Towards A Fit-For-Future Cadastral System For Jamaica: A Socio-Technical Approach

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1.0 Summary

According to (De Soto, 2000; Feder and Nishio, 1999), there is a robust acquiescence on the importance of well-defined land and property rights. The fundamental definition of these rights relies forcefully on cadastral systems, which typically document the physical location of real properties and the associated rights to ensure security of tenure (Krigsholm, 2020). Cadastral systems consist of both technical and juridical pillars. In Jamaica, the technical aspect describes the land description and registration methodologies. At the same time, the juridical perspective focuses on establishing a Legal Cadastre as the primary repository of legal information.

Ting and Williamson (1999) opined that the dynamism between the citizenry and land is the catalytic force propelling the reform of cadastral systems. Williamson, Enemark, Wallace, and Rajabifard (2010) recognized four typical phases of development for cadastral systems: fiscal and juridical cadastre, as well as planning and multipurpose systems. It is of critical importance in Jamaica that the National Land Agency (NLA), which is the land administration agency and the membership of the Land Surveyors Association of Jamaica (LSAJ), which is the primary private sector stakeholder, and the University of Technology, Jamaica understand how this development continuum will evolve.

1.1Background

A foundational and fundamental acceptance that the dynamism of the relationship between people and land justifies the need to analyze land registration systems (Zevenbergen, 2004). This seemingly fluidized relationship introduces a social dimension. This view is reinforced by Ottens and Stubkjaer (2008), who postulated that cadastral systems are not simply technical systems fueled by technological advancement but logically contain a social dimension. The Jamaican reality beckons for an explorative view that is not restrained to the simplicity of linear predictions or projections from historical data but generates the comprehension of alternative outcomes and associated consequences.

Jamaica's cadastral system can be considered mature, characterized by age-old traditions and entrenched practices (Enemark, 2009). The dynamism of the land administration domain engenders a general awareness of the need for modernization and agility in cadastral systems in Jamaica. The hypothesis is that cadastral systems evolve with time to ensure their functional relevance and provide optimum service to society's burgeoning needs (Krigsholm, 2020).

Central to the progression of the agenda of comprehending the vistas of the future of Jamaica’s cadastral system is a comprehensive identification of the emerging change issues. Additionally, an analysis of the implications of change issues, a projection of the alternative outcomes, and a backcasting process will align current inputs to achieve the projected outcomes.

2.0 Introduction

The Jamaican context of a Small Island Developing State (SIDS) highlighted the climate emergency, identifying climate action as a crucial future signal. The intense competition for land, particularly in Central Business Districts (CBD) and safe zones with considerable elevation above mean sea level, fueled discussions regarding informal settlements. The cost associated with land-related technical and legal fees emerged as a significant issue, leading to a lack of tenure clarification, tenure security, informal settlements, informal subdivisions, and land conflicts. Another concern raised was the widening gap between geospatial technology and legislation. Lastly, the dwindling and outdated technical resources employed in academia were also highlighted as a problem.

The mature cadastral system of Jamaica has been operated by the executive agency (NLA), which has the economic objective of recordation of interests in real property, which is a central role. The issues that arose have social, academic, environmental and technological origins, which are not controlled by the state and are seemingly decentralized in the absence of legislation. This reality calls for strong collaboration between the state agency, private sector consultants and academia.

The competing needs for land, informal settlements, and informal subdivisions were all posited regarding town centers, which can be categorized under urbanization. The cost of land-related services could be a resultant indicator of Jamaica's macro or microeconomic variables. The use of high-threshold technology was seen as standard in geospatial work in Jamaica but is not necessarily a feature of the recordation of rights processes. Summarily, the various origins of these issues may be political, economic, academic, legal, technological and social. The possibility of multiple drivers of one issue is also a reality.

The expansive literature supports the findings of the Jamaican case study. Fetai, Ostir, Kosmatin Fras, and Lisec (2019) have championed the utilization of surveying technology, especially in cadastral mapping by unmanned aerial vehicles (UAVs). Krigsholm (2020) argued that urbanization is a primary driver of the need for multidimensional cadastral information.

3.0 Implication of Change Issues

The expectation is that technological advancement will continue to influence workflows, efficiency, cost, and accuracy of cadastral information from the perspectives of data users and collectors. The NLA can benefit from temporality, which is the availability of historical records and the up-to-datedness of the cadastre (Krigsholm, 2020). The temporal aspects of cadastral information are projected to increase due to the need to monitor land resources. Jamaica is set to benefit from an Electronic Land Registration System (e-titling) that aims to improve the efficiency of land registration. The defined roles and responsibilities of public and private agencies must be clarified. This seemingly digital age will augment a heightened need for electronic information.

Jamaica can benefit from advanced electronic information such as a 4D cadastre. The cadastre fuses boundary information, which is typically spatial. Boundary information can define limits of possession or interest and the infinitesimal lines between parcels. This information can also be extended to a temporal dimension of conveyance. The 4D cadastre can provide information on dynamic boundaries such as navigable and non-navigable waterways. In Jamaica, the orthodox and legal definition of a boundary adjoining a navigable waterway is the high-water mark, whereas that of a non-navigable waterway is the centerline of the feature.

This information can be used to monitor urbanization and rural development over time by tracking changes in land use and land cover. Another benefit includes enabling physical planning technocrats to make faster and better decisions. Doner et al. (2010) postulated that the implementation of a 4D cadastre can be realized from technical, organizational and legal perspectives.

The genesis of the undergirding challenges is the complexities of modelling dynamic and multi-dimensional spatial information. Another source of challenge is that the legal, organizational and technical components are individually fraught with issues. Overarchingly, the user needs assessment must be contrasted to the cost of a 4D cadastre due to the economic reality of Jamaica. Ho et al. (2018) cautioned that the lack of direction could impede investment in this direction, as it remains unclear what entity should initiate the actions toward a 3D or 4D geo-information system in Jamaica.

4.0 Futuristic Development

Krigsholm (2020) opined that cadastral systems should ideally feature the tenets of dynamism, agility, interoperability and coordination with other state spatial information databases. The future cadastral system of Jamaica can be envisioned from the concepts of the socio-technical transition theory. This theoretical framework studies the dynamism of systems that change from one state to another and how these changes affect society and technological elements. Ultimately, this theory will be used to comprehend how Jamaica's cadastral system can become more sustainable.

The acquiesced view is that the digitalization of cadastral submissions should be progressed as a key pillar of the cadastral system. Jamaica operates a robust digital service ecosystem whereby a network of interconnected technologies, platforms, and services work together to deliver services to create new customer experiences. The ecosystem should be augmented to encompass the advancements in automation, especially in checking cadastral plans. This agenda is projected to improve service delivery standards from 6-8 weeks to complete the checking process.

The digitalization of paper-based records was the genesis of the digital ecosystem. The natural progression to automation and artificial intelligence, projected to increase incrementally to full automation, will expose cadastral systems to global cyber security threats. The burgeoning need for data sharing among stakeholders introduces the calls for data management and data security.

Dale and McLaughlin (1999) argued that the threat of cyberattacks, coupled with citizens' need to control their data, will impact cadastral systems, as information management is vital to land administration functions. The data-sharing agenda also emphasizes the necessity of standardizing data collection and ensuring interoperability (Kalantari et al., 2008). LVM (2018) suggests that, although the demands for increased access to data are being addressed, the solution must be backed by data protection and cybersecurity measures. Jamaican policymakers rightly seek answers concerning cybersecurity and data protection.

Macharis and Crompvoets (2014) noted that agencies had explored networked options, representing a substantial shift. Gathering extensive knowledge of the existing system and the anticipated business ecosystem is a prerequisite for any significant reconfiguration. The burden of this paradigm lies in the stakeholders' perception that they must adhere rigidly to established practices, which inherently creates resistance within the system (Krigsholm, 2020). The necessary interventions will require some degree of reshaping the perceptions and fixations of the past.

Technology will undoubtedly continue to serve as the catalyst for the improved digital paradigm. The development of mobile applications may supplant the existing electronic

services and transactions. However, demographic data is lacking from the equation, making it unclear what percentage of the population would prefer applications over digital transactions. Therefore, customer service must consider service modalities rather than solely service delivery standards driven by technological advancement.

Automating workflows will likely culminate in the automated maintenance and updating of the cadastre, the repository of information maintained by state agencies. The new paradigm will require capacity building of the staff operating cadastral systems and the 'professionalization' of the customer base through public education platforms. These critical inputs will require significant funding from the Government of Jamaica (GOJ).

The fiercely competitive demand for land in urbanized areas of Jamaica, particularly around central business districts, has led to a considerable increase in high-density and strata developments. This is part of the real estate response to the disparity between the required housing stock and that which is produced. This dynamic has also transformed the settlement patterns of rural areas from linear and dispersed to rectangular.

Additionally, as property valuations become increasingly dynamic, with more variable comparative data and real estate transactions growing ever more complex due to risk analysis and property potential, updated property information will gain greater importance. Property valuation ultimately influences the transactional fees associated with tenure security. It is logical to anticipate that as the need for secure tenure rises, so too will the key determinant of associated costs. This issue may be addressed through state-sponsored or subsidized systematic registration.

On a purely technical basis, considering cost implications, thousands of survey diagrams will be required to accurately describe the land needed for tenure security. The precision of the surveying standards affects the survey methodology, which consequently impacts the cost of describing a parcel. The standards for the accuracy of cadastral surveys are expected to be reviewed.

Currently, different standards exist for urban and rural surveying. This issue is exacerbated by the vague definition of urban and rural areas or the ambiguous nature of being sufficiently urbanized. An ideal approach to compiling a cadastre is to establish a uniform accuracy standard. This consistency in positional and relative accuracies will enhance the state of the cadastre. Such uniformity is expected to improve interoperability, advancing Jamaica's multidimensional ambitions.

Jamaica has a homogenous reference framework (Jamaica Datum 2001), so the ambition should include a multi-purpose cadastre that can incorporate all geospatial and hydrostatic information to fulfil the operational and strategic mandates of a National Spatial Data Infrastructure (NSDI). This includes enabling the effective acquisition, processing, storage, distribution, and utilization of geospatial data across different sectors within Jamaica.

Interestingly, though not surprisingly, future elements exhibit symbiosis or at least incorporate cross-cutting tenets. The ongoing push towards digitalization will require standardization in data collection, with a strong emphasis on data protection in storage repositories. The advancement of Jamaican ambitions should highlight the need to explore a multipurpose approach that relies on a National Spatial Data Infrastructure (NSDI).

5.0 Divergence of Operational Reality and Legislation

Unmanned aerial systems (UAS) are rapidly developing in Jamaica. These imaging or scanning devices enable fast and accurate data collection. However, the technology has not entered the sacred annals of cadastral surveying and is not supported by the Land Surveyors Act of Jamaica. Using a fixed boundary system to delineate and demarcate property boundaries requires a monument at every change of bearing or every 600 feet.

However, there are generalized boundary descriptions within this fixed boundary system. For instance, dynamic boundaries exist in coastal areas, where the high-water mark has been recognized as the boundary since June 1, 1956, as stated by the Beach Control Act. Other examples include riverine features, where the center line of the feature is recognized as the boundary between adjacent estates, and curvilinear features, such as a winding road, where markers are accepted every 600 feet rather than at every change of bearing.

These general conditions provide a reasonable justification for mapping an undisputed physical boundary by a UAS. With appropriate ground truth, the parcel can be accurately described. Technology has outpaced legislation in this regard, making it pertinent to develop a future-proof approach to addressing this issue. The establishment of a boundary system that incorporates innovations meant to enhance efficiency, accuracy, and affordability should be considered.

The stakeholders must now consider the impediments to complete registration in Jamaica, one of which is economic reality. Jamaica's foray into systematic adjudication, now operated by the National Land Agency (NLA) as the Land Administration and Management Division, has noted successes. The reality of this approach required legislative changes regarding the description of parcels by a map.

6.0 Discussion

Technological advancements will continue to enhance Jamaica's cadastral systems, and this aspect concerning the realistic resolution of tenure insecurity is merely one factor. Other components include legislative reform, data models, geodatabase management, data protection, cybersecurity, actors' perceptions, and, most importantly, the cadastral system's end users and beneficiaries.

The immediate challenge is to assess the dimensions of the current cadastral system, execute an accurate and realistic future dimension and identify the innovations, rules and actions required to deliver transformative modification. A nuanced approach to analyzing current and future systems must incorporate the citizenry these systems serve. This consideration must encompass societal dynamism and challenges such as affordability, urbanization, valuation trends, demographic changes, employment profile, demand for land and the importance of land registration (Atazadeh et al., 2017).

The counterarguments suggest that caution must be exercised regarding the shift towards collecting personal data for future solutions, particularly in light of data protection breaches and cyberattacks. The technological platform will incorporate volunteered geographic and attribute information; however, protocols and procedures for verifying this information before it is included in the registration process must be established. Krigsholm (2020) asserted that the ambition of fully automating cadastral systems necessitated that volunteered data collection be an integral feature of this ecosystem.

7.0 Conclusion

Aligning this investigation with the socio-technical transition framework of Jamaica's cadastral system, the genesis of the transition schema lies in determining the transition blueprint. At this juncture, the current system must be optimized while respecting traditions and practices. This inertia of cultural-cognitive elements aligns with today's cultural, technical, and economic realities. The hypothesis suggests that it will not be efficient or effective in satisfying the burgeoning agenda of the future.

Ho et al. (2013) suggested that this inertia was arguably strengthened when the entire cadastral system was considered rather than merely its property registration components. This derivative perspective provided a speculative view that future ambitions presented significant challenges.

The pathway into the future will require significant research, consultation, and collaboration to surmount the myriad of challenges of designing and implementing a fit for the future cadastral system in Jamaica. The approach's feasibility must be juxtaposed with the legislation and operational realities of academia, private practice and the state. Ultimately, policy, education, and strategic development must be harmonized to advance land administration in Jamaica.

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Biographical Data

Wayneworth G. Hamilton is an intellectually rigorous individual with a keen attention to detail. Mr. Hamilton embodies a continuum of professionalism and integrity, while consistently recognizing his responsibility to his fellow professionals. He is aware of his dynamic role in the geospatial and hydrospatial industries, the built environment, and society as a leader, and he operates accordingly.

Mr. Hamilton holds a Bachelor of Science Degree with First Class Honours in Surveying and
Geographic Information Sciences and a Master of Science in Built Environment from the University of Technology, Jamaica, in 2012 and 2015, respectively. He is a recipient of the coveted Newsome, McCook and Associates Award (2012) for excellence in academic performance in Land Surveying and G.I.S., the Dr. Laurence Neufville Award (2015) for outstanding academic achievement, and the award for best research project at the postgraduate level.

Furthermore, Mr. Hamilton has been honoured with the prestigious University of Technology, Jamaica 60th Anniversary Outstanding Alumni Award for Service to the University and Country (2019) as well as the Certificate of Honour for Distinguished UTech, Jamaica Alumnus in 2023.

Mr. Hamilton has over 25 years of experience in the geospatial industry. He attained the professional credential of Commissioned Land Surveyor in Jamaica in 2016 and worked as a Geo-Information Management Consultant. He lectured at the University of Technology, Jamaica, in the School of Building and Land Management, covering Land Surveying and Geographic Information Sciences as well as the Master of Science in Built Environment Programme from 2016 to 2021. Mr. Hamilton is also a member of the Kiwanis Club of Montego Freeport and serves as a Justice of the Peace in the Parish of Saint James, Jamaica.

Mr. Hamilton served as Director of the Survey and Mapping Department at the National Land Secretariat of the Turks and Caicos Islands Government from November 2021 to January 2025. His notable contributions include capacity building/ recruitment of staff, introduction of an active geodetic network, redevelopment of the geodatabase, aerial imagery, street views, LiDAR Survey of Providenciales, hydrographic audit compliance, upgrading the technical resources, and creating collaborative partnerships with local, regional, and international geospatial stakeholders.

Mr. Hamilton has a keen interest in research, publications, and media. He has contributed publications and presentations with the International Federation of Surveyors (FIG). He was a columnist for the Western Mirror, where he wrote a highly impactful and educational column titled “Your Land & You", as well as hosting a podcast titled “Kicking It With The Pros.”

Mr. Wayneworth G. Hamilton, in his current role as Senior Director of the Surveys and Mapping Department of the National Land Agency of Jamaica, is a transformational

leader with vision, emotional intelligence, charisma, a passion for excellence, and interpersonal skills that inspire and foster the growth and development of the Surveys and Mapping Department. His qualifications and experience represent a vital contribution to the capacity building of his team. His leadership and work ethic serve as a solid foundation to advance the ambitious yet achievable growth agenda of Jamaica's National Land Agency (NLA). His professional objectives include fulfilling the NLA's operational and strategic aims, developing a world-class team, and delivering effective and efficient geospatial/ hydrospatial services to support Jamaica's land administration, development, and economic growth.

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