

Smart Cities under the Lens of Cultural Branding and Education: The Case of Palmas - TO in Northern Brazil

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Abstract— The development of smart cities has traditionally been associated with technological infrastructure and data-driven governance. However, recent studies highlight the importance of integrating cultural identity, education, and civic participation into urban innovation processes. This study explores the role of cultural branding and educational institutions in promoting smart city strategies in emerging urban contexts. The research adopts a qualitative exploratory approach, combining a literature review with a case study analysis of the city of Palmas, the capital of the state of Tocantins in Northern Brazil. In addition, the study includes documentary analysis and observation of institutional initiatives related to urban innovation, cultural promotion, and digital inclusion. The findings suggest that cultural assets, local identity, and educational institutions can play a strategic role in the development of smart city ecosystems, particularly in medium-sized cities in developing regions. This research contributes to the debate on alternative pathways for smart city development by highlighting cultural branding and education as key elements in urban innovation strategies.

Keywords— *Smart City; Soft Power; Branding; Palmas - TO.*

I. INTRODUCTION

This study contributes to the smart city literature by integrating cultural branding and educational dynamics into the analysis of urban innovation ecosystems, particularly in emerging cities in developing regions. Considering the idiosyncrasies of a culturally rich country like Brazil, it is crucial to emphasize the importance of integrating local culture with public policies to strengthen urban identity. The composition of a Smart City project must take into account dynamics involving knowledge, context, interactions, foundation, time, and space. Given Brazil's geospatial conditions, the country's cultural expressions are diverse and vary significantly between regions [1]. In this sense, cultural appreciation can become a great ally in improving quality of life, promoting digital inclusion, and fostering democracy. Based on these concepts, this research aims to support the innovative development of cities by intersecting modernity

and tradition, emphasizing the importance of Cultural Branding for urban growth and evolution.

Despite its contributions, this study presents some limitations that should be acknowledged. First, the research adopts an exploratory qualitative approach based primarily on a literature review and a single case study. Another limitation is that the empirical analysis relies mainly on documentary sources and institutional initiatives, which may not fully capture the perspectives of all actors involved in the local smart city ecosystem, such as citizens, entrepreneurs, and public managers.

Furthermore, the long-term impacts of cultural branding strategies and educational policies on urban development cannot yet be fully evaluated. However, these limitations also create opportunities for future research that may incorporate comparative analyses, quantitative data, and broader participation from different social actors.

This article is structured as follows: Section I presents the introduction, contextualizing the research and outlining the limitations of the study. Section II describes the methodology used. Section III discusses soft power and cultural branding within the concept of smart cities. Section IV addresses smart cities in the Brazilian context. Section V examines Palmas-TO as a model of cultural branding for the Northern region of Brazil. Section VI discusses the relationship between culture, education, and digital literacy in the development of smart city ecosystems. Finally, Section VII presents the conclusions of the study and highlights how future research can contribute to this topic.

II. METHODOLOGY

This research adopts a qualitative exploratory approach in order to analyze the relationship between cultural branding, education, and the development of smart city strategies in emerging urban contexts. The methodological design combines a literature review and an empirical case study analysis, focusing on the city of Palmas, located in the state of Tocantins in Northern Brazil.

A systematic literature review was conducted to identify the main theoretical frameworks related to Smart Cities,

Cultural Branding, Soft Power, and the role of education in urban innovation ecosystems. Academic articles, books, and public policy reports published in international databases were analyzed in order to establish the conceptual foundation of the study. In addition, the research employed a qualitative case study methodology [7], considering Palmas as an emerging urban environment with potential for the development of smart city initiatives.

The collected data were analyzed through qualitative content analysis, allowing the identification of patterns related to cultural identity, knowledge production, digital inclusion, and citizen participation. This methodological framework makes it possible to explore how cultural branding and educational institutions can contribute to the development of smart city ecosystems, particularly in medium-sized cities located in developing regions.

III. SOFT POWER AND CULTURAL BRANDING IN THE CONCEPTUAL FRAMEWORK OF SMART CITIES

Transforming into a Smart City requires specific changes and likely demands systemic transitions involving the co-evolution of technology, culture, and governance. Cultural and historical attributes create unique and special urban areas for local communities and visitors [2]. Additionally, the authors emphasize that culture can act as a special driver for regenerating economic growth; information and communication technologies (ICTs) enable the uniqueness and special qualities of cities to be integrated into a smart culture approach. When discussing governance, the authors suggest that this pillar shapes the economic development of cities and that, with the incorporation of ICTs, it is possible to enhance inclusion and the opportunities offered.

In this context, the term "Soft Power" was developed in the mid-1980s by the American political scientist Joseph Nye [3]. This term defines a country, state, or city's ability to use its image to attract business and progress through the dissemination of its ideas, culture, and values. In other words, soft power is a form of influence exercised through non-coercive means, such as cultural, ideological, and diplomatic influences.

The economy strengthens education, which in turn strengthens culture, ultimately reinforcing the economy and generating a significant global impact [3].

Soft power generates financial returns, investments, and recognition for cities. Through technology, creative industries strategically exploit intellectual property to foster local digital development. South Korea exemplifies this approach, with substantial investments in creative industries, including music, audiovisual production, and digital games, projecting the country's global image.

Contributing to these concepts, Place Branding is the network of associations in consumers' minds, based on the visual, verbal, and behavioral expression of a place, embodied through its objectives, communication, values, and local culture [4]. In other words, branding is the process of creating and managing a brand's identity in the market, involving the identification and definition of distinct characteristics that differentiate a place from its competitors.

When considering branding for cities, the process is multidimensional, requiring an analysis of history, culture, ecosystem, policies, and other characteristics of the location. By applying branding techniques and marketing strategies, economic, political, and cultural development can be promoted for cities, regions, and countries. Rio de Janeiro is

Brazil's most internationally projected city in terms of image, as few places in the world combine abundant natural beauty with a vibrant urban lifestyle [5]. In 2012, Rio de Janeiro became the first city in the world to be designated a "World Heritage Site as a Cultural Landscape" by UNESCO. Additionally, it hosts renowned events such as Rock in Rio, Rio Carnival, and the New Year's Eve celebration at Copacabana Beach. The city's cultural identity is further strengthened by its signature musical styles, including samba, bossa nova, choro, and funk carioca.

Promoting a city's cultural branding through innovation and technology requires integrating unique cultural elements with digital tools, creative practices, and innovative strategies. The goal is to create a strong and authentic city image while leveraging technology to amplify its reach and engage both local and global audiences.

IV. SMART CITIES IN THE BRAZILIAN CONTEXT

To evaluate the smart development of cities in Brazil, the Connected Smart Cities [6] initiative assesses municipalities through the Connected Smart Cities Ranking, which identifies the most smart and connected cities in the country. The ranking seeks to map cities with the greatest potential for development by analyzing a comprehensive set of indicators related to intelligence, connectivity, and sustainability. The initiative also promotes collaboration among companies, public institutions, and government entities, creating a platform that identifies innovative practices capable of improving urban management and the quality of life of citizens.

The Connected Smart Cities Ranking evaluates urban development through multiple dimensions that reflect the complexity of contemporary urban systems. Among the aspects analyzed are mobility solutions, urban infrastructure, environmental sustainability, technological innovation, health services, public safety, education, entrepreneurship, governance, and economic development. Together, these indicators provide a multidimensional perspective on how cities integrate technological solutions, institutional capacity, and public policies to foster urban development.

In terms of mobility, the ranking considers the adoption of intelligent transportation systems and the implementation of digital technologies that improve urban circulation and accessibility. Examples such as electronic ticketing systems in public transportation and the use of smart traffic lights, particularly in large metropolitan areas such as São Paulo, demonstrate how digital technologies can enhance traffic management and public transportation efficiency.

Urban infrastructure is also a fundamental element in the evaluation of smart cities. Indicators related to urban planning include the coverage of water supply systems, sewage treatment services, land use regulation, and the existence of strategic master plans guiding urban expansion and development. In addition, the use of digital tools in urban governance—such as computerized and georeferenced real estate registries accessible to citizens and the availability of online systems for issuing construction permits—reflects the integration of technological solutions into public administration.

Environmental sustainability represents another central component of the ranking. The analysis includes monitoring of risk areas associated with natural disasters, such as landslides, erosion processes, and hydrological events including floods and flash floods. The evaluation also considers indicators such as access to water supply services,

sewage treatment coverage, solid waste collection, recycling rates, and the monitoring of mapped environmental risk areas. These elements are fundamental for understanding how cities address environmental challenges while pursuing sustainable development.

Technological infrastructure and innovation capacity are equally important in the assessment of smart cities. The ranking evaluates indicators related to entrepreneurship, technological services offered by public institutions, and the adoption of digital technologies across sectors such as mobility, urban planning, security, and governance. Particular attention is given to the expansion of digital connectivity, including broadband access, the average speed of internet connections, the level of population coverage by broadband networks, and the presence of emerging technologies such as 5G networks. Additionally, the proportion of the workforce employed in technology and innovation sectors provides insights into the capacity of cities to generate knowledge-based economic activities.

The analysis of urban development also incorporates indicators related to healthcare infrastructure and social well-being. Access to healthcare services, availability of hospital beds, presence of qualified professionals, and public investments in the health sector are considered in the evaluation. Basic sanitation infrastructure is also included in this analysis, since inadequate sanitation conditions can significantly impact population health outcomes, including infant mortality rates. This perspective highlights the interconnected nature of urban systems, where infrastructure, public services, and social well-being are closely linked.

Public security indicators are also examined as part of the evaluation of urban quality of life. These indicators include homicide rates, the number of municipal civil guards and traffic officers, per capita investments in public security, and the existence of integrated operations control centers that monitor urban dynamics and coordinate emergency responses. Such elements demonstrate the role of institutional capacity and technological tools in promoting safer urban environments.

Education is another fundamental dimension in the assessment of urban development. Indicators related to educational opportunities include the availability of public university places relative to population size, student performance in national educational assessments such as the Brazilian National High School Examination (ENEM), the ratio of computers available to students in schools, and public investments in education, research, and development. These elements reflect the importance of human capital formation and knowledge production in supporting long-term urban innovation processes.

Economic and entrepreneurial dynamics are also considered in the ranking. The analysis evaluates the creation of new businesses, the presence of innovation ecosystems, and the economic sustainability of municipalities. Indicators related to income levels, employment availability, and the diversification of economic activities help measure the capacity of cities to generate economic growth while maintaining social stability. Governance indicators complement this analysis by examining aspects such as municipal transparency, opportunities for social participation, the educational level of public managers, and public investments in strategic sectors including education, health, urban planning, and security.

The results of the Connected Smart Cities Ranking reveal significant regional disparities in Brazil. Cities located in the

South and Southeast regions generally perform better across most indicators, reflecting higher levels of infrastructure development, technological adoption, and institutional capacity. This disparity is particularly evident in the environmental dimension, where the majority of the highest-ranked cities are concentrated in these regions. In contrast, cities located in the North and Northeast regions tend to present lower performance levels in several indicators of urban development.

However, when analyzing the criteria used to evaluate the smartest cities in Brazil, it becomes evident that cultural aspects are largely absent from the assessment framework. Despite the comprehensive nature of the ranking, the role of cultural identity in urban development strategies is not explicitly considered. This omission is particularly relevant in a country such as Brazil, where cultural diversity represents an important social and economic asset.

From the perspective of cultural branding, the promotion of local culture may represent an important pathway for strengthening urban development strategies, especially in regions that present lower technological and infrastructural indices. The North and Northeast regions of Brazil, for example, are widely recognized for their rich cultural heritage, including traditional festivals, music, gastronomy, architecture, and historical traditions. By leveraging these cultural assets, cities in these regions may develop distinctive urban identities capable of enhancing their attractiveness and competitiveness.

In this context, the valorization of cultural heritage can contribute to the construction of strong city brands that reinforce symbolic identity and promote social cohesion. Cultural activities, artistic production, and the preservation of local traditions allow cities to build narratives that extend beyond their geographic boundaries, increasing their visibility in national and international contexts. This process not only strengthens local identity but also stimulates economic and social development by attracting tourism, investments, cultural events, and creative talent.

Thus, incorporating cultural dimensions into smart city strategies may represent an important complement to existing technological and governance-based approaches. By integrating cultural assets with innovation policies, educational initiatives, and participatory governance, cities may develop more inclusive and sustainable pathways toward smart urban development.

V. PALMAS-TO AS A MODEL OF CULTURAL BRANDING FOR THE NORTHERN REGION OF BRAZIL

Palmas, the capital of the state of Tocantins in Northern Brazil, represents an emerging urban environment with significant potential for the development of smart city strategies. Founded in 1989, Palmas is one of the youngest state capitals in Brazil and was planned according to a modern urban design that favors territorial expansion, mobility, and environmental integration. These characteristics provide a favorable structural basis for the adoption of innovative urban development strategies aligned with contemporary smart city frameworks.

Despite its relatively recent development, the city has progressively incorporated initiatives related to innovation, digital governance, and urban sustainability. Such initiatives contribute to the creation of an environment conducive to the implementation of smart city strategies that combine technological infrastructure with social participation and the

strengthening of local identity. In this sense, Palmas illustrates how emerging cities can gradually build institutional and technological capacities that support more integrated models of urban development.

One of the most relevant institutional actors in this context is the Federal University of Tocantins (UFT), which plays an important role in promoting research, innovation, and knowledge transfer in the region. Through research groups, academic programs, and extension activities, the university contributes to initiatives related to digital inclusion, technological experimentation, and civic engagement. Universities therefore function as knowledge hubs that connect academic production, technological innovation, and community participation, reinforcing the development of local innovation ecosystems.

In addition to its academic ecosystem, Palmas also presents cultural and environmental assets that can support a cultural branding strategy aligned with smart city development. Landmarks such as Praia da Graciosa and the city’s cultural circuit reinforce local identity while simultaneously creating opportunities for tourism development, cultural events, and community interaction. These assets contribute to the symbolic construction of the city’s image and reinforce the potential of cultural resources as drivers of urban development.

These characteristics illustrate how medium-sized cities located in developing regions may adopt alternative pathways to smart city development. Rather than relying exclusively on large-scale technological infrastructures, cities such as Palmas can leverage cultural identity, educational institutions, and participatory governance mechanisms to foster innovative and inclusive urban ecosystems. From this perspective, smart city development is not limited to technological advancement but also depends on social, cultural, and institutional dynamics.

The case of Palmas, therefore, provides empirical evidence that smart city development can emerge from the intersection of culture, education, and local institutional capacity. This perspective highlights the relevance of cultural branding as a strategic element in urban innovation processes, particularly in emerging urban contexts where cultural resources and local identity represent important development assets.

Recent recognition further reinforces this potential. For the fourth consecutive year, Palmas was ranked as the smartest city in Northern Brazil according to the Connected Smart Cities Ranking [6]. In addition to this recognition, the municipality benefits from a geographically strategic location that places it near the center of Brazil’s territory, creating favorable logistical conditions that may strengthen its economic development potential. The presence of extensive natural reserves also contributes to the promotion of ecotourism and supports the city’s sustainable development strategies.

In the Cultural Branding dimension, cultural landmarks and tourism assets—such as Praia da Graciosa—stand out as important elements that contribute to the city’s identity and attractiveness. In the Education dimension, research and innovation initiatives led by the Federal University of Tocantins highlight the role of academic institutions in local development.

Digital Inclusion is represented through university extension programs and civic engagement activities that expand community participation and access to knowledge. Finally, the Urban Identity dimension reflects the integration of cultural and environmental elements in urban planning and

city development, reinforcing the territorial identity of Palmas.

Within this context, cultural policies must consider the diversity of audiences and cultural expressions present in urban environments. However, the first step for effective cultural policy development is the recognition, by public authorities, of the intrinsic value of cultural expressions and diversity. From this understanding, it becomes possible to value and accommodate the various cultural manifestations present in different segments of the city [7].

From this perspective, Palmas presents distinctive characteristics that may enable it to become a reference model for place branding in the Northern region of Brazil as illustrated in Figure 1. By integrating culture and technology,

Dimension	Evidence
Cultural Branding	Cultural Landmarks and Tourism assets such as Praia da Graciosa
Education	Research and innovation initiatives led by the Federal University of Tocantins
Digital Inclusion	University extension programs and civic engagement activities
Urban Identity	Integration of cultural and environmental elements in city development.

Figure 1. Dimension and evidence in Palmas- TO.

the city can strengthen public policies focused on digital inclusion, the development of intelligent citizenship, and the appreciation of local cultural heritage. Such an approach contributes to the construction of an urban development strategy in which cultural identity becomes a central component of smart city initiatives.

In this sense, the cultural branding strategy of Palmas could be structured around three main dimensions. The first dimension involves culture and local identity, encompassing the history and cultural heritage of Palmas and Tocantins, traditional handicrafts, regional gastronomy, and diverse cultural manifestations, as well as cultural and sustainable tourism initiatives. The second dimension relates to digital inclusion and citizen participation, focusing on the development of basic and advanced digital literacy programs that enable citizens to actively participate in digital environments. The third dimension concerns digital governance and sustainable development, including the implementation of participatory platforms, e-governance initiatives, technological tools that facilitate dialogue between citizens and public administrators, training programs for public managers focused on smart city policies, and educational initiatives aligned with the Sustainable Development Goals (SDGs).

From a practical standpoint, the development of the Palmas cultural brand should begin with structured studies aimed at integrating technological tools that improve public services and expand access to information for both residents and visitors. Given the presence of universities and research institutions in the city, Palmas has strong potential to establish partnerships with academic actors in order to identify local needs and develop technological solutions that promote quality of life and strengthen the tourism sector.

Moreover, Palmas can be strategically positioned as an influential hub in both national and international contexts, not only due to its cultural heritage but also because of its natural landscapes and environmental resources. Iconic locations

such as Palmas Lake, the waterfalls of Taquaruçu, the Serra do Lajeado mountain range, and the region's characteristic sunsets constitute symbolic elements capable of reinforcing the city's identity and attractiveness.

The cultural branding strategy of Palmas should therefore align the promotion of cultural identity with innovative technological solutions capable of enhancing visitor experiences and strengthening the city's international visibility. The integration of culture and technology enables the connection between tradition and modernity within the broader framework of intelligent urban development. Examples of such initiatives include the development of cultural tourism applications featuring digital itineraries that highlight indigenous, quilombola, and regional traditions, combined with immersive virtual reality experiences that present local dances such as Sússia (also known as Suça or Súcia) and Catira. Additional initiatives may involve the digitization of archives related to local festivals, such as the Taquaruçu Gastronomic Festival, enabling the virtual promotion of regional gastronomy and cultural traditions.

Interactive technological resources may also contribute to strengthening the city's cultural identity. For example, digital panels installed in parks and other high-traffic areas could present historical information about Palmas and Tocantins, while nighttime projections might showcase local legends and cultural narratives. By promoting the development of such solutions through partnerships with universities and local innovation actors, the city can strengthen its cultural branding strategy while simultaneously expanding its technological capabilities.

In this context, technology becomes a powerful enabler for building and disseminating the city's image. Initiatives such as gamification based on local cultural narratives, digital platforms centralizing information about cultural heritage, virtual and augmented reality experiences, digital archives of historical records, documentary productions, podcasts, and artificial intelligence-based cultural assistants could significantly enhance public engagement and expand global access to the city's cultural assets. Furthermore, the use of big data analytics to monitor tourism trends may support more strategic cultural planning and improve the effectiveness of urban branding initiatives.

Finally, as an ecological hub with extensive natural resources, Palmas also has the potential to strengthen its tourism sector through the development of a nautical events agenda centered around Palmas Lake. Activities such as wakeboarding, rowing, kayaking, canoeing, and flyboarding could contribute to the diversification of tourism experiences while reinforcing the city's image as a destination that integrates nature, culture, and innovation.

VI. CULTURAL ASSETS, EDUCATION AND DIGITAL LITERACY IN THE DEVELOPMENT OF SMART CITY ECOSYSTEMS

Believing that the challenges inherent to Smart Cities encompass the integration of economic development with public service planning, the maintenance of a pragmatic orientation through investments in practical, feasible, and financially sustainable projects, and the assurance of active participation by community representatives, local businesses, and residents in order to align initiatives with the city's opportunities and challenges [8].

Thus, considering local culture as a pillar of smart city development is essential, as public policies should be directed

toward technological, social, and governmental solutions that respect the needs, values, and identities of the population.

Figure 2 presents the conceptual model proposed in this study, highlighting the interactions between cultural assets, education, digital literacy, and civic engagement in the formation of smart city ecosystems. Cultural assets such as heritage, local identity, and tourism resources constitute the symbolic foundation for cultural branding strategies, enabling cities to construct narratives that strengthen their identity and expand their visibility within broader social and economic networks.



Figure 2. Conceptual model linking cultural assets, education, and digital literacy in the development of smart city ecosystems.

In these educational institutions, particularly universities and research centers, play a central role in the development of human capital, digital competencies, and innovation processes. Through the production and dissemination of knowledge, these institutions contribute to strengthening digital literacy and to the formation of citizens capable of actively participating in urban development processes. In this context, digital literacy functions as a connecting element between education and social participation, allowing citizens to access information, interact with digital infrastructures, and contribute to participatory governance processes.

The interaction among these elements fosters the development of urban ecosystems characterized by innovation, social participation, and sustainable urban growth, thereby offering an alternative pathway for smart city development in emerging urban contexts. In this regard, technology should be understood as inherently social in nature. Consequently, citizens' needs must serve as a guiding principle for technological development initiatives, ensuring that such efforts are oriented toward addressing and resolving local social challenges [9].

Furthermore, the configuration of smart cities necessitates the adoption of new governance models in which public authorities and citizens cultivate sustainable and collaborative relationships. Within this framework, the integration of sustainable public management practices with collective governance becomes essential, grounded in and reinforced by active citizen participation [10].

VII. CONCLUSION AND FUTURE WORK

This study explored the relationship between cultural branding, education, and the development of smart cities in emerging urban contexts, using the city of Palmas, in Northern Brazil, as an empirical case. The results suggest that the development of smart city ecosystems should not be understood exclusively from a technological perspective, but rather through a broader approach that integrates cultural identity, education, and social participation.

The case of Palmas illustrates how medium-sized cities in developing regions can leverage cultural assets and educational institutions to promote innovative urban environments. Instead of relying exclusively on large-scale technological infrastructures, these cities can develop alternative pathways toward smart city development by strengthening local identity, promoting knowledge production, and encouraging civic engagement.

In this context, cultural branding emerges as a strategic mechanism capable of reinforcing urban identity and positioning cities within broader networks of tourism, knowledge exchange, and economic development. At the same time, educational institutions play a central role in developing the human capital and digital competencies necessary for the functioning of smart city ecosystems.

Future research can expand this study in several directions. Comparative analyses involving other emerging cities in Brazil and Latin America may provide a broader understanding of how cultural branding strategies interact with smart city initiatives across different socioeconomic contexts. In addition, future studies may incorporate quantitative methods, surveys, and interviews with local stakeholders in order to more accurately capture citizens' perceptions, levels of digital literacy, and the role of community engagement in the development of smart city ecosystems.

Another promising line of investigation involves analyzing the role of universities as innovation hubs in regional development, particularly with regard to knowledge transfer, entrepreneurship, and digital inclusion initiatives.

Therefore, the integration of cultural assets, educational initiatives, and participatory governance is understood as an important framework for understanding how emerging cities can pursue more inclusive and sustainable strategies for urban innovation.

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