Center for International Programs and Sustainability Studies
Course name: Systems Thinking and Sustainability
Course code: SUSD-3160
Total contact hours: 48
Pre-requisites: None

COURSE DESCRIPTION

This course provides students with an introduction to systems thinking within the context of sustainable development and the need for a change of perspectives in a globalized, post-pandemic world facing climate change. It examines systems thinking theory in a fun and dynamic manner with practical examples taken from everyday life as a means to gain a greater understanding of how and why systems work the way they do. Students will learn to discover, understand and appreciate the systems of which we are part, how we function (or don't) within them as individuals and as society, and to hone our skills so our involvement in systems dynamics —whether at the personal, local, national, international or global levels— can contribute to sustainable development in a constructive manner and positive outcomes over time. The 17 Sustainable Development Goals (SDG) included in the 2030 Agenda for Sustainable Development[1] adopted in 2015 at the 70th Session of the United Nations General Assembly provide a backdrop to the course.

In addition to the bibliographic material in the references below, the course draws on a wide and dynamic range of resources to enable a critical analysis of the systems currently operating within our globalized world. These resources specifically provide an opportunity for students to identify, examine and engage in current on-going issues relating to the five critical dimensions

of sustainable development: People, Planet, Prosperity, Peace and Partnerships, also known as the 5P, within the context of climate change and key concepts associated with sustainability, such as ecosystem services, circular economies, well-being, and vulnerability.

This course helps students acquire the knowledge, values and skills to enable them contribute to shaping a better tomorrow with a greater understanding of systems thinking and system dynamics —and specifically causal feedback loops— as they relate to global issues, and national and local trends with regards to the wellbeing of people and planet. It will also enable them acquire an appreciation of the need to understand and have meaningful information on life cycles in a variety their forms (products, biological, etc.) and the systems of which they are part within a sustainability framework.

AUDIENCE

This course is structured for international students attending the Study Abroad Program at Universidad Veritas. Nonetheless, courses are not exclusive to overseas visitors so some native students may enroll in this specific course.

A better tomorrow requires us all to take a stand, building on our interests and passions in life to improve society in whatever domain we choose. This course thus seeks students from diverse backgrounds. It is aimed at:

- Science and math, engineering and technology majors who seek to broaden their perspectives by learning of the social and economic dimensions of sustainable development and their interdependencies;
- Business majors (management, marketing, etc.) seeking a better understanding of the decision-making processes and how these impact economic, social and environmental well-being along value chains;
- Environment-related majors seeking an introduction to the social and economic dimensions of sustainable development and their interdependencies.

- Humanities and social science majors interested in who would like a global perspective of the implications of sustainable development and its interdependencies; and
- Any student interested in exploring career opportunities in the sustainability field.

This course falls within the social area, general organization, and business fields and answers the driving question: **How are we to contribute to a sustainable future in an interconnected world faced with unprecedented challenges?**

The following **generative topics**[2] help answer this question:

- A new way of thinking: thinking in terms of connectedness, relationships, patterns, and context.
- The essential properties of an organism, or living system, are properties of the whole which none of the parts have. They arise from the interactions and relationships between the parts3).
- Frustration as a citizen of an increasingly global society with just how hard it is to make a positive and lasting difference.
- The system, to a large extent, causes its own behavior.
- Since the Industrial Revolution, Western society has benefited from science, logic, and reductionism instead of intuition and holism.
- Hunger, poverty, environmental degradation, chronic disease, war etc. persist in spite of analytical abilities and technical brilliance directed at eradicating them.
- "Words and sentences must, by necessity, come only one at a time in linear, logical order. Systems happen all at once. They are connected … in many directions simultaneously."
- Truths known at some level by everyone: A stitch in time saves nine.
- We, ourselves and our families are complex systems.

It is recognized that our post-pandemic world challenged by climate change is demanding new cognitive, interpersonal, self-leadership and digital skills to help citizens ensure well-being in the labor market. This course already integrates several distinct elements of talent as recognized by the recent McKinsey & Company article.[4]

The acquirement of the following **skills and abilities** will be promoted during the course**:**

- Ability to identify different types of systems with heightened curiosity.
- Ability to communicate the findings of simple systems' analyses creatively and effectively through system mapping.
- Ability to identify and qualify the social, environmental and social parts of systems and their interrelations.
- Ability to recognize the different concepts studied and how they relate to real life scenarios.
- Ability to critically qualify, from a systemic perspective, threats to healthy social, environmental, and economic structures.
- Ability to think in terms of connectedness, relationships, patterns, within the context of sustainable development.

The following **values and attitudes** will be promoted among students:

- Team work and leadership
- Logical and communicative intelligence
- Oral, written and graphic (system mapping) communication
- An interest in learning to learn
- Constructive interaction with others
- Negotiating while inspiring trust and empathy
- In-depth listening

COMPETENCES, CRITERIA AND EVIDENCE OF PERFORMANCE

For Universidad Veritas competencies are reflexive and comprehensive activities that correspond to the professional profile and contextual problems correctly including an ethical commitment, and integrating learning to be, learning to do, learning to know, and learning to live together, within framework of continued improvement.

Both disciplinary and general competences are presented, linked to their criteria and evidence of performance for this course on Systems Thinking and Sustainability.

Type of competence	Performance criteria	Evidence of performance
Disciplinary skills		
Identify systems, including feedback loops with a view to analyzing causes and effects of issues and the multidimensional aspect of sustainable development, particularly the temporal and special dimensions.	**Identify** systems, of which we are part, having the greatest environmental, social and economic impacts	○ Communication of results (presentations) ○ Discussion of issues ○ Simple systems mapping
	Analyze these systems through the 5P (people, planet, prosperity, peace and partnership) lens and characterize the interrelations among elements of the systems	○ Case studies understood ○ Presentations ○ Workshops/simulations
	Critically analyze the causes and effects of impacts of system elements considering the need to increase wellbeing and ecosystem health within those systems	○ More advanced systems mapping ○ Presentations ○ Discussion of interrelations ○ Final project
General skills		
Integrate knowledge, skills and attitudes necessary for continuous learning throughout life considering their effective and just application in today's knowledge-based society	Learn to know	○ Systems maps ○ Case studies integrating knowledge ○ Research reports
Develop the necessary knowledge, skills and attitudes in order to communicate orally and in writing in the native language in the different disciplinary areas covered in the curriculum	Communicate disciplinary ideas orally, graphically and in written form	○ Systems mapping skills ○ Oral, graphic and written presentations ○ Analyses of videos and other visual media

Integrate knowledge, skills and attitudes required for team work and leadership considering mentorship and evaluation	Leadership and teamwork	○ Problem solving ○ Oral presentations
Integrate knowledge, skills and attitudes required for learning interpersonal communication techniques	○ Effective interaction with others ○ Negotiate inspiring trust and empathy ○ Speak with responsibility and ownership	○ Case studies resolved ○ Research reports
Develop knowledge, skills and attitudes necessary to communicate orally and in written form in a foreign language in different disciplinary areas covered in the curriculum	○ Communicate orally and in writing in a foreign language in day-to-day exchanges and with simple texts	○ Systems mapping ○ Translation of articles ○ Group discussions
Integrate knowledge, skills and attitudes necessary for the promotion of wellbeing and prosperity, acquiring motivation and commitment for establishing goals and as prerequisites for success	Take the lead in developing a personal-professional project demonstrating commitment to collaborative learning	○ Final project developed
	Identify challenges and seek system-based solutions through dialogue and collaboration, establishing and respecting commitments	○ Final project proposes solutions
	Implement new project, learning from mistakes, and continue focusing on wellbeing and prosperity	○ Final project implemented

Table 1: Course disciplinary and general skills linked to criteria and evidence of performance.

COURSE CONTENT

Part 1: Systems theory with reference to current sustainable development challenges

Theme/Module 1: Sustainable development and systems thinking

- The Sustainable Development Goals (SDG)
- Some background to systems thinking
- Definition of a system and a breakdown of its parts
- Putting the parts back together again

Theme/Module 2: System structures and behaviors

- The basics: stocks and flows
- Feedback loops (goal seeking or stability seeking)
- Runaway loops (reinforcing vicious or virtuous cycles)
- The “systems zoo”

Theme/Module 3: Systems and us

- Why systems work so well
- Why systems surprise us
- System traps and opportunities
- Opportunities and the SDGs

Theme/Module 4: Systems and sustainability in practice

- Globalization and systems
- Big systems – little systems
- Our part in system health and decline
- Our contributions to healthy systems

Part 2: Shifting perspectives

Theme/Module 5: From the parts to the whole

- From the parts to the whole
- From specialties to multidisciplinary approaches
- From objects to relationships
- From measuring to mapping
- From quantities to qualities
- From structures to processes

Part 3: Systems thinking in practice (project development)

Theme/Module 6: Facing challenges

- Why should we change?
- Why should we work together and with whom?
- What should we do?
- Why bother?

Theme/Module 7: Collective impact

- Mutually reinforcing activities
- Common agenda
- Shared measurement
- Continuous communication

Theme/Module 8: Final project

- Understanding your system
- Mapping and sharing
- Values and mental models exposed and validated
- Getting going!

METHODOLOGY

This course provides students with an introduction to systems thinking and its overarching principles with a specific focus on causal feedback loops within systems drawing from sustainability-related issues on different scales. At the same time students will learn to identify, analyze, understand and appreciate real-life situations of which we —particularly as unsuspecting consumers— are part and parcel, and at the same time contributing to myriad of dynamic systems of which we are possibly unaware.

Students, who may well have been exposed to conventional linear processes of cause and effect within, for example, the specific academic paths they have chosen (humanities, social, natural, formal or applied sciences), will learn that the real world comprises multi-dimensional systems from which most of us benefit. For example, globalization which forms the basis of the world's economy, involves a multiplicity of systems, —ranging from supply chains, to ecosystems, and climate systems— but these same systems are also impacting our overall health and wellbeing (e.g. COVID-19 and climate change) and the integrity of the ecosystems on which we depend. The course shall provide students with opportunities to delve into the systems that are most aligned with their areas of interest through case studies, simulations, and workshops, and acquire the tools to gain a better understanding of their dynamics and how they might apply these in future scenarios to bring about change.

They will learn that: relationships between problems and their causes are indirect and not obvious, as opposed to being obvious and easy to trace; we unwittingly create our own problems and should not expect others to change; most quick fixes have unintended consequences having no difference or making matters worse in the long run; in order to

optimize the whole, we must improve relationships among the parts; and only a few key coordinated changes sustained over time will produce large systems change.[5]

The methodology used involves the creation of individual learning spaces that students build around their own areas of interest and adapt to their specific learning styles. It is intended that the results of such a strategy contribute to a group space and an interactive learning environment in which the educator guides students as they apply concepts and engage creatively in internalizing the concept of systems thinking guided by global concerns and thus sustainability.

Throughout the course students will be given the opportunity to adapt their lines of study to their individual areas of interest, or perhaps even encounter new ones! As systems thinking involves changes in perspective, it is expected that some, if not all students, discover a new enriching educational experience, learning to learn in new ways. Systems thinking calls for a different means to communicate, where mapping becomes a necessary and fun way to express how systems function, and where intervention might be beneficial in the medium and long terms.

The first part of the course introduces students to systems theory in the context of today's global concerns. Students are encouraged to explore concrete current events and scenarios from diverse media sources that illustrate concepts and principles of systems theory, and carry out their own research into examples for sharing and discussion in class.
The second part of the course shares with students the need for a change of perspective: learning to focus on the whole rather than the parts; understanding the inherent multidisciplinary nature of issues addressed within systems; perceiving relationships rather than just objects; mapping rather than measuring; seeing processes instead of structures; and valuing qualities rather than quantities.

The third and final part of the course, focusing on systems thinking in practice, questions why we should change, why we should work together and with whom, what we should do and why.

Building on research, activities and knowledge acquired in the first and second parts of the course, this part introduces some of the vital first steps of a participatory initiative for students' final projects to address areas of interest in which they have identified system dysfunction, stress or failure.

EDUCATIONAL RESOURCES

In order to facilitate learning and course development a range of recent bibliographic materials, multi-media equipment for individual presentations (with wi-fi access in each classroom), furniture and acrylic boards are placed at the disposition of students for weekly sessions and lectures coordinated by the professor to complement proposed teaching activities. The latter include the different learning techniques outlined herewith that optimize the student's ability to assimilate knowledge. The majority of lessons take place in the classroom.

The student has physical access to the institution's library during opening hours, study areas or computer labs and any other convenient area on the university's campus for individual or group study. Likewise, the university provides free Wi-Fi access to all students, professors and staff throughout the campus.

The university also places the Canvas Learning Management System at the disposition of students and staff ensuring pedagogical flexibility making it easier to integrate new technologies into the courses, and ensure seamless and effective communications between the student and professor at all times through an app center.

LEARNING ASSESSMENT

ASSIGNMENTS	VALUE
Two (2) analytical workshops involving systems analyses (10% each)	**20%**
Two (2) presentations on issues of interest (5% each)	**10%**
Three (3) system maps of increasing complexity to reflect system structures, behavior, and mental models (10% each)	**30%**
Final project: proposal for an intervention in a system familiar and of interest/pertinent to the student	**40%**
TOTAL POINTS:	**100%**

LEARNING EVALUATION

Below you will find a sample of rubrics used for evaluation purposes. Most of these will be integrated with individual assignments on the Canvas platform and adjusted accordingly.

- Activities in the form of **workshops and role playing**, promoting shared spaces in which students, working in teams, develop skills in graphic, oral and written communication, in summarizing, leadership, learning to listen and learning to work together in dealing with sustainability issues in time and space dimensions, specifically addressing the dynamics of systems under review.
- Activities in the form of individual and group **presentations** providing opportunities to communicate both orally, in writing and in graphic form —and building on the specific learning styles of individual students— sharing the results of workshops and research undertaken; and to demonstrate the appropriation of issues of interest.
- An introduction to **systems mapping** is essential in that systems cannot be discussed merely with words. Words come only one at a time in a linear, logical order, while systems happen all at once. Mapping allows connections not just in one direction, but in many directions simultaneously. "It is necessary … to use a language that shares some of the properties as the phenomena under discussion" (Meadows, 2008). This strategy provides a valuable tool to assist in the understanding of the interdependencies between the SDGs and the identification of the causes and effects of different impacts with a view to:
    a) gaining a better understanding the system dynamics of sustainability issues and the roles of different stakeholders within the systems involved;
    b) identifying possible leverage points so as to influence outcomes and promote change;
    c) discovering some of the underlying causes of complex problems; and
    d) providing opportunities for their presentation both graphically and orally.
- The identification and analysis of systems involves **broad research**. This process promotes critical analysis on the part of the student of the different options available

- and of the interrelations between the SDGs and/or the different parts of a specific system. From a systems perspective, analyses will focus more on the qualitative nature of interrelations rather than quantitative ones. The results of research and the identification, analysis and interpretation of pertinent information from different sources (bibliographies, social media, web pages, communications media, interviews, etc.) will facilitate independent learning, the internalization of new concepts and those introduced in class.

A. Categories for the evaluation of <u>workshops/role playing and simulations</u>

The method involving the resolution of issues relating to systems' analyses and sustainability in a workshop setting, includes role playing and/or simulations, promotes shared spaces in which students, working as a team, develops their skills in graphic, written and oral communications through systems mapping, summarizing, leadership, listening and interacting constructively with others.

B. Categories for the evaluation of presentations

Activities in the form of individual and group presentations provide opportunities for oral and graphic presentations to a) share the results of assignments, and b) demonstrate appropriation of issues of interest.

C. Categories for the evaluation of <u>systems mapping</u>

Systems mapping is a vital skill to be acquired in communicating the nature of systems. Systems happen all at once and are multidimensional so words and sentences, which come one at a time and are linear, are replaced by a systems "language" and symbols. This language and these symbols, key tools that are gradually introduced throughout the course and reflect the increasing complexity of the systems under scrutiny, contribute students' ability to effectively communicate systems dynamics through mapping with a view to:

a) Acquiring a greater understanding of the complexity of sustainability issues and the actors involved;

b) Understanding the qualitative and quantitative nature of the interrelations between the different parts of a system and/or life cycle;
c) Identifying possible places in a system where leverage is desirable/possible in order to stimulate change and positive outcomes;
d) Discovering some of the underlying causes of complex problems;
e) Providing an opportunity to share findings in an effective and professional manner in both graphic and oral form.

D. Categories for the evaluation of the <u>final project</u>, a participatory initiative for each student to address a specific area of interest relating to sustainability in which they have identified a system failure that requires addressing.

Building on research, activities and knowledge acquired during the course, the student is invited to address a meaningful area of interest in which a specific issue is identified and a system failure or weakness is brought to light.

The objective of the final project is to provide a systems framework for a participatory intervention in an issue of interest and/or concern, that requires an integral or holistic focus to ensure a positive outcome and no or minimal unexpected negative consequences.
The system under scrutiny and the subject of the student's final project, will:

- Identify and delimit a system under stress, or that is dysfunctional or failing of personal interest
- Map the system concerned, demonstrating its multidimensional aspect, using causal feedback loops, with sub-systems referenced as required, using the appropriate systems language and symbols
- Identify all parts of/stakeholders in the system's potential optimization
- Demonstrate a clear understanding of the relationships between elements of the system, and specifically their qualitative and possibly quantitative nature
- Reflect the assumptions regarding mental models in the mapping process

ATTENDANCE

Regarding classes:

1. Students are only allowed a total of two (2) nonconsecutive (back-to-back) **class absences**. A student shall fail the course if more than two absences are registered.

2. Three **late arrivals to class** (within the first 15 minutes) are treated as one absence. Attending class 30 minutes late without an official justification will count as an absence.

3. In the case of an **absence from any assignment evaluated in class** (presentations, evaluations, field trips, etc.) a student will be given a grade zero unless an official document is presented within one week of the absence.

4. On presentation of the official justification to excuse the absence, the missed assignment shall be presented on that same day in order to avoid a grade zero.

Regarding field trips:

5. An unjustified **absence on a field trip** will immediately result in the loss of all points assigned to that specific trip. However, if an official document justifying the absence is presented, 50% of the assignment points may be obtained on presentation of a complementary research assignment, to be agreed upon with the professor, within one week of the field trip.

6. An absence on a field trip may be justified should two course field trips coincide. In such a case, and in order to avoid losing points, students shall be able to opt for carrying out a research assignment.

CODE OF CONDUCT

Professors have the right to expel a student from the classroom should he/she/they:

1. Be disruptive in the classroom
2. Behave in a disrespectful way
3. Be under the influence of alcohol or even smells of alcohol
4. Be under the influence of any illegal drug
5. Show hygiene-related problems that may disturb other students

ELECTRONIC DEVICES

The use of cell phones, smartphones, or other mobile communication devices is disruptive and is therefore prohibited during class. Students will be requested to turn all devices OFF and put them away when class begins. These may be used only when the professor assigns a specific activity including Internet-related searches and other processes. Those who fail to comply with this requirement will be asked to leave the classroom for the remainder of the class period. Using devices while the professor or other peers are lecturing, or presenting is perceived as a lack of interest and disrespectful.

BIBLIOGRAPHY

This is a partial bibliography. Given the dynamic nature of sustainability and events relating to climate change each course module will provide students provide students with recent bibliographic sources and other materials of interest.

Capra, F. & Luisi, P. L. (2014). *The systems view of life: A unifying vision.* Cambridge University Press.

Meadows, D. H. & Wright D. (Ed.) (2008). *Thinking in systems: A primer*. London: Earthscan.

Meadows. D.H. et al. (1972). The Limits to growth; a report for the Club of Ro*me's project on the predicament of mankind.* New York: Universe Books.

Sachs, J.D. (2020). *The Ages of Globalization: Geography, Technology, and Institutions*. New York: Columbia University Press

Senge, P. M. (2006). *The Fifth Discipline: The art and practice of the learning organization.* New York: Currency, Doubleday.

Senge, P. M. (1994). *The Fifth Discipline Fieldbook: Strategies and tools for building a learning organization.* New York: Currency, Doubleday.

Stroh, D. P. (2015). *Systems thinking for social change: a practical guide to solving complex problems, avoiding unintended consequences, and achieving lasting results.* White River Junction, Vermont: Chelsea Green Publishing.

CIPSS PROGRAM POLICIES

The student must comply with the provisions of Universidad Veritas CIPSS Student Policies available on the Canvas platform.

CHRONOGRAM

Week	Sub competence	Content	Teaching strategies
Part 1: Systems theory with reference to current sustainable development challenges			
1	Identify systems, of which we are part, having the greatest environmental, social and economic impacts	Theme 1. Sustainable development and systems thinking. The sustainable development goals; some background to systems thinking; definition of a system and breakdown of its parts; putting the parts back together	Introductions/sharing backgrounds and aspirations Course presentation and sharing of program
2		Theme 2. System structures and behaviors. The basics: stock and flows; feedback loops; runaway loops; and the "systems zoo"	Presentation #1/2: results of research into systems and discussion of examples
3		Theme 3. Systems and us. Why systems work so well; why they surprise us; system traps and opportunities; opportunities and the SDGs	Use of system thinking language and symbols System map 1/3: System identification and characterization
4		Theme 4. Systems and sustainability in practice. Globalization and systems; big systems–little systems; our part in system health and decline; our contributions to healthy systems	Examples of different systems System analysis and comparisons Workshop #1/2: Systems and SDGs
5			

Part 2: Shifting perspectives			
6	Analyze these systems through the 5P (people, planet, prosperity, peace and partnership) lens and characterize the interrelations among elements of the systems	Theme 5. From the parts to the whole. From the parts to the whole, from specialities to multidisciplinary approaches; from objects to relationships; from measuring to mapping; from quantities to qualities; from structures to processes; from Cartesian certainty to approximate knowledge	Seeing the parts and building the system.
7			System map 2/3: Building the system and analyzing the parts
Part 3: Systems thinking in practice (project development)			
8	Critically analyze the causes and effects of impacts of system elements considering the need to increase wellbeing and ecosystem health within those systems	Theme 6. Facing challenges. Why should we change? Why should we work together and with whom? What should we do? Why bother?	Workshop 2/2: Group dynamic in mapping Presentation #2/2: Processes, relationships between parts, and qualifications/ quantifications
9			
10		Theme 7. Collective impact. Mutually reinforcing activities; common agenda; shared measurement; continuous communication	System map 3/3: Sharing projects' systems' maps illustrating
11		Theme 8. Final project: Understanding your system; mapping and sharing; values and mental models exposed and validated; getting going!	Final project presentations and submissions
12			

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REFERENCES

[1] United Nations. https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

[2] Drawn from Meadows, D.H. (2009).

[3] The interpretation of Ehrenfels well known phrase "the whole is more than the sum of its parts", Ehrenfels, C.V. (1960/1890). Über gestaltqualitäten. Repr. in F. Weinhandl, ed., *Gestalthaftes Sehen*. Darmstadt: Wissenschaftliche Buchgesellschaft.

[4] McKinsey & Company. (2021). Defining the skills citizens will need in the future world of work. Online. https://www.mckinsey.com/industries/public-and-social-sector/our-insights/defining-the-skills-citizens-will-need-in-the-future-world-of-work# (accessed 23.12.21)

[5] Based on table 1.1. Systems thinking for social change. David Peter Stroh (2015)