

Intellectual output 3. Educational support content targeting instructors

Learning sheets for HERA activities

Sustainable city

Topic: teamwork, sustainability, environment, pollution, financial management, interdependency

Introduction

As the world keeps pursuing continuous economic growth our natural environment continues to degrade. The accelerating rate of extraction of natural resources and destruction of habitats to provide for our rapidly growing population are not sustainable anymore. Pollution levels are also steadily increasing, people are unhappy as ever and around 1.3 billion people live in multidimensional poverty. We need to change



Figure 1. The sustainable city scenario challenges students to collaborate for enriching quality of life.

our ways of living and develop a plan for a more sustainable way of meeting our needs and ensuring a future for new generations. Since cities are an important hub for the economy and house about 68% of the world population it is important to learn to manage them sustainably and keep balance between consumption, pollution and maintaining natural environment. Sustainability isn't only about the protection of natural resources but is a broad discipline merging ecology, economy, politics, social development and psychology among many others. It is time for society to become more aware of their impact on the environment and on themselves and break free from self-serving ways for a happier society.

Context

In this scenario students create with limited resources a city that is as sustainable as possible. This scenario has three different roles where each has a specific area of

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responsibility. In the scenario, a financial manager, an environmental specialist, and the mayor need to manage a joint budget and to cooperate in the quest of city planning. The goal is to create an "ideal" city: wealthy, sustainable, safe, pollution free, and with a high happiness index. This requires thorough planning, fine balance, and collaboration among participants because the scenario is specifically designed to introduce role objectives that introduce dependencies among the activities of the players towards achieving a common goal. Will the players be able to collaborate in order to create an exemplary result?

Following is the description of the suggested roles:

Role 1: Financial manager

The financial manager is responsible for managing city revenue. She needs to build commerce and industries to create a steady income for the city. The income is the basis for the development of the city and other players' work. The financial manager has the ability to build and bulldoze commercial and industrial buildings, with each category generating different income. This is meant to encourage the player to use both types of structures and enhance immersion in the game.



Figure 2. Students start working on a small but functional city, which needs to be enhanced towards sustainability standards.

An ideal city has clean water, soil and air, high employability, and happy residents. It might sound tempting to ignore all those factors but in order to generate income the financial manager should keep environmental damage and workers' happiness in mind. Otherwise she might be risking being disrupted by their city's fellow representatives who have the ability to bulldoze unsustainable design. The financial manager's success is dependent on that of other players. For example, without proper electrical coverage the city cannot generate revenues. As a result, the financial manager relies on the infrastructure created by the environmental specialist in order to have more space for



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businesses and electricity. In order to achieve the desired goals teamwork is paramount.

Role 2: Environmental specialist

The environmental specialist has an overseeing role. He is responsible for the city's environmental wellbeing and sustainability. His goal is to provide the city with infrastructure and manage the electrical network and pollution levels. In order to achieve that, the environmental specialist needs to monitor the financial manager's and the mayor's work and ensure it is environmentally friendly because their decisions affect his ability to reach his personal goals. One example is low pollution levels. If other players go overboard on introducing buildings, the pollution levels rise and this makes it hard to achieve the goals in hand. To reinforce sustainability, the environmental specialist has the ability to bulldoze anything that conflicts with his goals. In addition, the environmental specialist's responsibilities include building infrastructure, providing the city with electrical coverage, and expanding the city by building roads. This provides a basis for the development of the city, its size, and its capacity to generate revenue.

Role 3: Mayor

The mayor is responsible for societal management. The mayor is in charge of the city's inhabitants' wellbeing: their happiness, health, security, education, and entertainment. The mayor needs to provide citizens with housing, businesses, services, culture, and reduce possible criminal activities. In addition, a happy citizen requires wealth and a pollution free environment so the mayor needs to work with his fellow representatives to achieve the goals in hand. In order to avoid the financial manager overpowering the city scene with a purpose to simply get rich the mayor is provided with the ability to bulldoze industries that do not follow the sustainability guidelines and prohibit them from reaching their personal goals. But the balance lies in between and the mayor should still take the city's ability to generate revenues under consideration. Otherwise there might not be enough funds to build housing, public services, and cultural buildings. Most of the objectives have a high percentile (90%) in order to encourage the player to think thoroughly about all of the aspects and try out the different options HERA provides. Teamwork is paramount in order to succeed and find a fine balance between one's own personal pursuits and allowing fellow representatives to do the same without stepping on each other's toes.

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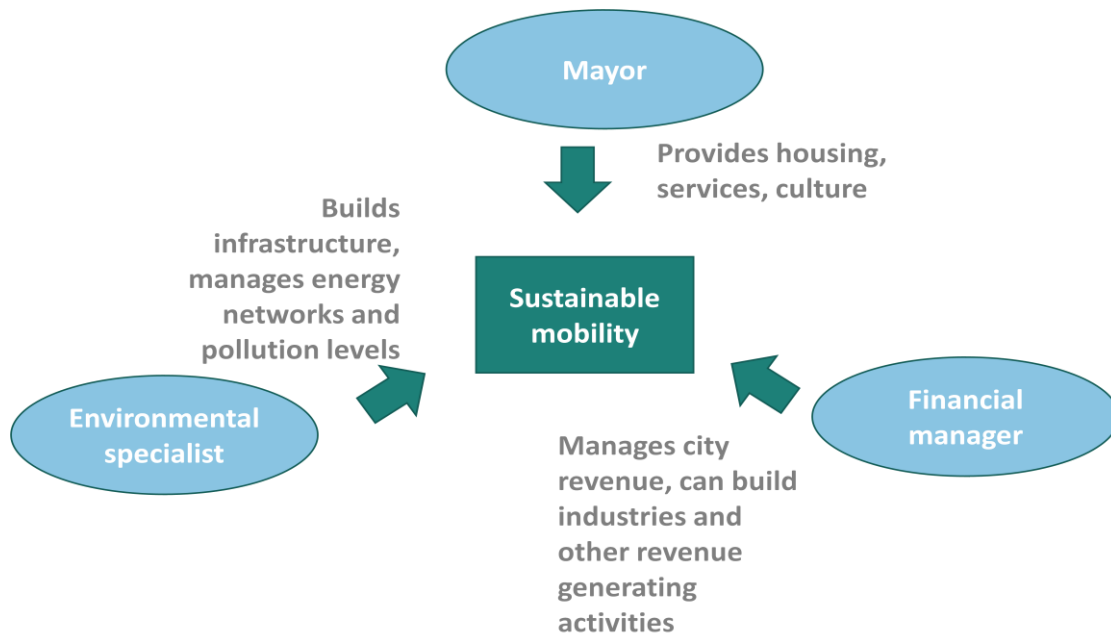


Figure 3. Roles, actions, and dependencies.

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 issues.
- Have created the conditions necessary for navigating the challenges modern society and environmental changes pose for the public and private sector.

Prerequisites

Students need to have basic understanding of concepts related to sustainable development.

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Audience

Sustainable development is a goal that can be achieved only through the collaboration of scientists, engineers, and economists that offer diverse, complementary knowledge. The scenario is of interest to students in all of the above disciplines.

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.
- **City management:** Discussing what a well operating city needs and how to manage these aspects.
- **Environmental impact and pollution:** Seeing how it can occur in cities, how it affects the population and some countermeasures that can be done about it.
- **Interdependence:** An essential element for sustainable development where the dynamics encourage collaboration, trust and alliance over competitiveness and dominance.
- **Happiness index:** Citizens' wellbeing and its relation to the surrounding environment. Which aspects aid in creating a thriving community.
- **Transversal skills:** Collaboration, communication, critical thinking, problem-solving.



Figure 4. Students need to address issues related to pollution.

Description of the scenario

The overall objective is to create an "ideal" city, namely a city that is wealthy, sustainable, safe, pollution-free, and with a high happiness index.



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Sustainable development cannot be implemented effectively if parts of the government act separately or when some are out for their own individual gain. Succeeding in sustainability requires knowledge from vast areas, understanding relations and environmental impacts. All parties have to work together in order to create a healthy and pleasant city for everyone.

This can be achieved by starting with designing a comprehensive and an orderly strategy for developing the city. Through planning and seeing the weak spots we prevent faulty design and stagnation in the implementation process. The choice of the solution will be determined by the local characteristics of the site including its size, population, revenues, and landscape. The plan can be adjusted throughout the game. This scenario demands good analytical skills, innovative and critical thinking and compromises.

Students must understand that a sustainable city cannot be achieved by one player dominating the scene for personal gains for which countless examples of similar behaviors can be found in the real world. The key is to work together and create interdependence. Here, we hope to prompt sustainable mentality and showcase the importance of interdependency instead of competitive and codependent ways. If done correctly it helps to lighten the workload for each representative and achieve a living environment that is pleasant to everyone, including for the representatives themselves who presumably live in the area.

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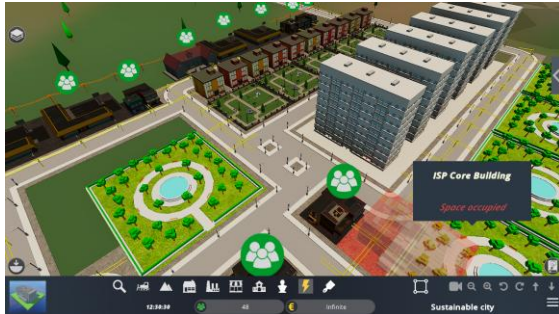


Figure 5. Students further need to increase the population of the city by making more services available.

One solution is to use pre-built plateaus for establishing a wind park. This is a green alternative to nuclear or coal-based energy production and takes advantage of windy areas while being away from the city centre. Some energy can also be produced by

recycling stations. However, all trash sites should be set up somewhere in the outskirts.

Since factories create pollution it's important to have water, ground and air treatment stations as a countermeasure. Industrial and residential areas should be separated in order to keep the population away from potentially hazardous chemicals. Although water bodies don't interact with pollutants directly in the game it is not wise to build industries on the shores because of potential leaching that would occur in real life. In addition to chemical impacts it will reduce the value of the milieu as well. Natural areas should be kept clean and accessible for the public in order to provide cultural ecosystem services. These areas can be used for relaxing, picnics, sports, events and other free time activities. Terrain tools could also provide creative options for design - mountains control the winds, provide shade and scenery; water bodies provide habitats, aesthetic enjoyment and could even act as a supply of drinking water for the city. After all, a city must have a water supply. This of course requires water treatment services. Another way of exhibiting sustainable thinking is considering farmlands, parks and trees as means to provide natural environment (for example absorbing and retaining water, offering cooling effects and shade, providing habitats and enhancing biodiversity) and as an important part of the milieu. What comes to societal management there should be a lot of different facilities provided. In order to avoid wasting land, resources and fuel placement of different areas should also be thought out. Factors like security, education, presence of nature, employment, health, electricity and internet connection should all be taken under consideration for a happy citizen.

Suggested class activity

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1. The teacher presents the problem to the class and introduces the scenario and the game. The teacher has pre-designed part of the city for starters that students need to develop further.
2. The students have to understand the problem and define possible solutions.
3. Teacher forms groups and gives students their roles in the game.
4. The students must get to know their roles and understand their abilities as well as aspects where they are limited and need to collaborate.
5. Team members need to develop an orderly plan to start developing the city. Evaluating ideas, combining them, and prioritizing them towards designing the best possible solutions.
6. The students follow through with their ideas while adjusting the plan according to the flow. Using the agile system in-game is encouraged for communicating each role's needs and for avoiding stagnation.
7. The students discuss game results, their experiences, and the knowledge they developed and the teacher provides feedback.



Figure 6. Students have a lot of flexibility to introduce services that address the needs of inhabitants.

Assessment methods

This is a collaborative, open-ended activity in which a single solution doesn't exist. Self-assessment is useful in this scenario offering students the benefit of taking responsibility for 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.



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Supplementary material

1. UN and Sustainable cities: <https://www.unep.org/regions/asia-and-pacific/regional-initiatives/supporting-resource-efficiency/sustainable-cities>
2. Environmental Management Tools and Techniques:
<https://info.undp.org/docs/pdc/Documents/BTN/Env%20mgt%20tools%20and%20techniques.pdf>
3. Possible things to take under consideration when building a city:
<https://www.theguardian.com/cities/2015/jun/30/how-build-city-step-by-step-diy-guide>
4. World Happiness Report: <https://worldhappiness.report/ed/2020/cities-and-happiness-a-global-ranking-and-analysis/>