmmd, P. (n.d.). *Students' Intention to Use of Pirated Software in Rajarata University of Sri Lanka.*

Pykäläinen, T., Yang, D., & Fang, T. (2009). Alleviating piracy through open source strategy: An exploratory study of business software firms in China. *The Journal of Strategic Information Systems*, *18*(4), 165–177. https://doi.org/10.1016/j.jsis.2009.10.001

Schmuhl, M. A., & Na, C. (2019). Globalization and software piracy within and across 103 countries. *Crime, Law and Social Change*, *72*(3), 249–267. https://doi.org/10.1007/s10611-018-9805-8

The Electronic Transactions Act, 2063 (2008 AD). (2008). Nepal Government.

Unleashing IT: Advancing Nepal's Digital Economy Expanding jobs and exports. (2023). Institute for Integrated Development Studies (IIDS). https://iids.org.np/images/publications/15c4487b777dcf3239cd6af6dd15c2c1.pdf

Zhang, L., Wentao Mao, Lin Cheng, & Dehui Wu. (2015). Explore the influencing factors of Chinese consumers using pirated software. *2015 12th International Conference on Service Systems and Service Management (ICSSSM)*, 1–5. https://doi.org/10.1109/ICSSSM.2015.7170220