SPORT City
Data Science Lab On Smart Cities

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Abstract

In an urban context, we like to read sport as an acronym for *Sociality*, *Protection*, *Opportunities*, *Renaissance* and *Territory* (SPORT). At its core, sport has the power to bring people together, foster a sense of community and social connection, and create opportunities for personal growth and development. Cities, and sports facilities inside and around them, can leverage sports to regenerate their territory and improve social capital. The main objective of this work is to present a digital initiative that connects sport and social behaviors, to improve the quality of life, especially in "undisciplined" cities. The work has been inspired by a concrete opportunity that is materializing in a Sicilian city, where a football club is working to bring back to success the local team while generating positive effects on the local and regional community. The entrepreneurial initiative aims to build a platform that local municipalities can provide to their citizens to detect and to measure some desired behaviors. Based on the score achieved by the different areas of the city, some actions will be put in place by the management of the football team to reward the most performing areas.

Keywords: SPORT

Contents

1. Introduction

The project takes its inspiration from some conversations with the management of a Sicilian football club. The club wants to foster the growth of its youth sector, involving boys and girls who live in the area but also young people who live in other parts of Italy and abroad. The growth of the youth sector could be combined, in agreement with local public authorities (eg. Comune, Regione), with an improvement of the quality of life in different zones of the city, involving families and businesses that are part of them. The municipality, envisaging the opportunity, wants to collaborate with the aim of improving its territory, even regenerating some areas, both under the scope of way of living and security, as well as to promote tourism.

Our project aims to understand the existing connections between sport activities and community development, and create an operational framework for implementation in a specific territory. While there is ample literature on urban development, social and economic communities, and the impact of sports on individuals and social living, the intersection of sport and urban development has not been deeply studied.

Sport events are often associated with cities, and there is a growing recognition of their potential to shape communities and the places they inhabit. Modern approaches to urban development acknowledge the role of sports in revitalizing urban areas, promoting public infrastructure, enhancing the quality of life, encouraging active lifestyles, fostering unity and community, and driving economic growth. However, research on the relationship between sports and urban development is still catching up with these changes. In the context of community development, two main theories are relevant: asset-based community development (ABCD) and needs-based community development. ABCD emphasizes the importance of community assets in achieving development goals. It recognizes that communities have the ability to drive their own development by mobilizing their existing assets and fostering collaborative partnerships. Needs-based community development focuses on addressing the needs and problems within a community to enhance residents' quality of life. It requires thorough data collection and collaboration with community members, but it can

also lead to a dependency on external experts if not properly implemented. The social exchange theory suggests that residents are more likely to support community development when they perceive direct benefits from the proposed initiatives. Understanding the perceived benefits and costs from the perspective of community members can help shape strategies to enhance community engagement and align development initiatives with their interests. Small-scale sport events can contribute to urban development by facilitating incremental improvements in infrastructure and amenities that directly benefit the local community. They can also have positive economic impacts by generating work opportunities, particularly in the service sector, and contributing to tourism. Additionally, sport events can promote social change and social capital by fostering bonding capital and prosocial behaviors within the community.

In our platform framework, we plan to focus on small-scale sport facilities and initiatives that have the potential to create significant social, educational, and economic changes for the majority of the population. These initiatives may not be as grand or appealing as iconic Olympic stadiums, but they can have a transformative impact on the lives of ordinary families. Overall, our proposal aims to bridge the gap between sport activities and urban development by creating a framework that leverages community assets, addresses community needs, considers the principles of social exchange theory, and emphasizes small-scale initiatives for sustainable and inclusive community development.

2. Existing Research Framework

Our project proposal has been triggered essentially by the intersection of two goals: understanding how the existing connections between sport activities and community developments have been studied so far and creating an operational framework to be concretely implemented on a clearly identified territory.

Undoubtedly there is a wealth of literature on urban development, social and economic communities, and smart cities. There is also plenty of research focused on the effect of sport on human beings and social living. Unfortunately, the intersection of the two is a topic that has not been deeply studied. As clearly investigated by

[1] Dickson Zhang (2020), when we think about sport events we immediately connect them to a place and usually this place is a city. A very large city. As emerged in 2019, during an international conference on sports and urban development hosted by a Chinese University, the academic, economic, social and policy research are still far from joining forces to detect, measure and study the real connection between "sport and urban development", despite the fact that it's becoming more and more evident that sports have a strong potential to shape communities and the places where they live.

Modern approaches to urban development acknowledge the potential of sports to reinvigorate urban areas, bring about community transformation, promote public infrastructure, enhance the image of destinations, enrich the quality of life for local residents, encourage active lifestyles, foster unity and a sense of community, and spur economic growth. The effect of sports on urban development is a subject that is widely debated among government officials, professionals, and scholars. In the academic field of sport management, numerous studies have examined the social, economic, and environmental impacts of events and stadiums on host communities. However, a significant number of researchers have not explored these subjects with a specific emphasis on urban development [2] Kozma et al. (2014).

Urban development focuses on influencing the condition of urban life ([3] International Social Work, 1966). More than a half of the world population resides in urban areas and the impact of the city on their daily lives is definitely higher than that of single or small communities of people trying to reshape the urban context. In small villages and residential areas it is undeniable that even a single individual can make the difference. Unfortunately in very large and complex urban spaces this power relationship is unbalanced.

There are several concepts strongly connected to urban development. Urban planning refers to a technical and political process that deals with the design and development of land use and the physical environment, encompassing elements such as air and water quality, transportation, communication, and distribution networks that link urban areas ([4] MacGill University, 2019). Urban design is often regarded as a multidisciplinary field that integrates various areas of knowledge and practices from spatial, political, economic, urban planning, sustainability, and architecture studies. Positioned between urban planning and architecture, urban design aims to create more favorable spaces for people than those that would be created otherwise ([5] Frick, 2012). It emphasizes the interdependent relationship between cities and their inhabitants, and involves deliberate and coordinated actions to design new cities or modify existing ones and their surrounding areas in response to the needs of the people who live in them. Urban design acknowledges that the shaping of cities is influenced by strong internal forces ([6] Urban Design Group, 2019).

Urban governance is one of these forces. Effective urban governance places significant emphasis on fostering strong relationships and interactions between the government and its stakeholders. Additionally, it recognizes the importance of establishing appropriate conditions and rules that govern these relationships and interactions ([7] Cruz et al., 2018). [8] Rijke et al. (2012) assert that a move is underway from government to governance, which represents a transition from the traditional, well-established forms of hierarchical governance practiced by dominant bureaucratic and administrative governments to more informal governance approaches, where power is dispersed among a range of actors and organizations.

The evolving role of sports in urban development has been highlighted also by [9] Jin et al. (2011), [2] Kozma et al. (2014), and [10] Zhang et al. (2018). Presently, urban leaders are placing greater emphasis on incorporating sports facilities into local development plans. The hosting of significant sporting events has evolved from being solely focused on event management to becoming an integral component of economic, cultural, and environmental impacts, with an increasing emphasis on community development. However, research on the relationship between sports and urban development has yet to keep pace with these changes.

Exploring existing literature on the connection between sports and communities, we found very interesting the analysis performed by [11] Kaplanidou (2021), focused on using sport events

for community development through the lenses of community development theories. This analysis highlights two main theories related to community development: asset-based community development ([12] Fisher et al., 2009; [13] Mathie and Cunningham, 2003) and needs-based community development ([14] Nel, 2018). This second approach is even more interesting in the light of our Data Science academic studies because it's heavily based on data.

Asset-based community development (ABCD) "is a theory that underlines the importance of community assets to achieve development goals". The central idea of the theory is that communities have the ability to drive their own development by recognizing and mobilizing their existing, often overlooked, assets ([13] Mathie and Cunningham, 2003, p. 474). Community development can be achieved by leveraging these assets towards predetermined community goals. [15] Kretzman and McKnight (1996) define community assets as encompassing individuals, associations, and institutions, which can be combined to foster community growth. According to [15] Kretzman and McKnight (1996), the relationships among community members serve as the driving force behind local associations and network building. More recently, [16] Mathie and Cunningham (2005) explored the link between Asset-Based Community Development (ABCD) and social capital theory, emphasizing the psychological aspects of mobilization and citizen involvement, which provide a sense of control over the community development process. In the realm of sport management literature, the ABCD framework has been applied to the development of tennis communities, incorporating elements such as identifying a community champion, fostering collaborative partnerships, and delivering high-quality tennis programming ([17] Vail, 2007). In the context of sport events, [18] Misener and Schulenkorf (2016) propose that the ABCD approach shifts the focus from solving social problems to leveraging and enhancing existing community strengths.

The needs-based or problem-based community development theory focuses on addressing the needs and problems within a community to enhance residents' quality of life ([14] Nel, 2018a). In the context of sport events, these needs and problems could range from a lack of sport facilities to insufficient volunteers or a lack of local expertise in hosting such events. However, the needs-based approach can have limitations. When individuals and their needs are solely viewed as the focus of intervention, they may develop a dependency on external experts rather than recognizing their own capacity to contribute to community development ([19] Nel, 2018b). This approach requires thorough data collection to understand the problem in order to provide appropriate solutions ([14] Nel, 2018a). Data collection should involve relevant participants throughout the process to gather diverse perspectives. One challenge of the needs-based approach is that it may overlook existing or past programs and interventions aimed at addressing the identified problem ([14] Nel, 2018a). Focusing solely on problems can lead community members to feel passive and reliant on external solutions, particularly if the government or an external organization is solely responsible for problem-solving ([20] Durie and Wyatt, 2013). Despite its criticisms, the needs-based approach can be successful when organizations driving the process of problem-solving collaborate with community members.

By engaging the community and recognizing their strengths, a connection can be established between the needs-based community development theory and the Asset-Based Community Development (ABCD) theory ([21] Che, 2018). This collaborative approach encourages active involvement, empowers community members, and enables the utilization of existing community assets and strengths in problem-solving and community development efforts.

It's also worth to mention the importance of taking into account in our framework the contribution of the Social exchange theory, as discussed by researchers such as [22] Emerson (1976), [23] Kaplanidou (2012), and [24] Prayag et al. (2013), that provides insights into the principles of support for developmental stimuli within a host community. In essence, social exchange theory suggests that residents are more likely to support community development when they perceive direct benefits from the proposed development. Conversely, if they observe personal or community costs associated with the development, they may withdraw their support. This theory recognizes the idea that individuals engage in a social exchange process

where they weigh the potential gains and losses of participating in a particular development or initiative. When the perceived benefits outweigh the perceived costs, residents are more inclined to provide support and contribute to the development. However, if the costs outweigh the benefits, their support may diminish. By considering the principles of social exchange theory, researchers and practitioners can gain insights into the factors that influence community support for development projects. Understanding the perceived benefits and costs from the perspective of community members can help in shaping strategies to enhance community engagement, address concerns, and align development initiatives with the community's interests and aspirations.

Sport events can be seen as urban development contributors and, especially smaller-scale events can represent a solution for hosting communities ([25] Gibson et al., 2012). According to [26] Taks (2013), urban development goals can be more attainable through smaller-scale events, although large events have the potential to accelerate projects more rapidly. Small-scale sport events often result in infrastructure upgrades rather than the construction of new facilities ([25] Gibson et al., 2012). The local community typically views these infrastructure improvements positively, particularly when they contribute to an enhanced quality of life ([23] Kaplanidou, 2012). The argument put forth by [26] Taks (2013) suggests that while both small and large events can contribute to urban development, small-scale events may offer more practical and achievable outcomes. These events can facilitate incremental improvements in infrastructure and amenities that directly benefit the local community. While large events may have a more significant impact, they often require substantial resources and may have a longer planning and implementation timeline. The positive perception of infrastructure changes by residents, as highlighted by [23] Kaplanidou (2012), indicates that such improvements align with the community's interests and needs. When infrastructure upgrades enhance the quality of life, residents are more likely to view them favorably and recognize the positive impact on their daily lives. Therefore, by focusing on small-scale sport events and associated infrastructure upgrades, urban development initiatives can incrementally enhance the local community's well-being and contribute to their overall satisfaction with the urban environment.

Sport events can be considered also as economic development contributors, because they can generate a significant impact in host communities ([27] Preuss, 2005; [28] Preuss et al., 2015). Focusing again on smaller-scale events, they have the potential to create work opportunities, especially in the service sector. In particular, [25] Gibson et al. (2012) found that tourism may have an important impact on the local economy. A study was performed on six smaller-scale sport events and it was clearly observed that they generated positive economic contributions to the hosting community which size was about 250,000 residents (slightly less than those living in the area, Catania, where we would like to test our framework).

Sport events can be also seen as contributors of social change, social issues and social capital ([29] Spaaij, 2009). In the first decade of 2000, many studies analyzed the perception of social impact of sport events among residents, while in the second decade researchers were focused purely on the social impacts of sport events. Social impacts are usually measured evaluating "cultural and social aspects, reducing crimes, reducing resident displacement and enhancing cultural exchanges ([30] Balduck et al., 2011; [31] Bull and Lovell, 2007; [32] Ohmann et al., 2006). [33] Zhou and Kaplanidou (2018) conducted a study and discovered that a prominent form of social capital developed among participants of sport events is bonding capital, which refers to the formation of closer relationships within the community. This bonding capital stems from the shared experiences and interactions that take place during sport events. The research also indicated that the generation of positive social capital through sport events can lead to several potential outcomes. One of these outcomes is prosocial behaviors, which encompass acts of kindness, cooperation, and support within the community. Engaging in sport events can foster a sense of unity and mutual trust, encouraging individuals to exhibit prosocial behaviors towards others. Another potential outcome highlighted by [33] Zhou and Kaplanidou (2018) is increased everyday socialization. Participating in sport events provides opportunities for individuals to meet and interact with others in their community. These interactions can extend beyond the event

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itself, leading to more frequent and diverse social connections in everyday life. The increased socialization can contribute to a sense of belonging and strengthen social ties within the community. In summary, [33] Zhou and Kaplanidou's (2018) research underscores the significance of sport events in creating bonding capital, fostering closer relationships among participants. The positive social capital generated through these events can result in prosocial behaviors and increased everyday socialization, enhancing social cohesion and community interactions.

In our paper we will not focus on extraordinary, iconic buildings like Olympic sport events and stadiums. We will pay attention to small, simple, way less expensive sport facilities and initiatives that probably are less appealing to urban elites but that could dramatically change the current and future social, educational, economic status of many normal, and usually invisible, families composing the majority of the population and our land.

3. Problem Description & Research Question

Italy likes football and usually football is considered, by families and their children, a way to leapfrog from nothing to all. But there are several steps in the middle that should deserve attention because, even if it's easier (and definitely more attractive) to imagine a boy or a girl becoming the new Lionel Messi or Cristiano Ronaldo or Lucy Bronze or Samantha Kerr, it's much more achievable a distribution of benefits to a larger amount of human beings, measuring benefits not using money but a the more interesting concept of social capital.

The project takes its inspiration from some conversations with the management of a Sicilian football club (Catania Calcio SSD). The club wants to foster the growth of its youth sector, involving boys and girls who live in the area but also young people who live in other parts of Italy and abroad. In our work football represents just the visible part of an iceberg, which has most of its energy and power invisible and undisclosed.

The growth of the youth sector could be combined, in agreement with local public authorities (eg.

Comune, Regione), with an improvement of the quality of life in different zones of the city, involving families and businesses that are part of them. The municipality, envisaging the opportunity, wants to collaborate with the aim of improving its territory, even regenerating some areas, both under the scope of way of living and security, as well as to promote tourism.

The combination of the two could find its synthesis in the development of new sport facilities where new football teams and schools perform their activities. These sport facilities will be located in areas of the city that "deserve" them, meaning that they demonstrated through concrete actions that a specific urban territory satisfies a set of key performance indicators in line with the expectations of the local government and the goals of the football team.

Our main research question is focused on the possibility of creating a structured framework, allowing local governments and local football clubs to join forces with the ambition to generate a virtuous cycle in which municipalities, sport teams, supporters and the rest of the citizens can act as unique, intertwined community to improve social, economic and environmental capital of a territory.

It's of course almost impossible to investigate the whole set of components that form the "capital" of a territory. Therefore we decided to focus on few, partially measurable, drivers:

- Safety
- Cleanliness
- Hospitality capacity

Safety is considered as a proxy of the social capital, cleanliness a proxy of the environmental capital and hospitality a proxy of the economic capital. The framework we aim to create takes into account the above-mentioned drivers and connects them to the decisions policy makers and sport managers will take to pursue their respective goals.

The suggested framework is composed by the following components:

- Information & Engagement
- Collect & Distribute

- Data analysis & Measurement

- Return & Reward

Information & Engagement refers to the activities that the promoters of the SPORT City program must perform in order to inform all citizens and to transform them into active participants. It represents the initial and mandatory step that the local municipality and the local sport teams must perform to describe the main purpose of the initiative to as many citizens as possible.

Citizens' engagement is crucial to establish effective, and efficient, public policies. Goals must be transparently disclosed and, if needed, adjusted based on the inputs received by the participants. In this respect, establishing a communication channel between policy makers and citizens that involves the local football team as "intermediary" (sustained by a layer of "street level bureaucrats") could represent a way to ensure the widespread reception of the message and a higher percentage of involvement.

Engagement is key every time a public policy needs to be implemented. The implementation phase, even when perfectly planned, can take unexpected paths and can lead to different outcomes with respect to the original goals. In a context where municipalities face challenges in engaging citizens, the widespread use of social media and technological advancements have played a significant role in facilitating the dissemination of information and creating new avenues for interaction and collaboration. These developments have enabled the involvement of citizens and organizations in the co-production of public services. Social media platforms have rapidly gained prominence in public administrations, becoming a central component of the e-government process.

The utilization of social media in the public sector has also captured the attention of the academic community, which recognizes the potential for redefining traditional boundaries between individuals, organizations, communities, and various levels of public administration through new modes of communication and interaction facilitated by the internet. This ongoing evolution of relationships among different actors in the public sector is shifting the perception of citizens from mere customers to partners of the administration in policy formulation and the delivery of public services. This involvement is motivated by the potential to enhance the quality of public services. It not only fosters greater citizen participation in decision-making processes but also enables increased transparency and accountability by providing citizens with more control over resources and outcomes.

Collect & Distribute is strongly related to two concepts: facts sharing and exchange platform. In the past two decades, the concept of smart cities has gained significant attention from businesses, governments, media, and academia. Initially, it referred to the use of information and communication technologies to promote economic development, as well as the integration of digital platforms into urban management for e-governance purposes. This perspective was supported by organizations like the OECD and EUROSTAT, which emphasized the role of ICTs as drivers of urban innovation. However, the concept of smart cities has recently evolved to encompass a broader understanding of city planning and development, incorporating social and environmental considerations.

Through the utilization of Big Data, both city management and citizens gain access to a wealth of real-time information about the urban environment. This information serves as a foundation for decision-making, actions, and future planning within a collaborative framework, with the aim of reducing inequalities and social polarization. The widespread adoption of Big Data technologies facilitates the establishment of new frameworks and pathways for planning smart cities, fostering the creation and development of social and relational capital.

The SPORT City framework goes exactly in this direction and in this respect existing and widely adopted technologies play a crucial role. A recent research ([34] We Are Social, 2022) described Italy and Italians in terms of digital habits. Below some numbers:

- more than 78 million cellular mobile connections (almost 130% of the Italian population)

- more than 50 million internet users

- more than 43 million active social media users

- on average, the daily time spent on the internet is 6 hours and the daily time spent on social media is almost 2 hours

An interesting fact that emerged from this research is that comparing the primary reasons for using the internet, we find at the top that almost 75% of the respondents uses it to find information and at the bottom that 32% uses it to share opinions.

The proposed framework aims to make this gap narrower, turning citizens (including public employees) into aware and awake contributors, using existing social media channels to feed local municipalities with information. To make it very concrete, one of the three pillars of the framework we propose in this work is focused on cleanliness. A clean city is a sign of respectful and engaged citizens, as well as a sign of an attentive and efficient local government.

As we will describe in the "Research methodology", we used a limited sample of pictures showing the presence of garbage in different locations of the city to testify how easy it could be to collect such valuable inputs and to distribute them to the dedicated waste collectors, triggering actions almost in real time.

Data analysis & Measurement is mainly described in the "Research methodology" section. Here it's relevant to mention that the success and the development of the proposed framework depends on many factors and, among them, the data to be used for planning and scheduling initiatives and their constant monitoring represent one of the key elements.

For example, some types of data that could be used by the local authorities when planning and managing the SPORT City program are:

- open data readiness (in our specific case mainly related to crimes, waste management and hospitality)

- presence of sports facilities and planned developments

- presence of sports associations in the area and their characteristics

- current youth participation in sporting activities

- distribution of families in the area and their composition

- availability of solutions to host young people from other areas of Italy and abroad

- possibility of school placement

- socio-economic situation of families in the area (for initial assessment and monitoring of economic development)

- socio-environmental situation of city neighborhoods (for initial assessment and monitoring of their desirable improvement)

- level of promotion and tourist accommodation (conventional and sharing economy)

- ICT diffusion and network connections.

At a general level, the ultimate objective of the SPORT City framework is to allow local authorities to build a simplified social capital index at borough level, applying therefore a micro approach, that will be then used within the project to guide public and private (the football team) plans and actions.

Using [35] [36] Putnam's terminology the aim of our framework is to turn from a bonding social capital to a bridging social capital, creating an environment where horizontal ties replace vertical structures that, especially in some Italian regions, usually produce scarce results and prevent energies from flowing into positive developments. Data will be collected directly from citizens or from certified external sources and, as described in the next section, they will be used to create a score that will be then assigned to each borough.

Return & Reward is the trigger that transforms thoughts and plans into actions and results. Part of the content of this section has been inspired by a research article published in 2022 by a group of researchers belonging to the Universities of Padova and Verona ([37] Blasi et al., 2022) which focuses on the relationship between smart cities and citizen engagement, using social media (in their specific case, Twitter) as a communication channel.

Among the various tools used by municipalities to stay connected with citizens, Twitter has emerged as one of the most popular platforms. Twitter is an American microblogging and social networking service that enables users to post and interact with messages called "tweets" ([38] Haro-de-Rosario et al., 2018). Consequently, their analysis focused on Twitter conversations, as it serves as the preferred social media platform for city-citizen interaction.

In the ongoing scholarly discourse, much attention has been given to the technological advancements in smart cities, particularly with the advent of Web 2.0 and the integration of crucial technologies into our daily lives. However, only a limited number of studies have been conducted to understand how local governments effectively engage with their citizens through the utilization of such technologies. Nevertheless, the relationship between municipalities and citizens is a critical aspect in this context.

It is essential for administrations to have a clear understanding of the most effective smart city model that can positively transform the community through digital technology. This model should be economically sustainable, fostering collaboration between the public, private, and civil society sectors. Additionally, it should address the socio-cultural needs of citizens and focus on their daily requirements. Above all, a smart city must prioritize a "human" approach, which requires administrators who are well-informed and engaged citizens who share a common vision.

In our framework we consider Return & Reward as the most relevant component that allows municipalities to deliver appropriate messages to citizens, based on the data collected, to demonstrate that there is a virtual feedback loop in place. In addition to that, the joint program that involves the local football team will reinforce the feedback with appropriate rewarding measures that will likely increase citizen participation and their willingness to contribute more to the success of the initiative.

In this respect social media play an important role, helping municipalities to reduce the distance between them and their citizens, favoring the massive dissemination of information and opening new modes of interaction and collaboration. It's worth mentioning that in the realm of social media, citizen participation can be observed through two forms of interactivity: user-content interactivity and user-user interactivity. User-content interactivity occurs when a user engages with the content and its creators, while user-user interactivity involves interactions between multiple users. Active citizen participation depends on both the methods employed and the topics addressed by municipalities when interacting with citizens on social media platforms.

Multiple studies have demonstrated a correlation between the type of topics posted by municipalities on social media and the level of citizen engagement. The nature and content of the topics addressed by the municipality play a significant role in determining the level of citizen participation.

When municipalities communicate about issues that are relevant and directly impact the lives of citizens, it tends to generate higher levels of engagement. For instance, topics related to community events, local services, public infrastructure, environmental initiatives, and public safety often attract greater attention and interaction from citizens. These topics are more likely to evoke responses, comments, and discussions among citizens.

Conversely, when municipalities focus on less engaging or distant topics that may not directly affect citizens' lives, the level of engagement tends to be lower. In order to foster active citizen participation, municipalities should strive to identify and communicate about topics that are of genuine interest and relevance to the community. By addressing these issues, municipalities can increase citizen engagement and promote more effective and inclusive governance.

[39] [40] Bonson (Bonson et al., 2015, 2019) affirms that some specific topics, like cultural activities, sports, public transportation or promotional publications, can generate a higher level of civic engagement. Based on that we strongly believe that the link between specific public policies (e.g. people engagement to improve the safety of a borough or the waste management process) and an eye-catching topic (as football could be) could really get the attention of the citizens and drive them towards more responsible behaviors.

Developing this topic further, we suggest in our framework to go more local as possible, meaning that, as confirmed by some studies ([39] [40] Bonson et al, 2015, 2019; [41] Ma, 2013) the perceived closeness between followers and the municipality on social media platforms can contribute to higher levels of citizen engagement, particularly in smaller social media communities. In these communities, citizens may feel a stronger sense of connection and proximity to the municipality, which leads them to believe that their opinions and feedback hold significance and are likely to be acknowledged ([42] Bryer, 2013, [43] Bryer et al, 2011).

This perception of being heard and valued by the municipality can serve as a motivator for citizens to actively participate and interact on the municipality's social media channels. When citizens feel that their input is meaningful and can potentially influence decision-making processes, they are more likely to engage in discussions, share their opinions, and contribute to the dialogue. Therefore, in smaller social media communities, where the sense of closeness and connection is more pronounced, citizens may feel encouraged to participate proactively on the municipality's social media platforms, knowing that their voices have a greater chance of being heard and considered. This, in turn, fosters a stronger sense of community engagement and collaboration between citizens and the municipality. We make these concepts concrete suggesting below two possible approaches.

How could municipalities return valuable, interesting and operational feedback to their engaged citizens?

We reintroduce the concept of street level bureaucracy, suggesting the creation of a team of public employees living in different boroughs of the municipality and fully dedicated to constantly interacting with the citizens via social media.

Based on the inputs received from the citizens (e.g. garbage collection needs, requested via social media messages and pictures) or directly sourced through the available dataset (e.g. crimes detection, as the one we used in our empirical analysis) this team should provide different forms of feedback.

An example of interactive feedback could be concretely represented by a waste management truck that, in shifts, is always available to respond to citizens signals and, as soon as possible, resolve the issue highlighted. An example of near real time feedback could be the daily distribution, via social media, of a ranking of the boroughs based on scores achieved, for example, based on engagement (e.g. number of messages), number of crimes detected (e.g. evidence of charges presented to the local police), garbage alerts (e.g. pictures showing the location of the garbage to be collected).

How then could football teams, and any other local sport teams, reward engaged citizens?

In the short term, rewards could be represented by best seat free tickets, possibility to attend training sessions and to meet the players, public announcements during the events, leisure activities with the staff and the management of the team.

In the medium term, the most valuable reward is to participate in the program that will lead to the activation of a soccer school, sponsored by the local football team, in a specific area of the city and, in the long term, the construction of a sport facility where local and foreign girls and boys, and their parents, can create a new sport community and, hopefully, new professional players that will join the local football team and will contribute to its success and to the success of the city.

4. Research methodology

Considering that this research is part of an academic program in Data Science, our analysis combined existing literature (as described above) and available data. The research methodology encompassed several key activities, including the collection of datasets, web scraping, and other data acquisition techniques.

It's worth noting that our research methodology does not have the goal to validate research questions and hypotheses. Its main goal is to verify if there is the concrete possibility of using available and user generated data to create an operational framework leading to concrete actions that municipalities, sport teams and single citizens can execute to foster their collaboration and to

increase the overall capital of a territory.

As described above, our data analysis is mainly focused on three areas, security, cleanliness and hosting facilities, used as proxies for social, environmental and economic capital. At the beginning we tried accessing existing datasets related to our dimensions of analysis. This involved identifying reputable sources, such as government databases, research institutions, and open data platforms, from which relevant datasets were downloaded. For each area we identified a main data source:

- **Safety**: Mine Crime dataset[1]

- **Cleanliness**: Collection of local residents and tourists photos

- **Hosting Facilities**: Tripadvisor

We embraced a combination of quantitative and qualitative approaches and different data collection strategies were then used, such as API requests and web page scraping. We organized the data into csv files, mongo db collections, and geojson files.

Concerning the software used, we used Python as the programming language to process the datasets and to perform the analyses, while for the geospatial visualizations we used the open source tool Kepler[2].

4.1. Safety

Finding data on the safety of cities in Italy, with the exception of very large ones, is not easy. For this reason, we contacted the company SAFETE-COM SRL SB. This company with its Mine Crime project collects and systematizes data on urban offenses, both criminal and administrative. Their idea is to build a digital observatory on urban safety and to build the first Italian database on this topic, accessible to both private and public entities.

After contacting them, they provided us with all the data they collected for the city of Catania in 2022. This dataset consists of 433 observations, and for each of them we have the following attributes:

- Id: unique identifier within the dataset

- Address: street name

- Category: description of the crime. Some examples are *"furto"*, *"spaccio"*, *"incendio"*, *"violenza"*, *"rapina"*, *"estorsione"* and *"minaccia"*

- Latitude: latitude of the crime point

- Longitude: longitude of the crime point

- Date: date of crime detection

- Location: area, in our case always Catania

The crime dataset has been used to geolocate the reported crimes using latitude and longitude data to position the reported crimes on a grid, in order to determine for each identified geographical area the number of crimes that took place. A heatmap showing where crimes were recorded can be seen in the Figure 1.

Figure 1: Heatmap of crimes registered by Mine Crime in Catania (2022)

It is clear that the data collected in the Mine Crime project in the year 2022, as far as the city of Catania is concerned, represent only a small percentage of those actually existing. Based on the data reported by the Arma dei Carabinieri, over 80 prominent elements and members of organized crime arrested, 273 pistols, rifles and knives seized, more than 164 kilograms of drugs and assets worth over 7.3 million euros, 10,658 high administrative fines for an amount of over 5.6 million euros, 28,886 crimes prosecuted, denouncing 6,121 people in a state of freedom and arresting 1,947. The balance of the fight against drug dealing is 553 arrests, of which 69 on delegation of the judicial authority following investigations and 135 complaints. The

maximum attention of Carabinieri was also paid to the serious phenomenon of gender-based violence with over 90 arrests in red-handed, 516 complaints in a state of freedom and 220 precautionary measures carried out.

To show the objective of this project, however, the dataset was more than sufficient. Other strategies that could be adopted to collect such data include scraping local newspapers, like CataniaToday, or being able to get in touch and make a connection with law enforcement.

4.2. Cleanliness

Since there is no dataset regarding the cleanliness, we decided to build ourselves a small dataset composed of a set of pictures of garbage left on the street. These pictures were taken the first week of May by citizens and tourists visiting Catania in that period.

Figure 2: Examples of collected images from citizens/tourists

Our goal with these photos and with this dataset is not to report thoroughly the waste management issue in Catania but to show how easy it could be to gather information provided directly by engaged citizens and public workers (e.g. public transportation drivers, local police). Indeed, if the user has enabled permissions, every picture taken from a smartphone can be today easily geolocated.

For this experiment, we totaled a dataset of 30 images of different parts of the city, either in png or jpeg format. Once collected in one place, for each image, we extracted latitude and longitude from metadata using some python scripts. Figure

3 shows the map with the geolocated points where the images were taken.

Figure 3: Locations where images were collected

Our idea to facilitate the automatic collection and analysis of this information is to build a web application, where citizens and tourists can actively contribute by taking and uploading images. By leveraging the power of technology and community participation, our web portal aims to harness the collective effort of residents and visitors to maintain a clean and hygienic urban landscape. Through this interactive platform, individuals can effortlessly report instances of litter and garbage in their surroundings by capturing images and providing criticality ratings.
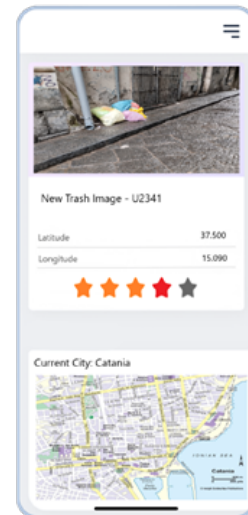

Figure 4: Example of an application through which users can take trash pictures and score them

For each picture the user will have the option of assigning a critical rate ranging from 1 to 5. The relevance and the weight of each image within the analyses will then decrease as time progresses, to zero in 3 months. In a first phase we also want to try to give more weight to photos taken by nonresidents, who may have a limited time in the city and therefore prioritize issues that can impact their experience and perception of the destination.

A normal evolution of the project to derive situations of degradation and littering on the streets could then be to mount cameras outside public transportation, such as buses, and through video analysis extract the information, avoiding potential user biases.

4.3. Hosting Facilities

Regarding the data on accommodations, we made several attempts and adopted different strategies. As a first test, we tried contacting the tourism observatory of the Sicilian region[3]. They have a geoportal where it is possible to view GIS data related to all accommodations in the area. Unfortunately, we could not get in touch and from the web application it is not possible to extract the data, even by scraping.

At this point we decided to use TripAdvisor data. TripAdvisor is an online travel platform that provides information, reviews, and recommendations for hotels, restaurants, attractions, and other travel-related businesses. It is one of the world's largest travel websites, featuring a vast database of user-generated content. At the beginning we opened a developer account so that they can use their APIs. Among them we selected the "Find Search" API, that allows us to select hotels and any other type of accommodations using longitude, latitude, and a radius as searching criteria. The output is a list of registered locations and their relevant data.

The free account has a limit of 5000 requests, more than enough for our project. The main problem is that these APIs do not have a paging mechanism, so by entering the same coordinates, you cannot get more than 10 elements. The solution should have been to build a coordinate grid, get the items for each coordinate, and finally remove any duplicates. Since the code would become very complex we changed strategy. As a final solution we decided to scrape directly from their site.

In particular, we considered two categories: hotels and rentals. Hotels refer to traditional lodging options, such as hotels, resorts, motels, bed and breakfasts, and inns, while rentals encompasses various types of vacation rentals, including apartments, houses, villas, condos, cottages, and other private accommodations. For both categories the procedure worked on two steps:

- From the complete list of all the structures, iterate over all the pages and extract the links, saving them in a csv file.

- Open each link and extract metadata, such as title, location, and coordinates if any.

The HTML structure of the various pages was quite simple and, apart from minor variations, there were no problems. All scraping codes are available in the shared drive folder[4] provided with the report. The data was then saved to two MongoDB collections. In total we obtained 2,168 records on accommodation facilities, of which 946 hotels and 1222 rentals.

The only important distinction between the two categories was how to obtain the coordinates of the structure:

- Hotels: The only information available was the address. Once extracted, we then used Microsoft's Bing georeferencing API to extract latitude and longitude. In some cases we had to manually adjust the result.

- Rentals; There was no indication of the address, but there was a Google Maps frame on the page. For each link we waited for it to load and extracted the coordinates directly from this frame. We eliminated those few elements where it was not present.

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[3]https://osservatorioturistico.sicilia.it/geoportale/
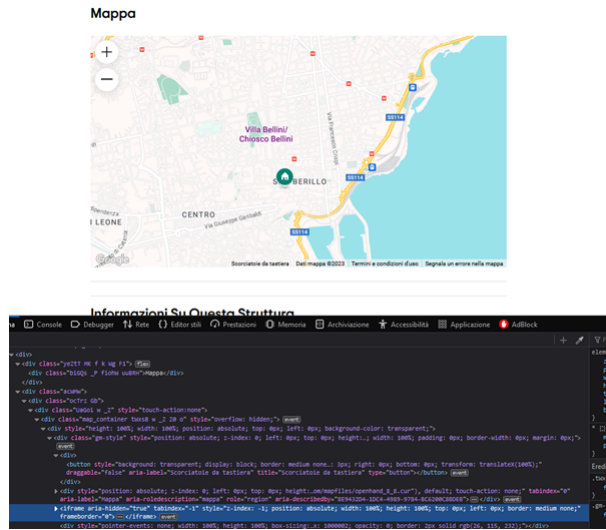
[4]Shared Google Drive Folder

Figure 5: Structure of the HTML GMaps iframe inside a rental page

Once the data for both collections were gathered, some preprocessing steps were necessary:

- Hotels: Of the 946 elements, after obtaining the coordinates, 8 of them lacked them, while 13 of them were clearly wrong. We then eliminated those facilities that did not fall within the metropolitan area of the city. In total we ended up with 936 records.

- Rentals: Of the 1222 elements 35 of them did not have coordinates, and consequently we eliminated them. Of the remaining ones, also in this case, we eliminated all those facilities that did not fall within the metropolitan area of the city. In total we ended up with 1063 records.

As we did for crimes and garbage, we placed the results inside the same grid to count the hospitality locations available in each cell - identified area. The real framework, that hopefully will be tested and implemented soon, will contain a more granular dataset, extending the coverage to families that expressed their availability to host for the whole football and school season young ladies and boys coming from other parts of Italy or from foreign countries.

Figure 6: Locations of the accommodation structures. Blue are hotels and orange are rentals

As we will see in the following paragraph, on the score by area, we have considered accommodation facilities in two cases: in the immediate vicinity, considering a radius of 800 meters, and not in close proximity but reachable by public transport. For this we extracted the GIS data of subway stops. Since it was not the purpose of this project, we only took the coordinates and accounted for their existence, and for this reason we did not analyze the routes and sections of public transport.

4.4. Target Scoring

At this point we put all the data together to get a complete picture. For the goal of our theoretical framework, we then selected a specific location in the grid, i.e. the possible target point, and we applied a very simple additive algorithm to determine a score.

We have devised a simple score ranging from 0 to 100 and the purpose of this score is to assign to each cell a rank and to create a ranking that will then represent an indicator for the local government and the local football team to reward the most performing areas and to identify, jointly with a representation of the citizens of that area, actions that could lead to better behaviors and, eventually, a higher rank in the future.

It is important to note that this score should be approached with caution, as it is a basic representation that does not account for all the relevant factors involved in selecting an ideal area. The purpose of this score is purely for demonstration and illustrative purposes. Therefore, this score serves as a starting point to initiate discussions and highlight some key aspects, but additional comprehensive analyses are essential for a well-rounded evaluation of potential sport facility sites.

As mentioned earlier it is a sum of several factors. For each category we assigned a score ranging from 0 to 25 points. The individual score in each category is calculated slightly differently.

Regarding crimes, we searched for all those that happened in an area within a 500-meter radius of our target point. To keep things easy, we treated all crimes equally, assigning each the same weight, regardless of their category. We used a value of 30 crimes as a threshold to indicate a dangerous area. The formula for scoring this index is calculated as follows:

$$crime\_score = max(25 - \frac{\#items}{30} \cdot 25, 0)$$

Also in terms of cleaning, we retrieved all the trash images that fell in the same 500-meter radius area. Of these images we already had a field describing their severity, with a range from 1 to 5, and therefore we used it. The trash score is calculated in the following manner:

$$clean\_score = 25 - \frac{TotalScore}{\#items} * 5 * log_{10}(\#items)$$

In this case we take into consideration both the number of photos taken and their severity.

Concerning hosting facilities, we considered both facilities in the immediate vicinity and those reachable by subway, for a total index of 50 points. In our analysis, we have relied upon two important assumptions:

- The hypothetical number of young people to be served was 500

- For hotels we assumed an accommodation of 4 people, while for rentals of 2 people

Regarding the analysis of the surroundings, we have retrieved all the structures located within a radius of 800 meters. At this point we calculated the number of people served and for the score we used the following formula:

$$nearby\_score = min(\frac{ServedPeople}{TotalPeople} * 25, 25)$$

For those reachable by subway we have made some changes. First we checked that there was a station within 400 meters of the target point. If present then we have retrieved all other stops

and calculated the distance to our target. As before, for each station, we then calculated the number of people served based on the number and type of structures. However, this time we used a radius of 400 meters. Furthermore, we multiplied each value by its relevance, which ranges from 0 to 1. In the case under examination, the city of Catania, we assumed a maximum distance of 10 km. The relevance is calculated as the distance to the target normalized by the maximum distance. The score is then calculated as in the previous case.

The final score is ultimately calculated as the sum of the individual partial scores:

$$score = crime\_score + clean\_score +$$
$$+nearby\_score + reachable\_score$$

Under suggestion we selected a target location, where there is already a small stadium, plus other sport facilities, in the Nesima Superiore area. The coordinates are (15.045799, 37.5170255). An example with all the selected factors within the map can be observed in Figure 7

In this case we ended up with a final value of 72.91/100, obtaining a good score in all categories, except for the structures in the immediate vicinity. At this point, system users may analyze other points on the map, compare the total and partial values, and choose the best option based on their own needs.

As anticipated before, it is important to note that this numeric score is merely a starting point and should not be considered as the sole determinant of the potential of a point. It is a simple measure that inherently carries certain limitations and potential shortcomings. To comprehensively assess the goodness of a point, it is crucial to consider a multitude of other factors that may influence its overall appeal, such as other data of transportation infrastructure, like buses, environmental sustainability, access to amenities, and many more.

5. Conclusions and inputs for further analysis

This work aims to build a framework that Italian local municipalities could adopt to use all sport activities and businesses present within their
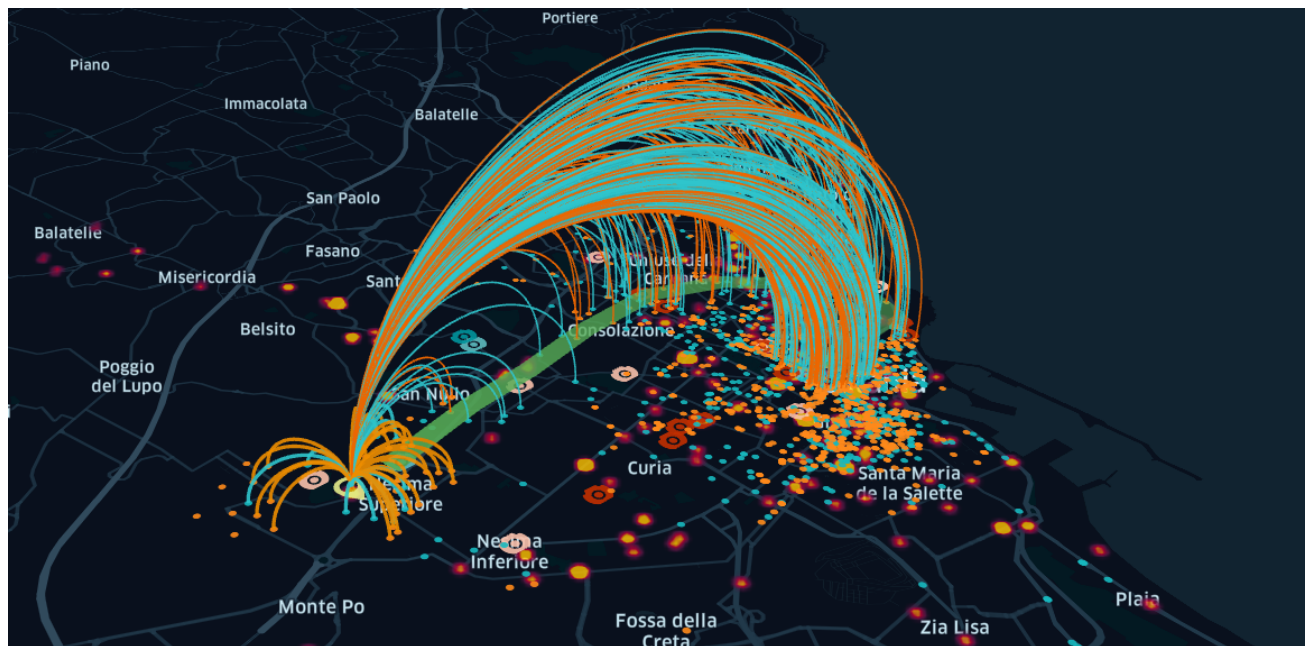
Figure 7: Final analysis of the target point

boundaries to increase citizens' engagement, to reduce inequalities and to reshape geographical and social territories.

With our analysis and with our index we have tried to provide a starting point, but many other considerations and refinements are necessary. The important thing, and what we hope to have shown, is that there are different ways to gather highly valuable data and that this data can be utilized to improve the community as a whole.

We encourage researchers who are interested in the intersection of sports and urban governance to investigate the role of sports in the development of smart cities. Smart cities are intricate systems that can enhance livability, workability, and sustainability. A smart city is typically defined as a city that combines "competitiveness" and "sustainability" by integrating various aspects of development, investing in infrastructure to support both economic growth and community quality of life, and promoting greater transparency and citizen participation in decision-making processes while also managing natural resources carefully. The realm of sports provides an ideal context to examine how local citizens perceive the potential of sports to contribute to the creation of smart cities. This is because sports have established links with local economic development, sports can strongly influence quality of life, sports can raise awareness about management and utilization of natural resources, and sports can undoubtedly positively impact the frequent lack of decision-making transparency and citizens' participation.

Football, like many other sports, is moving tons of people worldwide. Let's inspire them moving towards rewarding, collaborative and "smart" directions.

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