

THE TRANSFORMATIVE IMPACT OF TECHNOLOGY IN THE FUTURE OF LAND SURVEYING ACADEMICALLY AND PROFESSIONALLY

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SUMMARY

Land surveying instruments and procedures have progressed over time, and land surveyors' roles have become much larger than they were previously. Although the fundamentals of land surveying have not changed and the objective remains the same, techniques and methods have evolved significantly since the beginning of the history of land surveying. Today's surveyors have access to technologies that previous generations could only dream of. This is not to say that today's land surveyors are superior or more capable than those of the past; rather, they have a more advanced tool set, allowing them to produce more precise results.

Academically and professionally, Land Surveying and Geographic Information Systems (GIS) fields are becoming increasingly intertwined, with surveyors using GIS technology and GIS professionals building models with precise survey data. Land surveying now encompasses digital data processing and administration, in addition to traditional data collection. This has rendered what used to be acceptable as surveying curricula ineffective. Modernizing surveying courses in tertiary institutions is necessary to keep pace with technological changes. The regulatory bodies for surveying institutions/departments should continue to assess surveying programs in universities to align with technological advancements from the digital revolution.

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1. INTRODUCTION

Rapid technological improvements and the changing nature of professional roles are driving a considerable transition in the surveying profession (Haller Blanchard, 2023). In the surveying industry, geographic information systems have become extremely effective instruments that are transforming the handling, analysis, and visualization of spatial data (McKissock Learning, 2025). Although GIS provides previously unheard-of capabilities for organizing and analyzing spatial data, its growing use and accessibility also pose serious threats to the established limits of land surveying, possibly resulting in role ambiguity and moral dilemmas (University of Wisconsin-Stevens Point, 2020). This thesis examines surveying's academic and professional future by addressing the complex effects of GIS technology, the need for distinct professional boundaries, the modification of educational frameworks, and the moral issues that must direct the fusion of these fields. GIS integration has improved data management and spatial analysis efficiency, allowing surveyors to integrate survey data into bigger mapping projects, as noted by the National Society of Professional Surveyors (NSPS, 2021). However, the distinction between land surveyors and GIS professionals has become hazier due to the ease of usage of GIS software.

Some GIS professionals may claim to be capable of handling duties like cadastral surveys and boundary determinations that are typically the domain of land surveying. Property borders are established and defined by cadastral surveys, which require a high level of precision and legal knowledge. Property boundary conflicts brought on by inaccurate or insufficient surveys may result in expensive and time-consuming judicial fights. Such mistakes can have serious financial and legal repercussions, which emphasizes how crucial it is to uphold clear professional standards based on moral behaviour (Harrison & Smith, 2022; IPLSA, 2024). In order to overcome these obstacles, academic surveying programs must adapt by fusing cutting-edge GIS techniques with basic surveying concepts. A well-rounded education should guarantee that graduates have the technical know-how required for contemporary practice as well as a thorough comprehension of the ethical, legal, and professional obligations that come with land surveying (Kam & Lee, 2020). In order to preserve the integrity of surveying processes while preparing professionals to handle the challenges of spatial data management, a multidisciplinary approach is essential. Teachers also need to inculcate a strong sense of professional ethics, stressing the value of truthfulness, fairness, and conformity to the law. Institute for GIS Certification, 2024. Professionally, the surveying sector needs to adjust to the growing demands of urban development and technological breakthroughs. In order to preserve their distinct skill in land measurement and determining legal boundaries, surveyors must work in tandem with GIS specialists in smart cities and the Internet of Things (IoT) (Zhou & Wu, 2019). To promote cooperation while preserving the integrity of surveying techniques, this

partnership requires strong regulatory frameworks, continual professional development, and communication between the surveying and GIS communities. Additionally, surveyors need to be on the lookout for conflicts of interest, protect data privacy, and adhere to ethical norms (Esri, 2021; GIS Certification Institute, 2024). Through a thorough examination of the condition of surveying education today, the changing responsibilities of surveyors and GIS experts, and the ethical principles that must govern their interactions, this thesis will look at these dynamics. The goal of this research is to help ensure that the surveying profession has a sustainable and morally sound future by tackling these important challenges.

1.1.Purpose/Problem:

Land surveying's conventional geometric and technological emphasis is giving way to a more expansive, multidisciplinary paradigm powered by Geographic Information Systems (GIS). In order to handle issues like data integration, deficiencies in spatial abilities, and the changing concept of geomatics, this change calls for updated educational models, professional skill sets, and institutional frameworks. The most recent technological developments must also be incorporated into survey legislation; in nations like Zimbabwe, the current regulations have not been updated to take these developments into account, which further impedes improvements in the sector. Universities play a vital role in a profession's future by providing quality education, fostering critical skills. If the institution lack up-to-date surveying equipment face challenges such as graduating less competitive and less skilled students, a disconnect between academic learning and industry demands, and an inability to teach advanced techniques and software required for modern land surveying, all of which may have an impact on the viability of their program and the success of their graduates in the evolving, high-tech surveying field. A curriculum that lags behind industry advancements due to a lack of modern equipment causes a gap between what is taught and what is actually practiced in the field. Enrolment in the curriculum may decrease when employers and students become aware of the technical gap, and the reputation of the institution may suffer. It will be more difficult for universities to adapt their curricula to the surveying industry's expanding digitization trend, which places greater emphasis on integrated data collecting and evaluation methods. The reality of contemporary surveying, which mostly depends on new equipment for accuracy, productivity, and interconnection, are not well taught to students when they enter the industry.

1.2.Significance of the research:

The goal of this research is to help ensure that the surveying profession has a sustainable and morally sound future by tackling the important challenges. The research on the evolution of land surveying and GIS is important because it examines how technological advancements have transformed the field from individual measurement to complex spatial data management, resulting in innovation in education, policy, and interdisciplinary applications such as historical geography and urban planning. This research lays the groundwork for upgrading academic curricula, developing new professional specializations, and harnessing GIS to address societal concerns, ensuring that the subject stays relevant and appealing to future generations of surveyors and GIS specialists.

2. HOW TO BUILD THE FUTURE OF SURVEYING THROUGH EDUCATION

Meanwhile, technology is fast advancing. If professionals are not in control of training the future generation, tech companies and AI developers will rewrite the concept of "surveying" rather than true experts. Surveyors will not be the ones setting the criteria. Corporations will be promoting AI-driven mapping software. Drone users will believe that GPS accuracy is "close enough." Real estate developers will be inclined to cut costs instead of ensuring accurate property boundaries.

The future of surveying relies not just on maintaining knowledge, but also on actively transmitting it. That includes mentorship, formal training, and the use of digital education to make learning more accessible to the next generation. It is simple to blame external circumstances, but surveyors must accept responsibility for educating and training the next generation of professionals. This involves more than just hoping for a few apprentices to show up. It entails developing structured, easily accessible educational resources, establishing mentorship programs, and ensuring that real-world experience is passed down rather than disappearing with retiring experts. This is more than just safeguarding the profession; it is also about protecting the public confidence. Because if surveyors do not influence the future of their profession, someone else will. And they're likely to get it wrong.

3. THE IMPORTANCE OF CHANGES IN LAND SURVEYORS EDUCATION

The world is constantly evolving. Aside from rapid technological development and the IT revolution, the world faces new difficulties to address, such as the implementation of sustainable development, increasing economic growth, poverty reduction in developing nations, and so on. Land and real estate properties, as well as related activities, play critical roles in the economy, contributing to the successful attainment of the above goals. The changing global priorities have an impact on the priorities of many professions. Education, particularly at the university level, must adapt to these changes, as the economy and society demand new priorities. Sometimes university education is rather conservative, quite theoretical; perhaps it would be beneficial to strike a balance between the practical and scientific approaches. In terms of land surveyor education, universities have quickly acknowledged the relevance of information technology, expanding the curriculum to include geo-information understanding. As a result of their longer education, many competent land surveyors went to IT industries where they could earn much higher pay. The majority of institutions with land surveying faculties have failed to acknowledge the growing importance of land and real estate property-related businesses, as well as the function of land administration in the economy.

Many prospective students are uninterested in traditional land surveying and mapping, but they usually find themselves unable to find other courses in the university that are both appealing and practical. It would be wise to expand the expertise of land surveyors and add additional disciplines to their curriculum, such as legal matters, valuation, management, etc.

4. WHY SURVEYORS MUST INVEST IN EDUCATION NOW?

The future of surveying will not simply sort itself out. If experienced surveyors do not actively share their information, which is now happening and If the profession does not take aggressive actions today to educate the next generation, surveying as we know it will die. Tech corporations are changing the regulations, government agencies are delegating expertise to AI models, and the general public is growing less aware of what surveyors do. As a result, the profession is losing its identity, authority, and future.



If surveyors don't **take ownership** of education, here's what we're facing:

A weakened profession: Without proper education and mentorship, the next generation of surveyors will lack the competence required to maintain professional standards.

A loss of public trust: When errors occur, the public loses trust in surveyors. More boundary issues, court battles, and construction delays. When surveying accuracy deteriorates, it affects everything property rights, infrastructure, safety, and economic development.

Corporate control of geographical knowledge: Surveyors are the proper guardians of land measurement, but huge tech corporations are more than willing to fill the void. If surveyors do not step up, AI-generated mapping solutions and algorithm-driven services will dominate the industry without professional oversight.

5. HOW DRONES TRANSFORM SURVEYING CURRENTLY AND IN THE FUTURE:

- Drones are safe for usage in a variety of situations.
- Access to remote and challenging sites is improved.
- High-definition and highly precise maps can be built and produced.
- Drones may collect many types of data, such as images, videos, and lidar.

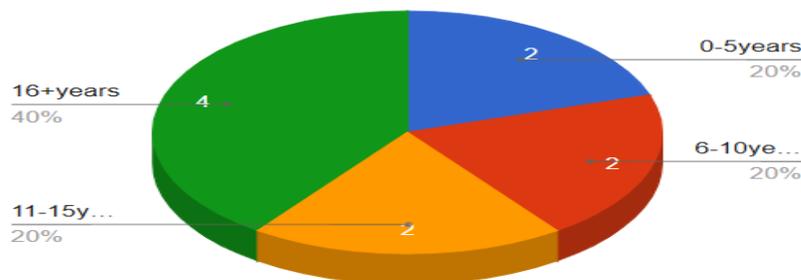
The collected information can be instantaneously uploaded to a server, and any authorized user can access it from anywhere. Everything becomes easier with the help of drones. It is also safer to use, so more tasks may be performed quickly and effectively. This is a clear evidence of significant development in the survey industry. Drones are likely to become the industry norm within the next few years. As more land surveyors embrace the technology, it will shift from

"competitive edge" to "business necessity." While traditional surveying will continue to be used, drones will perform the majority, if not all, of the surveying.



6. RESULTS AND ANALYSIS

6.1.1. Shows participants' years in the Surveying Industry



The questionnaire's results show a dramatic change in the surveying industry, emphasizing both benefits and difficulties brought about by technology developments.

6.2. Technology's effect on Surveying Professionals

The surveying industry has seen a significant transformation since the introduction of drone technology. People who can operate drones and create topographic maps without a professional surveying degree are now fierce competitors for surveyors. As the comments show, several participants stressed that efficiency and data collecting had improved due to technological improvements, but they also voiced concerns about the value of conventional surveying abilities.

In the past, surveying positions were only open to competent individuals with specific training. The use of drones has made some surveying operations more accessible, allowing non-surveyors to carry out initiatives that formerly required specialized training. Because there is less of a need for surveyors with competence in topographic surveying, this trend has raised questions about their continued usefulness.

6.3. THE Resilience of Cadastral Surveying

Due in large part to strict laws that protect this field, cadastral surveying is still a very stable section of the profession. The importance of cadastral competence is preserved because only registered surveyors are permitted to approve title surveys under recent statutory instruments. Even as the industry develops, cadastral surveyors continue to play a crucial role thanks to the legal environment. Nonetheless, the results show that surveyors must quickly adjust to this changing environment. Geographical Information Systems (GIS) and Artificial Intelligence (AI) are two examples of the cutting-edge technologies that are being incorporated into job positions through interdisciplinary collaboration, which is replacing old methods. In order to meet new difficulties, many respondents emphasized the significance of ongoing education and curriculum revisions.

6.4. Regulation and Adoption Difficulties

Participants pointed out that whereas cadastral surveying standards offer a safety net, similar frameworks are urgently needed for other specializations, especially given the advancement of technology. In order to ensure that the profession stays relevant, surveyors emphasized the significance of creating regulations that acknowledge and incorporate new tools and approaches. A positive move has been made with the inclusion of new statutory instruments that recognize improvements in surveying techniques. Nonetheless, participants generally agreed that in order to guarantee surveyors are prepared to manage the intricacies of contemporary practices, current standards need to change more quickly to keep up with technological advancements.

6.5. Future of Surveying in Academia

These developments in technology and changes in the field will have a significant impact on surveying education in the future. Studies like Van Oosterom et al. (2016) have already highlighted the necessity for curricula to change in response to technological advancements in the field of surveying. Incorporating real-world experiences and technology exposure into academic curricula has become more important as survey methods have improved.

According to the respondents, academic institutions should update their curricula to incorporate practical instruction using modern instruments like drones and GIS software. This is consistent with recommendations from earlier studies emphasizing the value of experiential learning in equipping students to face challenges in the real world (Murray et al., 2020). In order to guarantee that training is pertinent and in line with contemporary professional requirements, academia should also cultivate ties with leaders in the business.

6.6. Acceptance of Multidisciplinary Methods

In the future, it will be critical to incorporate multidisciplinary approaches into academic curricula. Skills outside conventional surveying procedures are becoming more and more important in modern surveying practice. Urban planning, environmental monitoring, and data analytics—applications that are significantly improved by technology integration—are required of surveyors. As a result, incorporating courses that cover these multidisciplinary aspects would better equip upcoming professionals for the changing demands of the labor market.

7. CONCLUSION

The surveying industry in Zimbabwe is confronted with both possibilities and challenges as it

advances. While conventional positions are at risk due to the democratization of surveying through technology like drones, there are also opportunities for innovation and increased skills. To be relevant in a fast-changing world, surveyors must negotiate this new landscape with a focus on adaptation, interdisciplinary collaboration, and ongoing professional growth. In order to guarantee that graduates are prepared for the future, academic institutions play a critical role in this transformation by updating curricula and cultivating collaborations with business. In the future, land surveying and GIS will continue to be professionally integrated with information technology, necessitating the acquisition of new skills in digital modeling, analytics, and data management.

To address the global shortage of professionals and adapt to the demands of a data-driven world, academia must evolve curricula to encompass a broader spectrum of technical, legal, and planning knowledge. This will foster stronger public-private-academic partnerships. Land surveying's evolution, which began with measuring the earth and drawing borders, has been considerably aided by the incorporation of GIS technology, which has advanced from simple data collecting to complicated data management, analysis, and visualization. By embracing technological developments, surveying and GIS professions will become more appealing to younger generations that demand technology in the workplace, facilitating succession planning and introducing new ideas.

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