A comparative approach to smart features of higher education institutions: Uni Konstanz and UAIC Iaşi

Bianca-Iuliana MISINCIUC
"Gheorghe Asachi" Technical University of Iaşi, Romania
Department of Foreign Languages

iuliana_misinciuc@yahoo.com

Abstract

Objectives: *This paper is an analysis of higher education institutions in relation to the "smart city" concept. On a micro level, the features of a smart university coincide with those of a smart city. The paper aims to investigate the University of Konstanz, Germany and the "Alexandru Ioan Cuza" University of Iaşi, Romania from the perspective of their functioning, administration and network of resources in order to observe smart features and room for improvement.* ***Approach:*** *The investigation employs a comparative approach and uses observation and personal first-hand experience as a former student of both institutions as research methods.* ***Results:*** *This comparative study provides an overview on smart features, ideas and solutions that are implemented in different aspects of university life: campus geography, student accommodation, public transportation, online administration of the institution, online platforms and portals for students and teachers, recreational activities and fruitful interaction between students. The analysis points out smart elements and characteristics, such as integrated student accommodation and other facilities inside the campus, the existence of public transportation means designated for students, smart stations, bicycle rental services, internet-based registration for classes and exams, online application for study programs and other events, interactive spare time activities and student associations.* ***Implications:*** *This study may provide valuable material for researchers in the field of development and smart innovation and also ideas for practitioners that work in academic institutions or city administration.* ***Value:*** *The originality and uniqueness of the paper reside in the comparison between two academic institutions from different countries and also in the contribution to the promoting and expansion of the "smart city" concept. By bringing the concept to a lower level, smart features can be implemented in companies, academic institutions and even in people's homes. Studying similarities and contrast between smart features of different universities is essential in order to highlight possibilities for improvement.*

Keywords: *smart university; smart campus; transportation solutions; online administration; comparative analysis.*

1. Introduction

A smart city is defined by digitalized or partially digitalized processes, efficient solutions and the use of information technology to insure an intelligent interaction between the city and its inhabitants. Innovative concepts and smart applications are engaged in running and operating a smart city, where aspects such as transportation, public services, tourism, healthcare, education, safety and security, sustainability, urban management and environmental responsibility are integrated and interconnected in a harmonious way [1].

The main dimensions of a smart city are technology, institutions and people, consequently relying on technology factors, institutional factors and human factors as the fundamental components of a smart city. The three directions subordinated to each factor are represented by learning, performed by the human factor, governance, which is the responsibility of the institutional factor and integration through the technology factor as the key to smart cities, since it ensures the collaboration and cooperation between all the main dimensions of society [2].

Higher education institutions are connected with the "smart city" concept on all levels: from the point of view of the human factor, the importance of such institutions resides in their role as places where specialists are formed, where people acquire and transfer knowledge and where their creativity is cultivated and their civic sense is boosted; from the technological point of view, higher education leads to the emergence and development of new infrastructure, smart technologies, digital networks and innovative ideas; and from the institutional point of view, higher education institutions stand as pillars of a smart community, through the implementation of smart regulations, policies and administration ideas.

2. Smart features of higher education institutions

The humanist dimension of the smart city is best illustrated by the tight relationship between learning and economic growth and social development [3]. From the perspective of teaching and learning, the role of education as a vital fundament in building a smart city is achieved by aligning the curricula with the "smart city" concept and by constantly modernizing the contents of lectures, in order to keep them up-to-date with the continuously changing realities and also in close connection with local or regional communities, as their particularities, the resources they dispose of and the challenges they have to face might differ from those of the global community. Study programs such as civil engineering, architecture, industrial engineering, information technology and telecommunications, robotics, renewable energy, transport and logistics, but also business administration and medicine are closely connected to the creation and development of smart cities and to improvements in the life quality of their citizens.

Apart from the processes of teaching and learning, it is interesting to analyze higher education institutions from the perspective of their functioning, management and network of resources, in order to observe smart features and potential room for improvement.

The features of a smart institution virtually coincide with those of a smart city. For instance, on a macro level, the smart administration of a city in terms of intelligent services, communication or security, is reflected in features such as the existence of systems and applications for online payments, registrations or appointments, web pages or social media pages that give citizens access to information and offer them an opportunity to get involved in the city life, and video surveillance systems that increase security in public spaces or in traffic and prevent criminality. On a micro level, the same features can characterize a smart higher education institution: the possibility for students to register for classes or exams online, platforms for them to access important information, opportunities for them to actively take part in the development and improvement of the institution, by getting involved in projects, making decisions or participating in debates and video surveillance for their protection.

Other smart features that apply both to cities and to institutions are intelligent energy and intelligent mobility. On both levels, intelligent energy implies the use of sensors, regenerative technologies and renewable resources, as well as methods to store energy, whereas intelligent mobility involves different measures and applications. In a smart city, intelligent mobility covers areas such as traffic management – based on adaptive traffic signals, video monitoring, speed control, parking place management, public transportation and integrated solutions such as car sharing or bike sharing, intelligent stations with electronic systems, smart displays and solutions for disabled persons, on-board Wi-Fi internet access and security in public transportation, eco-mobility, zero emissions goals and charging stations for electric vehicles. In a smart higher education institution, intelligent mobility measures include integrated solutions such as public transport exclusive for students, bicycle rental services or discounted public transportation passes.

Smart features also apply to buildings, in the form of the presence of automated systems, HVAC (Heating, Ventilation, Air Conditioning) solutions, advanced equipments, sensors, smart meters and thermostats, as well as video surveillance. In what concerns technology – the key factor in connecting the different dimensions of a smart community or a smart institution, the main elements are represented by Wi-Fi coverage and online access to all kinds of services. In a smart higher education institution, intelligent technology also includes smart boards, multimedia equipments and interactive systems.

Other smart features that apply on both the macro and the micro level are environmental management and monitoring, waste and pollution reduction, recycling and selective waste collection, as well as intelligent healthcare and medical services. Last but not least, smart citizens are the driving force of a smart city and subsequently, smart students are a vital part of a smart higher education institution.

3. A comparative analysis of Uni Konstanz and UAIC Iaşi

Iaşi is the second largest city in Romania and one of the leading centers of Romanian academic life. Apart from being a cultural and historic center, the city is on an upward trajectory towards modernization and digitalization, hosting debates

on the "smart city" concept and being a member of the OASC (Open and Agile Smart Cities) Organization since March 2019 [4]. Iaşi is also home to the oldest Romanian university, which was founded in 1860 – Universitatea "Alexandru Ioan Cuza" (UAIC).

Konstanz is a university city located in southern Germany and home to Universität Konstanz, an elite higher education institution founded in 1966. With a significant part of the population being represented by students, the city is continuously evolving and adapting to innovative concepts; the architectural features of the university itself mirror modernism and novelty through the interlinked buildings with untraditional designs.

In the context of smart cities and smart institutions, it is interesting and appealing to conduct a comparative analysis in order to study smart features of the University of Konstanz and the „Alexandru Ioan Cuza" University of Iaşi.

3.1. Campus geography and student accommodation

The university campus (Latin *campus*, meaning *field*) is the land where all the buildings and infrastructure belonging to the institution are situated. The structure and expansion of the campus have evolved in accordance with modern tendencies, social progress and growing numbers of students and their various needs, which led to the inclusion of amenities and facilities such as dormitories, shops, restaurants or cafes, special transportation routes and stations, leisure activity centers. Campuses therefore come to represent places where students not only learn and study, but venues where they live, eat, interact with each other, relax and spend their free time as well. The university campus as a community where the students are the inhabitants is consequently comparable to a miniature city and respectively the smart features of a city are transferred onto the campus.

The university campus of Uni Konstanz is more concentrated than that of UAIC Iaşi. In Konstanz, the academic buildings are all in the same area, since the university is located outside the city on the Giessberg hill, surrounded by forest and overlooking Lake Constance. But because of the rather isolated location of the academic buildings, the student dormitories are far away from university. The student services network Seezeit Studierendenwerk Bodensee offers approximately two thousand and four hundred rooms in thirteen dormitories, which are situated in different areas of the city; the closest dormitory is Sonnenbühl West I (1.3 kilometers away from the university) and the farthest is Europahaus (4.6 kilometers away).

In Iaşi, on the other hand, most of the dormitories are close to the academic buildings, which are situated in the inner city, but rather detached from each other. Out of the fifteen dormitories belonging to UAIC Iaşi, eight (C5, C6, C7, C8, C11, C12, C13 and Gaudeamus) are located within walking distance from the university (250 – 550m), while the others are located at distances of one kilometer, 1.4 kilometers or two kilometers away from the academic buildings. The layout of student accommodation in Iaşi makes it easier for students to get to and from university, either by foot, or by using public transportation. However, the academic buildings

are not concentrated in an especially designated place and they are situated in a busy neighborhood of the city, which sometimes makes it difficult for the students to attend consecutive classes in different buildings. In comparison to UAIC Iaşi, Uni Konstanz has many more separate academic buildings, but on the other hand more condensed premises, though larger. The expansion of a university campus and the long distances between the academic buildings and the dormitories may increase the danger that students are exposed to when they are on their way to classes, returning home or during breaks.

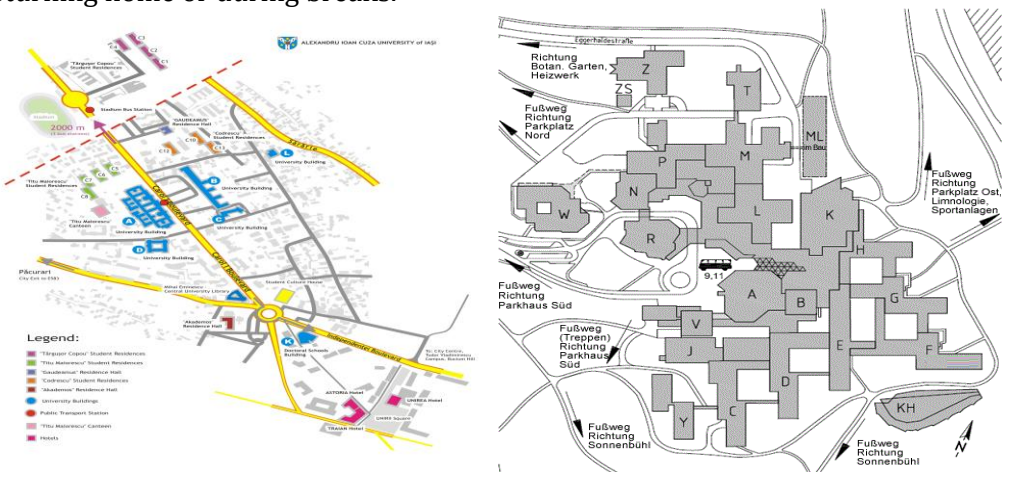


Figure 1. (a) UAIC Iaşi campus; (b) Uni Konstanz campus.
Sources: *https://www.mathematik.uni-konstanz.de/beratung-und-service/kontakt/anfahrt-und-lageplan/*
http://150.uaic.ro/wp-content/uploads/2010/01/harta_eng1.jpg

3.2. Transportation solutions

University students are generally at a stage in life where they are not yet prepared to fully support themselves financially. Apart from this fact as a lower-scale argument for public instead of private or individual transportation, environmental protection and reducing carbon emissions are the higher-scale reasons why a smart community – and subsequently, a smart university – put efforts into creating, developing and promoting public transportation and green transportation. Smart ideas and solutions for university students include:

- an extensive network of public transportation lines that provide wide coverage and connect the institution with all surrounding areas;
- buses or trams destined only to students;
- discounts for transportation tickets, passes and subscriptions;
- smart stations where useful information is displayed;
- and bike rental services, which can be free or subject to charge.

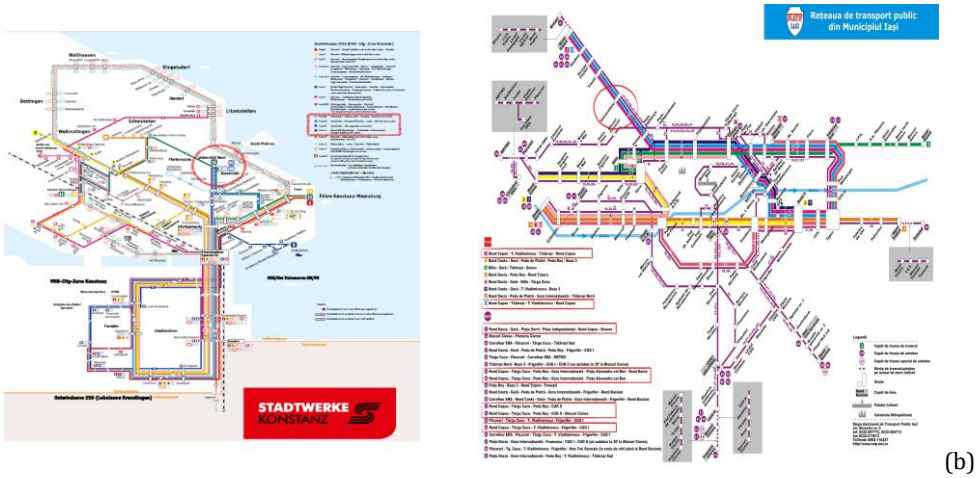
The cities of Konstanz and Iaşi both have broad networks of public transportation lines connecting the academic institutions directly or indirectly with all parts of the city, as it can be seen in Figure 2 marked with red circles and rectangles. The University of Konstanz is directly connected with the main areas

where the student dormitories are located, through four bus lines (9a, 9b, 9c and 11 – out of which 9c only runs during the lecture period, as additional assistance introduced especially for students) and the "Alexandru Ioan Cuza" University of Iaşi also has good connections with most parts of the city, through six bus lines (6b, 28, 28b, 41, 41b, 43b) and two tram lines (1 and 13).

A great way of stimulating the use of public transportation is the introduction of lines and vehicles destined only for students. This facility eases the commute by saving time and preventing crowding and it also increases the safety of students and makes them feel special. This smart measure has been implemented in Iaşi and has been successfully functioning for three years. Special buses and trams destined exclusively to school and university students run on the most crowded routes and during the rush hours of the morning, especially between 7 o'clock and 7:30; the vehicles display a message mentioning that they run especially for pupils and students, who are allowed inside based on their badges and student ids. In Konstanz there is no bus destined exclusively to students, but the need for adopting such a measure is not as great as it is in Iaşi, considering the much smaller number of inhabitants and also the fact that the university is isolated from the rest of the city and has its own private bus station which represents the end of the line, as opposed to UAIC Iaşi, which is situated inside the city and has an intermediary bus station.

Another successful way of promoting public transportation and helping students with their finances at the same time is represented by offering student discounts for the purchase of tickets, passes and subscriptions. This ensures that public transportation is used regularly and also that students are supported with the expenses that studying involves. Germany and Romania both offer student discounts for public transportation and in Romania the student benefits may depend on their academic performances or on their age; for instance, there are bigger public transportation discounts for students that are under twenty-six years old and registered in a program that is sponsored by the state, where all educational costs are covered – this benefit is based on good admission grades or good average grades after each university year; also, there is free railway transport for students that attend classes on a daily basis, as opposed to those who are enrolled in a low-frequency program. On the other hand, the city of Konstanz offers free transportation for students in the evening (after 7 P.M.), but excluding night buses where special rates apply [5].

Smart stations have not yet been implemented in Iaşi, but they have existed in Konstanz, as well as in many other German cities, for many years. They carry great importance, as they display useful information about the timetable and functioning of public transportation vehicles, as well as messages regarding potential problems; the facts are continuously updated from inside the vehicles, so that passengers can get real-time information. The existence of such smart stations contribute to better time management and more effective planning, while also training passengers to become more responsible at the same time; not being able to blame public transportation for being late means taking full responsibility for being on time. Considering that responsibility is best taught by example, we may argue that even a punctual public transportation timetable can have a positive impact on the development of young people as future responsible and smart citizens.



(a) (b)

Figure 2. (a) Public transportation routes in Konstanz; (b) Public transportation routes in Iaşi.
Sources: *http://stadtwerke-konstanz.de*
https://infois.ro

Apart from public transportation, bike riding is a great alternative or first option that is old-fashioned and modern at the same time; it represents the past of individual transportation, but also its future. We notice that bike riding performed as a fun activity or adopted as a necessary habit is characteristic to the most developed countries, where people ride bikes not because they do not afford cars, but because they prefer a type of transportation that costs less or nothing, does not harm the environment and is healthy at the same time. Bike riding can be seen as a pillar of green communities, as it is environmentally friendly and recommended as fitness exercise, thus being healthy both for the environment and for its inhabitants. Infrastructure is crucial in the context of bus riding as a smart transportation solution and education also plays a vital role; instruction and discipline concerning the use of special equipment and knowledge about rules to follow in traffic are essential for the good functioning of a bike riding network that can replace other means of transport and also for the safety of bike riders.

The network of bicycle tracks and parking facilities is much more developed in Konstanz and throughout Germany than in Iaşi and other Romanian cities. However, the first steps have been made in Iaşi and the city now has a few bicycle tracks that are especially used by students; the problematic aspects are related to the exclusivity and continuity of bike tracks: they are built as part of the pavements, meaning that pedestrians often interfere with bike riders, and they are sometimes suddenly interrupted or come to an end without really reaching a destination, meaning that they do not always successfully connect two or more points of interest. On the other hand, there is one aspect where Iaşi gains extra points: bike rental services for students, which are free of charge as opposed to Konstanz, where bike rentals are fee-based services.

An overview on the mentioned transportation solutions can be observed in Table 1 below.

Table 1. Transportation solutions

	Uni Konstanz	UAIC Iaşi
Public transportation connections	yes (bus)	yes (bus and tram)
Designated student transport Discounted passes Smart stations	no yes yes	yes yes no
Bicycle rentals	yes (subject to charge)	yes (free)

3.3. Online resources and platforms

Online administration is an essential attribute of a smart university. This feature allows easy access to information and provides the possibility to solve different problems more smoothly. It creates an effective and friendly interface between the students, the teachers and the administrative staff, enabling facilities, tools and resources such as:

- online registration for classes (compulsory or optional);
- online registration for exams;
- online application for study programs;
- online application for curricular or extracurricular events, scientific conferences, student competitions;
- online subject choice and subject change;
- online platforms that provide information about grades, credits and other personal details;
- online platforms where students can request, obtain and print out certificates of enrollment or other verified attestations;
- online campus management portals for students, professors and researchers;
- online classes, resources in written format or interactive workshops;
- online job market available exclusively to students;
- Wi-Fi connection inside the academic buildings and throughout the campus, by means of a secure network.

The online registration for classes and exams is available at Uni Konstanz through the StudIS portal; the selection of mandatory and optional classes allows students to create and adapt their schedule in accordance with their area and course of study, but also considering their needs, talents, interests and spare time preferences. Online registration for study programs and online application for educational or extracurricular events, scientific conferences or competitions are also possible at Uni Konstanz through the ZEuS portal. The same online conveniences are not available at UAIC Iaşi, where administrative matters are still more paper-based than electronically handled; the students do, however, have access to online platforms which provide information and resources and to the eSims portal which allows them to check their information, grades and credits.

A smart feature of Uni Konstanz is the existence of the student identification card (UniCard) that uses chip technology in order to become usable for multiple

purposes, replacing different badges, passes and vouchers and acting as a many-in-one card. The UniCard is presented on the website of the university as "der Schlüssel für (fast) alles" – the key to (almost) everything [6]; for instance, it is also used as library pass and as a rechargeable payment card for scanning, copying and printing documents on campus. The student identification card at UAIC Iaşi is in paper format, but it can be used outside the university as well, in order to get discounts for transport, events, cultural activities or touristic attractions.

3.4. Leisure and wellbeing

The campuses of both Uni Konstanz and UAIC Iaşi include different amenities and facilities that are created for students' wellbeing and free time. Among such facilities, the most important are the ones that offer food and beverages, which are much needed during break times when students spend long periods of time on campus. The students of Uni Konstanz usually spend their entire day on the premises, so the campus has a large student canteen that overlooks Lake Constance and also various other cafés, bistros, pasta or Asian food restaurants and snack bars that offer assorted possibilities for all tastes and pockets. The UniCard can also be used as a MensaCard (payment card for the student canteen) and as a payment instrument in all the other facilities. At UAIC Iaşi there is also a canteen destined for students and teachers, with very affordable prices, as well as two restaurant-canteens which can also hold festive events. However, the other restaurants, cafes and bistros in the area do not have restricted access and are open to all inhabitants of the city.

3.5. Student interaction

A smart solution for real instead of virtual student interaction has been implemented by Uni Konstanz in the form of interactive boards and notice boards that are installed on the hallways and contain all kinds of adverts, announcements and tutoring requests and offers. Another example that is worth mentioning is represented by the invitations for students to participate in experiments and get paid for it; this is a smart way of using all available resources, in this case the human resources of the university and it is also a smart way of functioning like a community and being self-sufficient. This idea brings benefits for all those involved, as it is brilliant for research purposes and very helpful for students' finances, even if the payment of a couple of Euros only counts as pocket money.

Student interaction at UAIC Iaşi is achieved by means of creating student associations and organizations where students learn about leadership principles, acquire skills and become responsible, by getting involved in organizing almost anything from festivals to charity events, scientific manifestations and recycling patrols. The leaders of such organizations and also the representatives of students in the senate or council of the university get voted, elected and have to keep a close connection with their colleagues, to be very receptive to problems and to come up with solutions and innovative ideas for improvement. These responsibilities that

perfectly mimic real adult affairs prepare students for being the leaders of the real society of tomorrow; this is another example and piece of evidence in favor of comparing a smart higher education institution to a miniature smart city.

The existence of Erasmus programs also represents a smart feature of higher education institutions. Uni Konstanz and UAIC Iaşi are both active participants and also partners in the Erasmus exchange studies program, which has also made possible the writing of this paper from the perspective of a former student of both institutions. Erasmus programs involve sending and receiving students, exchanging information and transferring experience; the Erasmus experience is very beneficial for students, as it offers them the chance to observe, to learn and then to apply new concepts and bring innovation into their home country.

4. Conclusions

A smart university is defined by intelligent interaction between the institution, its students, its employees and the society, just like a smart city involves intelligent interaction between citizens and all divisions and dimensions of the society. Higher education institutions are closely connected to the "smart city" concept through the importance of education for economic growth and social development and also through the implementation of features such as smart architecture, smart mobility, smart administration and smart interaction. The comparative analysis of Uni Konstanz and UAIC Iaşi reveals the existence of many common smart features, such as integrated transportation solutions, online resources and platforms, but also differences in what concerns accommodation and amenities within campus and internet-based administration, showing that positive examples create room for development and progress.

References

[1] Su, K., Li, J., Fu, H. (2011), *Smart city and the applications*, in: *2011 international conference on electronics, communications and control (ICECC)*, IEEE, pp. 1028-1031.

[2] Nam, T., Pardo, T. A. (2011, June), *Conceptualizing smart city with dimensions of technology, people, and institutions*, in: *Proceedings of the 12th annual international digital government research conference: digital government innovation in challenging times*, ACM, pp. 282-291.

[3] Hollands, R. G. (2008), *Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?*, City, 12(3), pp. 303-320.

[4] https://www.ziaruldeiasi.ro/stiri/municipiul-iasi-a-devenit-membru-al-retelei-open-and-agile-smart-cities--215029.html, date: 20.10.2019.

[5] https://www.uni-konstanz.de/studieren/rund-ums-studium/wohnen-und-mobilitaet/mobilitaet/, date: 02.11.2019.

[6] https://www.uni-konstanz.de/studieren/im-studium/formalitaeten/unicard/, date: 02.11.2019.