Towards a smart, sustainable city

Topic: smart city, sustainable city, critical thinking, collaborative skills, complex decision making

Introduction

Many large cities were built over many years, decades and even 100 of years. This means that many large cities are a total mix of houses, industry, and more that are based on fairly old building principles and brand-new building principles. Sustainability is one of the essential principles and goals that societies of today have, as well as the introduction of technology and internet to build more smart cities that can support to create less traffic, secure automatic shopping, and many more use cases. This is referred to as the smart city. In this scenario, the task is to transform the traditional city to what can be named a smart, sustainable city.

Context

With internet applications in cities and not just people's living rooms, cities can become smart. This can mean that traffic signs change according to the intensity of cars, that signs can direct ambulances through the traffic in the best and shortest way, that robots and sensors can be used to automate and optimize the waste and the way we handle waste in the city and many more. The concept of the smart city goes well with the purpose of transforming cities into sustainable cities. Sustainable cities can be defined very broadly as a city that handles the waste in a correct and biologically way, that energy comes from renewable sources and that new buildings are build with sustainable, biodegradable elements and that changes to older buildings are done with the same kind of considerations. One of the major challenges of this scenario is for the players to define how they perceive the concept of the smart, sustainable city and to create changes to an existing city so that it fulfills the idea of the smart, sustainable city.

Following are some suggestions on different roles that the scenario may support:

Role 1: Private contractor for commerce and housing

This role represents real estate contractors who build and sometimes tear down buildings to build new. The private contractor for commerce and housing has the overall purpose of increasing the commercial as well as the housing proportion of the city. This role has no specific interest in sustainability but needs energy for the buildings and internet coverage since that is essential for the inhabitants in the city.

Figure 1. Residential building provide housing.

Role 2: City energy manager

The city energy manager wants to transfer all energy production, waste management etc. to renewable energy. Additionally, this role has an interest in trying to impact the private contractor so this person will bulldoze existing not energy efficient buildings and replace with building that are more energy friendly. The city energy manager also has an interest in securing that waste management can take place under the best optimal conditions by use of technology, internet and automation. The role therefore has a specific interest in lowering the energy

Figure 3. Energy infrastructures support residential and industrial activities.

Figure 2. Network infrastructures promote business practices and economic growth.

consumption of the city, general pollution reduction and waste management in a more sustainable form.

Role 3: Private internet and technology contractor. This role is responsible for securing that the city has internet coverage overall to allow for smart city solutions and for energy friendly solutions. The private internet and technology contractor will work to make the city bigger so that there are more internet that needs to be placed in the city. The overall purpose of this role is to establish so much internet coverage as possible work for more housing and commercial buildings, and support the happiness in the city by the smart internet-based solutions.

In the following figure, the roles and interactions are displayed.

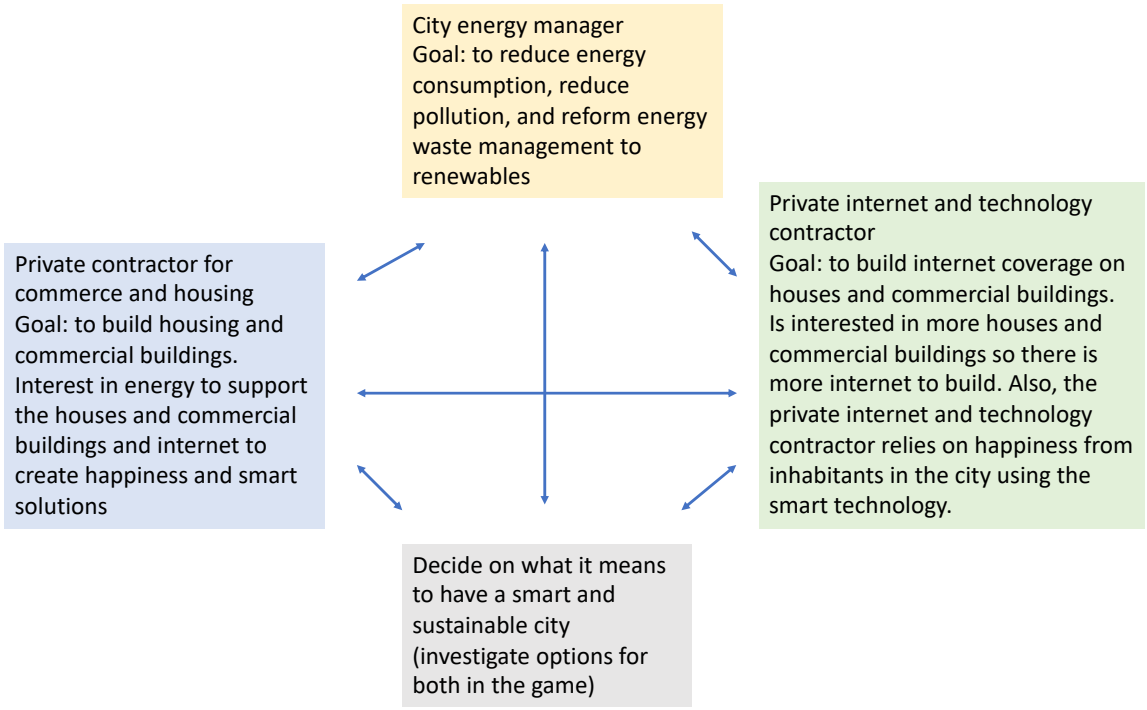

Figure 4. Roles actions and interactions.

Learning goals

Upon completion of the activity students will:

- Understand the connections between environmental, social, and economic aspects of everyday life.

- Have experienced how to achieve cooperation between different parties with different goals and needs.
- Built competence in taking an integrative approach in researching city management and related environmental and technological issues.
- Created conditions necessary for navigating the challenges in modern society that needs to change according to new goals and challenges.

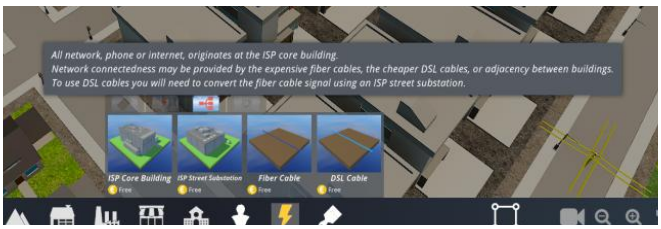

Figure 5. Energy infrastructures support residential and industrial activities.

Prerequisites

The students must understand the way the game works with respect to electricity, internet, pollution etc. It can therefore be a good idea for students to try to build a city by themselves as a first assignment, to learn how the different dependencies are between buildings, antennas, pollution, roads, etc. This scenario is a difficult game to play. Partly students must define and agree on what it means to create a sustainable and smart city. Then they need to agree on individual parts of this example city to find out where they create more value to go in the direction of the goals. The students also must be willing to compromise and find common solution in order for all rolls to be fulfilled.

Audience

The suggested activity targets economics and engineering students. The design and implementation of sustainability-supporting infrastructures is directly linked to technological advances as well as effectively managing a project within the constraints of a pre-defined budget.

Core concepts

- **Sustainability:** Encouraging decision making in terms of environmental protection and the impact of human activities on their surroundings both short- and long-term.

- **Sustainable city:** A city that is built on principles for sustainability and lower energy consumption and pollution.
- **Smart city:** An internet-based city that allows for smart solutions and can benefit the inhabitants of the city.
- **Transversal skills:** Collaboration, critical thinking, analytical thinking, innovative thinking, complex decision making, and problem solving.

Description of the scenario

The overall purpose of the scenario is to understand, experience, and build skills on addressing the challenges related to the management of a city when different central city representatives have different goals and perspectives. The scenario demands that the students assuming the roles discuss different possibilities for fulfilling the goal of a smart, sustainable city. Through the suggested activities students develop understanding on some of the real-life challenges current city representatives are facing today. The scenario demands good analytical skills, creative and innovative skills, critical thinking, and making compromises towards achieving common goals.

Playing the scenario can be supported with the functionalities in the HERA game relating to chat and board tools where aspects of the game can be discussed, negotiated, and agreed upon by the different roles.

The participants can explore the consequences of their decisions and to a real-world complex problem transforming a traditional city to a smart, sustainable city. The scenario is based on a non-trivial city design that includes rich enough facilities to allow meaningful decisions, such as commercial areas with shops, shopping centers, cultural establishments, sports facilities, traditional waste management facilities, traditional energy production, and more that can be adapted using renewable strategies. It will be most interesting to play the game if there is potential for changing the current status of energy consumption towards reducing pollution levels. There is no need to start the game with a very large city, since that can complicate matters and dependencies among energy, housing, internet, and happiness factors. But if the students are more experienced, a larger city can be used for the game.

Suggested class activity

1. The teacher presents the problem to the class and introduces the scenario and game.
2. The students brainstorm in order to understand the problem and the parameters within which they have to work. This includes the available city budget, the city plans that restrict the locations on which parking spaces may be built and may influence their capacity, installation and management costs, citizens commuting patterns, and more.

Figure 6. Factories further contribute to the economic activity of the city.

3. The students are encouraged to come up with as many ideas as possible through brainstorming. Techniques of design thinking could be used for promoting innovative design and the introduction of a human-centered solution that address actual needs of city citizens.
4. The students are asked to jointly decide on the ideas to implement from the pool of suggestions that they came up with considering restrictions, such as city plans, budget, and commute patterns.
5. The teacher forms groups and gives students their roles in the game.
6. The students play the game according to their roles.
7. The students discuss the game results and their roles; the teacher gives feedback.

Assessment methods

This is a collaborative, open ended activity in which not a single solution exists. Self-assessment is useful in this scenario offering students the benefit of taking responsibility of their learning. Students will discuss their roles within their group and reach a decision on whether they achieved their goal or not. Students may further present their solution to

the entire class receiving evaluation from their peers. Finally, the class may decide on the more creative solutions among all teams.