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BUILD SOLUTIONS

ONE-YEAR STUDENTS PROGRAMME

REPORT

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1 – FOREWORD

Building Urban Intelligent Living Design Solutions

Cities currently host more than half of the world population, which is projected to increase up to 70% by 2050 (UN, 2014). Already, cities account for 70% of global CO2 emissions (C40). With the expected population growth, cities would hence be the source of an estimated 85% of global GHG emissions.

There is a growing recognition and awareness that nature can help to provide viable solutions by using and deploying the properties of natural ecosystems and the services that they provide in a smart and 'engineered' way (EC). These living solutions provide sustainable, cost-effective, multi-purpose and flexible alternatives for various objectives. Working with nature, rather than against it, can further pave the way towards a more resource efficient, competitive and greener economy. It can also help to create new jobs and economic growth, through the manufacture and delivery of new products and services, which enhance the natural capital rather than deplete it (EC).

With that in mind, the big question is, why are nature-based solutions not used more to address the global urban challenges?

The main answer would be that there's a distinct skill and financing gap in the biotechnology sector. While we currently have great researchers in biotechnology, too often the commercialization and hence the implementation of their discoveries stumble due to a lack of personal experience in entrepreneurship and cooperation with industry leaders (Fritsch, 2010).

And even when most of those skills are present in a team attempting to commercialize a technology, another obstacle rears its head: the lack of short-term funding available to biotech start-ups and spinoffs (Swamidass, 2008). Recently, the High-Level Group for the European Innovation Council published their first recommendations which state that funding for disruptive, market-creating start-ups with deep-tech solutions (like biotech) is severely fragmented and doesn't meet the needs of the start-ups for developing the technology (http://ec.europa.eu/research/eic/pdf/eic_recommendations_set-1_2017.pdf). The lack of funding can be attributed to multiple factors, chief amongst them being the perceived risk and the huge capital expenditures necessary to develop sound biotechnology solutions.

Building Urban Intelligent Living Design Solutions (BUILD Solutions) project aims to set up transdisciplinary cooperation among universities and business, engaging students, teachers and researchers and providing them with the necessary entrepreneurial skills and connections to bring intelligent living solutions to the market, by investigating biological systems, creating smart design prototypes, business plans, plans for start-ups and working with accelerators.

The project's objective is to develop an experimental transdisciplinary educational system linking biology, intelligent design and business through several kinds of activities, such as courses for students and trainers, symposiums, development of educational resources, the set-up of an accelerator programme, launching an international call for ideas and creating new networks.

BUILDs is a project developed by Institute for Advanced Architecture of Catalonia - IAAC- (Spain), Université de Lorraine -UL- (France), Vienna University of Economics and Business -WU- (Austria), Ersilia Foundation (Spain), ECONICK (France), Plant-e (Netherlands), City Facilitators -CF- (Denmark), GreenTech Challenge -GTC- (Denmark), and co-funded by the Erasmus+ Programme of the European Union.

Living design solutions provide sustainable, cost-effective, multi-purpose, and flexible alternatives for several urban challenges.

2 – ONE-YEAR PROGRAMME

The One-Year Programme is one of the key transversal activities of the BUILDs project. Its main objective is to develop a new innovative and transdisciplinary approach to teaching and learning to merge the fields of biology, architecture, and business with the aim of exploring and introducing to the market intelligent living solutions that address global urban challenges.

To achieve this, we have put together trainers and researchers with business specialists and coaching experts in order to develop the content, structure, and tools of the One-Year Academic Programme that aimed at being multidisciplinary, fully interconnected, and that incorporates a business mindset. On the other hand, the actual activities of the One-Year Programme have been structured using the learning-by-doing methodology where students developed their projects by testing biology concepts, fabricating prototypes, and simulating performances on the market, while being coached by trainers of the three different disciplines as well as by business specialists.

The BUILDs One-Year Programme took place during the academic year 2019-2020, where a total of 30 students (10 students from each discipline of biology, design and business) have worked together with the support of their trainers and coaching experts.

The academic year was organized as follows. During the first semester (Sep-Dec 2019), the biology and agronomy students from UL worked towards the analysis of the scientific concepts behind the current global challenges and studied how nature-based solutions (NBS) can help facing them. Besides regular interaction with their own UL trainers, three online meetings were scheduled (one per month) to give guidance and feedback to the students' research process, where trainers from the other two higher educational institutions (HEI) and disciplines (meaning from IAAC as architecture and design experts, and from WU with the entrepreneurship expertise) participated, together with representatives of the other BUILDs business partners.

In December 2019 an all-students meeting was held online with the participation of both students and trainers from the three HEI (UL, IAAC, WU) as well as of all the project's partners. In that meeting, UL students presented their preliminary findings and introduced to their WU and IAAC peers the concepts of urban ecosystem services, ecological functions and to ecosystems services notions. They presented an exhaustive analysis of several NBS case studies, highlighting their main features, which challenges and United Nations Sustainable Development Goals they addressed, the ecological functions and the ecosystem services they provided, and the gaps they found from an ecological perspective, by ending with some suggested improvements. This served as the background basis for the continuation of the second phase of the One-Year programme when design

students (from IAAC) and business students (from WU) joined at the second semester.

The second part of the One-Year Programme started in the second semester (Jan-Jun 2020) with the 5-Day Workshop in January.

In the 5-Day Intensive Workshop, 10 students from each HEI, their trainers, and SMEs experts gathered during five days at IAAC (Barcelona), being the first meeting students had face-to-face. It was a really action-oriented learning experience, where students met, formed groups, and ideated new products and services combining intelligent living design, biotech, and business solutions to help green cities. Five start-up teams were formed (Epiclay, PlayJungle, Worm Generation, aeroSQAIR, and C:aire) and each one was composed by 6 members - formed by 2 students of each HEI. From there, they have been actively working remotely in their projects throughout the second semester.

At the end of the semester, they participated in an online challenge that included a final pitch before a jury of established investors. Epiclay was the first selected start-up by the jury and was chosen to participate in the Accelerator Programme in September 2020 in Copenhagen.

One of the key successes of the One-Year Programme has been the effective interdisciplinary collaboration set-up that has facilitated an easy exchange, flow, and co-creation of knowledge across the three disciplines and across borders!

3 – METHODOLOGY AND EDUCATIONAL GUIDELINES

3.1. One-Year Programme at each HEI

The end goal of the BUILDs One-Year Programme is to analyze, from the three different disciplines, how living systems have the potential to provide cities with multiple ecosystem services, such as food, materials, energy production, climate control, water purification, or pollination. In particular:

1. How can NBS restore or build ecosystem services in urban areas, and which are the benefits and limits of these solutions on urban biodiversity? (UL, biology perspective)
2. How can digital technologies help us integrate living systems into urban environments? Can we build the future of cities through a nature-based approach? (IAAC, design and architecture perspective)
3. How can we generate marketable intelligent living solutions for cities and efficient green business plans? (WU, business perspective)

To achieve this goal, students are set to work in 5 different startup groups that will develop and test their selected NBS through this multidisciplinary lense.

With this objective in mind, one of the main challenges of the BUILDs One-Year Programme was to set up a common and interdisciplinary educational setting that could work for the three HEIs considering their different academic year timings, university and course curriculum, and the physical distance.

After a depth analysis, the following roadmap was successfully agreed and implemented:

- Selection of 10 graduate students from each HEI:
  - UL students selected in August 2019 from the third-year program of the specialization on “Science et Génie de l’Environnement” from ENSAIA-UL.
  - WU students selected in November 2019 from the elective course of the Sustainability Challenge.
  - IAAC students selected in November 2019 from the second year of the Master in Advanced Architecture Programme.
- First semester starts in September 2019 with UL students analyzing the biology concepts of the urban intelligent solutions.
- With a ‘pass on the baton’ strategy, in December 2019 and January 2020 there are two events with all students to brainstorm on the different nature-based solutions to develop, based on the preliminary findings of the UL students and by introducing now the design and business disciplines.
- During the second semester all students work together towards the development of their selected product idea that is transformed in a start-up.

In the next section 3.2 it is addressed in detail the main actions, activities, and methods set to develop the interdisciplinary BUILDs One-Year Programme plan.

With the aim of assisting HEIs in the design of their own courses based on BUILDs main objective and planned objectives, BUILDs' partner Ersilia drafted the following Syllabus template:

BUILDs TEMPLATE SYLLABUS AND METHODS ADOPTED	
DATE	*Academic semester dates*
COURSE TITLE	*Title of the course in English (and in original language)*
TUTORS	*Name(s) of the tutor(s)*
OBJECTIVE OF THE COURSE	*What is expected to be transmitted to the students in this course and in relation to the BUILDs project*
COURSE CONTENT	*What are the key topics of the course and its relation to BUILDs*
OVERVIEW OF THE ACTIVITIES	*List the activities performed, including the time devoted to each one*
RATIONALE FOR SEQUENCING AND PACING ACTIVITIES	*Explain how the course has been organized to allow the interconnection with the other two disciplines and why it has been structured like this*
ASSESSMENT	*How will you assess the success of this course? What outcomes will illustrate that students have met the goals and objectives of this course in relation to BUILDs?*
MATERIALS/RESOURCES	*List the bibliography and materials used in the course*
SUPPORT AND FOLLOW-UP	*Means of communication with students, frequency, assignments, etc.*

The following lines will describe in detail how each HEI selected their students, adapted their courses and tailored their syllabuses in order to introduce the BUILDs programme roadmap.

3.1.1 IAAC: educational setting and syllabus

IAAC developed the elective course titled *Digital Design For Living Systems* as part of the second year of its Master in Advanced Architecture.

This course, offered during the second semester of the academic year 2019-2020, aimed at introducing to design and architecture students to the new visions and applications of integrating living systems into the urban environment by using computational design and other innovative technologies.

The course content was therefore adapted and tailored to give response to the main goal of the BUILDs One-Year Programme from an architecture and design's perspective: *How can digital technologies help us integrate living systems*

into urban environments? Students were invited to use computation design and digital manufacturing techniques to develop their start-up project ideas and 1:1 scale functional prototypes of urban elements, in order to integrate living systems into the urban environment.

The course was open for registrations at the end of the first semester, and in November 2019 10 students were selected based on their interest in BUILDs topic. Although their course technically started during the second semester with the 5-Day Workshop in January 2020, students participated in several preparatory sessions during December in order to familiarize themselves with the BUILDs project and with the preliminary findings of their peer biology colleagues from UL.

The *Digital Design For Living Systems* Course continued with the 5-Days Intensive Workshop held in January 2020 where all 30 students and their trainers met face-to-face and worked towards the formation of 5 interdisciplinary groups (the future 5 start-ups) and the ideation of new NBS products or ideas for greener cities. At the end of this intensive Workshop, 5 start-ups teams were born (Epiclay, PlayJungle, Worm Generation, aeroSQAIR, and C:aire), each one formed by two members of each HEI, and established a roadmap to work together remotely throughout the second semester.

With this in mind, IAAC organized the Course by offering weekly sessions in which several digital theories and innovative manufacturing techniques were introduced. Using a learning-by-doing approach, each session topic was addressed by using each one of the product ideas that the 5 start-ups were developing. Like this, while each start-up group was having in parallel their own team meetings to develop their NBS idea, IAAC students were receiving on their side thoughtful support from their design trainers throughout this course on a weekly basis.

Besides, during the implementation of this course, regular conversations with the other two HEIs were in place in order to guarantee that the BUILDs One-Year Programme agenda, assignments, and deadlines were being followed.

Learn more about the *Digital Design For Living Systems* Syllabus as follows:

BUILDs SYLLABUS AND METHODS ADOPTED: IAAC	
DATE	January - June 2020
COURSE TITLE	Digital Design For Living Systems
TUTORS	Chiara Farinea, Mohamad El Atab
OBJECTIVE OF THE COURSE	*What is expected to be transmitted to the students in this course and in relation to the BUILDs project* -Understand the basics of Living Systems and their application and implications on the urban environment. -Elaborate projects using computational methods and digital manufacturing to integrate living systems into urban environments.

	-Be capable of designing a real-situation project at a proof-of-concept level, resulting in a product with market potential. By the end of the course, IAAC students were expected to: • Critically understand the theoretical principles of digital design • Experiment and understand the different principles of 3D modeling such as architectural modeling and prototyping • Use and combine various design software according to individual projects and design outcomes • Use 3D printer, milling machine, and laser cutter
COURSE CONTENT	*What are the key topics of the course and its relation to BUILDs* - Computational design (using rhino & grasshopper) - Digital & physical prototyping - 3D printing (additive manufacturing) - Cnc Milling (subtractive manufacturing) - Casting and molding - Natural subtractive manufacturing - Biomimicry in architecture - Bio-computational drawings - Nature-Based Solutions
OVERVIEW OF THE ACTIVITIES	*List the activities performed, including the time devoted to each one* <u>IAAC Term 1 (Jan-Mar 2020)</u> Session 1 (16-12-2019): General Introduction to the project (9am, 3 hours Zoom session), together with several email communications with project background materials Sessions 2-5 (13/17-01-2020): 5-Days Intensive Workshop with all students from UL and WU, their trainers, and all business partners Session 6 (20-01-2020): Lecture on Nature-Based Solutions + Desk Critique Session 7 (27-01-2020): Introduction to Computational Design + Design Critique Session 8 (10-02-2020): Mid-term Presentations Session 9 (17-02-2020): Desk Critique with entire startups + Introduction to Fabrication Session 10 (24-02-2020): Fabrication support + Prototype mockup Presentation Session 11 (02-03-2020): Presentation Layout + Rendering session Session 12 (09-03-2020): Final Presentation (2 hours zoom session) <u>IAAC Term 2 (Mar-Jun 2020)</u> Session 1 (23-03-2020): Lecture on Logo Design + Online Design Critique Session 2 (15-04-2020): Online lecture on Bio Design Session 3 (20-04-2020): Computational Support + Design support hours Session 4 (22-04-2020): Midway Pitch All startups Session 5 (27-04-2020): Logo Review + Business plan Session 6 (04-05-2020): Fabrication Support Online Session 7 (11-05-2020): Presentation Layout + Final Rendering Session 8 (18-05-2020): Fabrication + Computational support hours Session 9 (25-05-2020): Fabrication + Computational support hours Session 10 (08-06-2020): Final Pitch
RATIONALE FOR SEQUENCING AND PACING ACTIVITIES	*Explain how the course has been organized to allow the interconnection with the other two disciplines and why it has been structured like this* The classes of this course were performed on a weekly basis throughout the second semester. Following the logic of the steps of a product design, each week one theoretical topic was introduced to help students with the development process of their product ideas. The lecture was followed by a design review

	session where the different start-ups proposals were analyzed from the architectural standpoint. On the other hand, all course assignments were scheduled in order to support and complement the BUILDs roadmap plan: the course established a mid-term deliverable before the BUILDs midway pitch in March, and another final-term deliverable before the final pitch in June. Furthermore, the sessions were also spaces that facilitated the interaction between the entire start-up group members to solve doubts and questions with the architecture and design trainers.
ASSESSMENT	*How will you assess the success of this course? What outcomes will illustrate that students have met the goals and objectives of this course in relation to BUILDs?* • Students will be able to demonstrate an understanding of core knowledge in Computational Bio-Design & digital fabrication • Students will be able to apply critical thinking and analytical skills to solve design problems • Students will be able to demonstrate visual skills to communicate the project • Students will be able to synthesize scientific information from a variety of resources. • Students will be able to work in groups and be part of an effective team. • Students will be able to design and fabricate
MATERIALS/RESOURCES	*List the bibliography and materials used in the course* • Biomimicry in architecture (Michael Pawlyn) • Towards an EU Research and Innovation Policy Agenda for Nature-based Solutions & Re-naturing Cities: Final Report of the Horizon 2020 Expert Group on 'Nature-based Solutions and Re-naturing Cities. • We need agriculture back in our cities and in our minds. • Sacred Ecology. • The Progress of Geometry as Design Resource. • Biotechnology and the built environment. • Architecture and Urban Ecosystems: From Segregation to Integration. • Grown, Printed, and Biologically Augmented: An Additively Manufactured Microfluidic Wearable, Functionally Templated for Synthetic Microbes. • Emergent Materials for Innovative Buildings and Ecological Construction. • Biomatrices and Biomaterials for Future Developments of Bioprinting and Biofabrication. • Structuring Materiality: Design Fabrication of Heterogeneous Materials. • Living Buildings Architectures' Path to Ecology. • Rethinking Materiality through Computation.
SUPPORT AND FOLLOW-UP	*Means of communication with students:* - *in class sessions* - *slack* - *emails* - *zoom meetings* *frequency:* - weekly class sessions with trainers - weekly and on-demand office hours *assignments:* - mid-term assignment (that served as the basis for the midway pitch set up in BUILDs)

	- *final-term assignment* (that served as the basis for the final pitch set up in BUILDs)

3.1.2 UL: educational setting and syllabus

UL-ENSAIA developed the specialization course titled *Science et Génie de l'Environnement* (Environmental Science and Engineering) as the last two and half semesters of its "Formation diplômante d'ingénieur en Agronomie".

This specialization started in the last trimester of 2018-2019 and during the two semesters of the academic year 2019-2020. It aimed at introducing environmental engineering to engineering-students with a curriculum in agronomy by teaching them tools to diagnose and manage ecosystems in urban context.

The course content was therefore adapted and tailored to give response to the main goal of the BUILDs One-Year Programme from a biology perspective: *How could Nature Based Solution contribute to answer the specific issues of urban environments?* Students were invited to apply their knowledge on various fields such as water course, rural area, industrial brownfield, city. They also identified the main environmental issues of urban areas and made a wide benchmarking of existing NBS, through the perspective of ecosystem services valuation.

Preparation was conducted with a group of 20 students from March to June 2019. The course was open for registrations in June 2019. 10 students were selected based on their interest in BUILDs topic. Their course started in September 2019 and went along February 2020, including the 5-Day Workshop in January 2020. The students organized several preparatory sessions for their colleagues from IAAC and WU during December in order to familiarize themselves with the BUILDs project.

Besides, during the implementation of this course, regular conversations with the other two HEIs were in place in order to guarantee that the BUILDs One-Year Programme agenda, assignments, and deadlines were being followed.

BUILDs SYLLABUS AND METHODS ADOPTED: UNIVERSITY OF LORRAINE	
DATE	September 2019 to February 2020 (preparations from March to May 2019)
COURSE TITLE	Environmental Science and Engineering (Science et Génie de l'Environnement)
TUTORS	Apolline Auclerc, Christophe Schwartz, Geoffroy Séré with the support of Catherine Sirguey, and Pierre Léglize
OBJECTIVE OF THE COURSE	*What is expected to be transmitted to the students in this course and in relation to the BUILDs project*

	The course aims at developing the skills and knowledge our students need to diagnose, manage and reclaim anthropized ecosystems (urban, industrial & mining areas), by the implementation of Nature Based Solutions.
COURSE CONTENT	*What are the key topics of the course and its relation to BUILDs* Thematic modules – environmental diagnosis and management: · Methods in urban agronomy (agriculture, soil science, ecology) · Management of derelict lands · Diagnosis of landscape, soil covers & biodiversity · Diagnosis of urban, industrial & mining environments · Implementation of environmental Biotechnologies · Diagnosis of water quality Tools modules: · Data analysis and processing · Geographic Information Systems · Life Cycle Assessment · Environmental law · Communication, careers Internship
OVERVIEW OF THE ACTIVITIES	*List the activities performed, including the time devoted to each one* • 02/04/2019: 9-12am: creation of a video on how to diagnose a polluted forest ecosystem • 10/04/2019: 9-10:30am: presentation to the UL students of the BUILDs program • 10/04/2019: 10:30-12am; 10/04/2019: 2-5pm, 24/04/2019 and 29/04/2019: 3-4pm: brainstorming on SDGs in 3 groups: literature and online research • 30/04/2019: 9-12am: presentation of their literature review on SDGs by groups to the tutors and other UL students • 03/05/2019 and 16/05/2019: 2-5pm, 17/05/2019: 9-12 am: work on existing NBS for analysis of their functioning, their link with SDGs, their limits, how to improve it. • 03/06/2019: 2-5pm: presentation of the studied NBS by groups to the tutors and other UL students • end of june 2019: selection of 10 UL students for BUILD program • 16/09/2019: 9-12am: Workshop on creative process about urban agriculture • 18/09/2019: 9-12am, 2-5pm: preparation of the online presentation for BUILD partners • 20/09/2019: 9-12am: online presentation to BUILD partners of their previous semester work • 26/09/2019-27/09/2019: 9-12 am: work on an oral presentation for the NBS Symposium October 1-2-3/10/2019 to present the BUILD program. • 07/10/2019: 9-12 am: lecture by Geoffroy Séré on Management of contaminated sites • 09/10/2019: 9-12 am: lecture by Apolline Auclerc on Monitoring of biodiversity • 06/11/2019: 2-5 pm: lecture by Jean Louis Morel on Ecosystem Services provided by Urban Soils • 27/11/2019: 2-5 pm: Workshop (½) by Hannah Frost on Creativity and Innovation • 28/11/2019: 2-5 pm: Workshop (2/2) by Hannah Frost on Creativity and Innovation • 29/11/2019: 2-5 pm: online lecture by Chiara Farinea on Living Architecture and design • 02/12/2019: 9-12 am: lecture by Véronique Escoffier (Métropole du Grand Nancy) on management of the air quality at the Metropole's scale • 03/12/2019: 9-12 am: lecture by Aida Bani on Agromining • 05/12/2019: 9-12 am: lecture by Pr Shallari on Policy to adapt to climate change

	• 06/01/2020: 2-5 pm: lecture by Anne-Laure Hamon on management of municipal wastes • 09/01/2020: 2-5 pm: lecture by Geoffroy Séré on Pedological Engineering to manage derelict lands • 27/01/2020: 9-12 am: lecture by Jade Bréchignac on Permaculture for urban agriculture • 09/01/2020: 2-5 pm: lecture by Geoffroy Séré on how to take soil quality into account in urban planning • 06/02/2020: 9-12 am: visit of ATMO Grand Est with Apolline Auclerc about Monitoring air quality
RATIONALE FOR SEQUENCING AND PACING ACTIVITIES	*Explain how the course has been organized to allow the interconnection with the other two disciplines and why it has been structured like this* The UL course has been organized in two steps. The preparatory one (from March to May 2019) focused on field exercises about how to conduct an ecosystem diagnosis (observation, measurements, interpretation, recommendations on the management). They were performed in parallel or even before teaching any fundamental knowledge dedicated to the interactions between compartments and the whole functioning of an ecosystem. UL students were then able to conduct an assessment of aquatic and terrestrial urban ecosystem complexity. The second one happened between September 2019 and February 2020. It aims at giving them the knowledge and know-how for the creation and evaluation of Nature-Based Solutions in order to optimise the ecosystem services provided. It was based on a succession of lectures, tutorial classes and projects conducted under the supervision of tutors and the mentorship of trainers from the other two disciplines (design and entrepreneurship). Lecturers were professors and visiting lecturers representing companies and stakeholders.
ASSESSMENT	*How will you assess the success of this course? What outcomes will illustrate that students have met the goals and objectives of this course in relation to BUILDs?* • Students will be able to design and implement a sampling plan dedicated to the evaluation of the quality of various ecosystems • Students will be able to exploit complex data and formulate recommendations regarding the sustainable management of various ecosystems • Students will be able to communicate about their project • Students will be able to synthesize scientific information from a variety of resources. • Students will be able to work in groups and be part of an effective team. • Students will be able to bring scientific and technological contribution to NBS design
MATERIALS/RESOURCES	*List the bibliography and materials used in the course* Bibliography • Towards an EU Research and Innovation Policy Agenda for Nature-based Solutions & Re-naturing Cities: Final Report of the Horizon 2020 Expert Group on 'Nature-based Solutions and Re-naturing Cities. • https://sdgs.un.org/goals • https://www.nature4cities.eu/h2020-nbs-projects Materials Powerpoint, Google Drive for class sessions Creative workshop Field trips

SUPPORT AND FOLLOW-UP	*Means of communication with students, frequency, assignments, etc.* - in class sessions - google drive - emails - visio meetings frequency: - weekly class sessions with trainers - weekly and on-demand office hours assignments: - mid-term assignment (that served as the basis for the midway pitch set up in BUILDs) - final-term assignment (that served as the basis for the final pitch set up in BUILDs)

3.1.3 WU: educational setting and syllabus

WU developed an elective course for master students with an open call to apply, if they are interested in "Creating green business solutions for the cities of our future". Purposefully, this call was distributed along all relevant masters at WU that focus on 'business' 'innovation' 'sales' & 'supply chain'. The students that applied were interviewed and selected based on several criteria, such as 'motivation', 'diversity', 'experience' and 'commitment'. The course started with the first activities in the beginning of November 2019. The aim at WU was to guide these students with very different backgrounds and capabilities through the BUILDs startup programme and equip them with tools and means necessary to be successful. Leaning the design of this course on the lean-startup methodology, meant to adapt the course to fit the needs of business students to be able to build green business solutions.

The objective of the first part of the programme -prior to finding their teams in Barcelona-, was to form a support base within the 10 WU students and introduce them to the topic: sustainable startups and nature-based solutions. Team building among the WU students was crucial from the very beginning. Same stands true for the topic of transdisciplinarity, which was highlighted continuously to make sure that the WU business students were ready and well prepared for the setting of the 5-days intensive workshop in January 2020 in Barcelona. Linking to this, the WU students self-assessed their strengths and weaknesses (personally and as a WU team), they dived into the two other disciplines, learned how to explain their own one in easy and understandable terms and established criteria on how to evaluate (their) sustainable business ideas.

During the 5-Days Workshop in Barcelona and a very intensive programme, 5 startups formed, each with 2 WU students. Hence the focus after Barcelona was on each startup's need, meaning that many sessions were with two WU students forming one startup. However, we also had several sessions in the bigger group, where knowledge exchange was created and fostered. Furthermore, specific

training (e.g. on customer segment and value proposition, as well as impact assessment) were offered, as the need for such training arose during the semester.

Every Thursday the students had the possibility to reach out to the WU trainers and ask for help, additionally to the other sessions provided to them. To not create a competitive atmosphere along the startups and to foster the exchange of knowledge and the spirit of collaboration, peer-to-peer sessions were implemented where -as the name suggests- a workshop setting based on the students' knowledge and helping each out, was facilitated. Students could pose questions and struggles to the other team members prior to the session, while at the same time also offering support and feedback to the others.

While guiding them through BUILD's One-Year Programme, a great emphasis was put on giving them opportunities to integrate themselves in the Viennese Startup Ecosystem and to look out for means of support after the BUILDs programme is finished. For this, a separate slack channel was set up where trainers and students alike could share upcoming events, calls and further training opportunities.

Besides the interactions between WU trainers and WU students, a close collaboration and interaction with other BUILDs consortium partners, were of utmost importance to the success of the programme.

BUILDs SYLLABUS AND METHODS ADOPTED: UNIVERSITY OF VIENNA	
DATE	November 2019 - October 2020
COURSE TITLE	Creating Green Business Solutions for the Cities of our Future 3 ECTS (as part of the start-up track of the Sustainability Challenge, elective course at WU, University of Business and Economics)
TUTORS	Hannah Frost, Laura Hohoff With the support of Christian Rammel
OBJECTIVE OF THE COURSE	*What is expected to be transmitted to the students in this course and in relation to the BUILDs project* - The objective of the first part of the course is to teach the concept of start-ups, different disciplines, teamwork, and to prepare the students for the Barcelona meet-up (5-days intensive workshop). - The second part aims at helping the students succeed in their start-ups, not being teachers but coaches and mentors that guide and facilitate by giving feedback rather than giving lectures. Instead, different workshop formats and peer-to-peer-learning sessions were offered and dedicated to the most pressing issues of the start-ups at the very moment.
COURSE CONTENT	*What are the key topics of the course and its relation to BUILDs* - How to build a sustainability-driven start-up: - team strength and weaknesses,

	- communication, - business plan, - customers and their needs and pains, - value proposition, marketing, etc. - team building, - Viennese start-up ecosystem and support scene, - Remote work pros and cons, - interdisciplinary work, - pitching & pitch deck - selling products/services.
OVERVIEW OF THE ACTIVITIES	*List the activities performed, including the time devoted to each one* - 4&6.11.2019: Interviews with potential BUILD students (2 days) - 08.11.2019: 11:30am - 12:30am First informal get together at the WU campus - 28.11.2019: 10am - 1pm Online meeting with the trainers & students from Nancy - 02.12.2019: 10am - 11:30 am 1st internal WU Workshop: Needs of sustainability-driven entrepreneurs, common resources at WU and gaps - 12.12.2019: 2:30pm - 5pm 2nd internal WU Workshop: Changing the Perspective- Intro to biology and design discipline, through design thinking elements - 16.12.2019: 9am - 12pm online meeting with all trainers & students - 03.01.2020: 10am - 12pm Workshop on setting up the criteria for the business assessment - 07.01.2020: 4pm - 6pm Business assessment workshop of case studies - 12. - 17.01.2020: Kick-off week in Barcelona - 30.01.2020: 11:30am - 1pm Reflection of Barcelona Week, next steps and curriculum - 04.02.2020: 3:30pm - 4:15pm Milestone Meeting Team 1 Melanie & Christoph - 11.02.2020: 5pm - 6pm Milestone Meeting Team 5 Jasmo & Sophia - 02.03.2020: 11:30 - 13:00 Milestone Meeting Team 4 Patrick and Esther - 03.03.2020: 11am - 12pm Milestone Meeting pt.2 Team 1 Melanie &[Christoph] - 04.03.2020: 12pm - 1pm Milestone MeetingTeam 2 Veronika and Anastasia - 10.03.2020:12pm - 2pm 1st Peer to Peer learning Meeting: Challenges of Remote Working and starting up a business - 13.03.2020: 11am - 12pm Milestone Meeting Team 3 Malte and Karolina [online due to Covid-19] - 19.03.2020: 11:am - 11:35am Milestone Meeting pt.2 Team 4 Patrick and Esther [online due to Codiv-19] - 20.03.2020: 10:00am - 12:30pm Workshop: How to know your customer and user better [remote/individual due to Covid19] - 26.03.2020 10:00am - 10:30am Feedback meeting with team 3 on Value Proposition Canvas and Customer/User Segments [online due to Covid-19] - 26.03.2020 10:30am - 11:00am Feedback meeting with team 1 on Value Proposition Canvas and Customer/User Segments [online due to Covid-19] - 26.03.2020 11:00am - 11:30am Feedback meeting with team 5 on Value Proposition Canvas and Customer/User Segments [online due to Covid-19] - 26.03.2020 11:30am – 12:00pm Feedback meeting with team 2 on Value Proposition Canvas and Customer/User Segments [online due to Covid-19] - 09.04.2020 + 14.04 - Pitch Training & Feedback Session [online due to Covid-19] - 15.04.2020 2:00pm - 4pm Mid-way Pitch [online] - 2nd Peer-to-Peer Learning Meeting (15.5, 10AM-12PM) - Week 27.04. - 1.05. Impact Measurement workshop (30.4 10-11:30PM)

	- Preparation for Pitch: individual feedback for each Team (4+5 of June 9:00-12:00 AM) - 08.06.2020 2:00pm - 4:00pm Final Pitch - 08.06.2020 4:30-7:30 PM Closing Session - Offboarding & Feedback individually (October- December 2020through December) - Stammtisch over summertime: social gathering for informal catch-ups (leading to exchanging experiences and tips): 14.7 and 10.08. [was foreseen to take place also during the winter semester, however, a social gathering is not possible due to covid regulations]
RATIONALE FOR SEQUENCING AND PACING ACTIVITIES	*Explain how the course has been organized to allow the interconnection with the other two disciplines and why it has been structured like this* - Adapting a course that fits the needs of business students building green business solutions for our cities, a few important keystones in our training activities are as follows: - Modular & Adaptability: - Based on the needs of the WU students, different formats and settings are established and continuously updated with feedback on their progress. - Different setting of meetings: - Individual meetings with each start-up (2 WU students of a start-up meet with WU trainer(s)) - All WU student Workshops with WU trainers facilitating and coaching - Time-wise: Pre and After Barcelona: - Pre Barcelona: - No individual meetings with the start-ups (as no start-up/team existed yet) - All WU students' workshops about what it means to start a sustainability-driven start-up (very few students have had a sustainability focus in their business focus prior to BUILD) - ALL WU students' workshop on transdisciplinarity and understanding the other disciplines as well as explaining their own in an understandable way - After Barcelona: - Individual meetings with the start-ups: Milestone Meetings -General Feedback- Individual grant and program application assessment- individual Feedback on different kind of situations (communication-logo-PR content-team decisions and role assignment) - All WU students Workshops: Peer-to-Peer learning, Creativity Methods, Customer Segments, Value Proposition Canvas, Impact Measurement, etc.
ASSESSMENT	*How will you assess the success of this course? What outcomes will illustrate that students have met the goals and objectives of this course in relation to BUILDs?* - Assessment of the success will not be a typical assessment of goals and if outcomes meet the goals. - Reasoning behind this is that start-ups do not have a linear success rate, but there is a constant process of failure and success and ongoing learnings from it. Furthermore, there are many outside factors that can contribute to a failure of the start-up, this however would not mean that the content of the lesson or the students themselves have failed, this is the nature of entrepreneurship and teaching entrepreneurship. - Hence, the assessment will mostly be based on self-reflection of the students, reflective talks with trainers at the end of the programme to be able to assess each individual's road and how much they have learned and grown throughout the year. → realized as individual feedback sessions with each start-up after the official end of the one-year programme.
MATERIALS/RESOURCES	*List the bibliography and materials used in the course* - Meeting room at WU premises,

	- flipchart paper, markers, post-its, design thinking prototyping materials - reading material on the topic: ecosystem services, business and sustainability, - online communication tool: slack & doodle & google sheets, time.
SUPPORT AND FOLLOW-UP	*Means of communication with students, frequency, assignments, etc.* - Constant communication with students via slack and during weekly consultation hours - Assignments after training on customer segment and value proposition, as well as pitch deck assignment (for mid-way and final pitch) → personal feedback on assignments - Personal notes: Difficulty with very different curricula for the different disciplines, however with good communication there is always a way to adapt things.

3.2. One-Year Programme Common Methodology and Educational Resources

As mentioned in the previous section, BUILDs One-Year Programme was undertaken through the three different disciplines' courses that IAAC, UL, and WU offered.

BUILDs trainers, researchers, and business experts worked together towards the development of a common action plan that could unite students and trainers of the three courses. The key driver was the creation of 5 start-up groups, each one of them formed by 2 students of each discipline. But how were they supposed to work together throughout the academic year? The answer is in the following methodological roadmap and educational resources adopted:

FIRST SEMESTER

During the first semester, UL students and trainers worked towards the theoretical analysis of how living systems and NBSs can provide ecosystem services to fight against the current urban challenges.

Together with the different biology and agronomy classes that UL trainers offered to their students, three online BUILDs sessions were scheduled to provide students with feedback and traineeship from the perspectives of design and architecture and business. Furthermore, in order to introduce UL students to these disciplines in detail, two masterclasses were offered by IAAC and WU.

At the end of the semester, the 30 students convened in an online meeting with representatives from all BUILDs partners. The session aimed at introducing students to each other and to inspire the new incoming students (those from IAAC and WU) with the main findings that their UL peers produced during the semester.

During the session they presented the concepts of ecosystem services and ecological functions, shared an exhaustive analysis of several NBS case studies, and suggested improvements and alternatives. This conversation opened the door to the next activity of the 5-Days Intensive Workshop.

Milestones:

- 3 online feedback sessions from design and business perspective (September, October, November 2019)
- 2 masterclasses:
  - 1) on design: by Chiara Farinea, IAAC; online, 29 November 2019;
  - 2) on creative and innovative thinking from a business perspective: by Hannah Frost, WU; in person in Nancy, 27 and 28 November 2019;
- 1 all-students pass-on-the-baton session (December 2019)

Educational Resources:

- In-class lessons
- Online feedback sessions
- Bibliography and materials
- Zoom meetings
- Online BUILDs resources:
  - Recommended readings
  - Case studies
  - Examples of European eco-businesses
  - Educational videos

MEETING POINT: 5-DAY INTENSIVE WORKSHOP

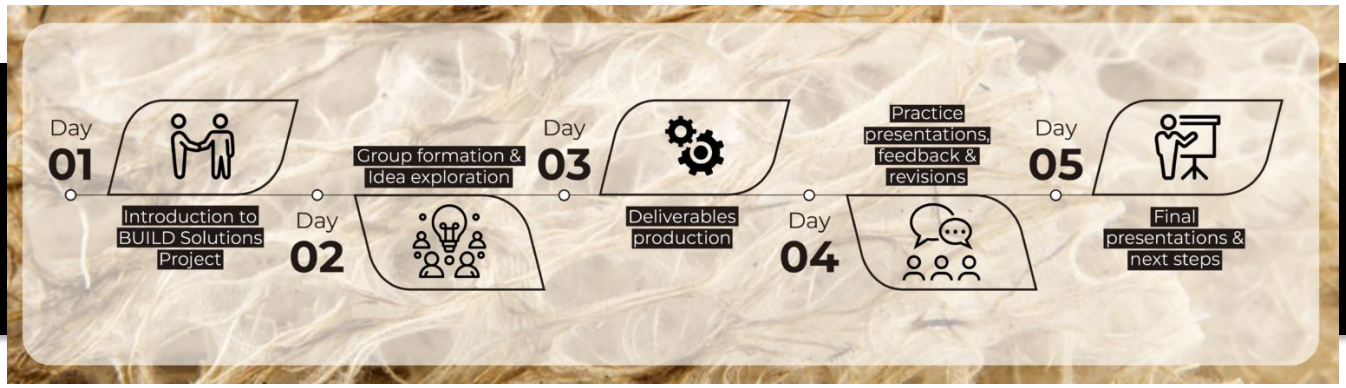
The 5-Day Intensive Workshop brought together, in person, the 30 students of the One-Year Programme (10 from UL; 10 from WU; and 10 from IAAC) and all project' partners, with the aim of creating a familiar environment where they got to know each other before they started working together during the second semester.

With the guidance of trainers and experienced professionals, students were immersed in an intensive week of activities aimed at creating start-ups and drafting entrepreneurial plans of different design intelligent living solutions for the cities of the future. The 5 interdisciplinary start-up groups were formed at the end of the Workshop and, as already mentioned, they were composed by 2 students from each academic institution. The topics chosen were green buildings, air purification, waste and circularity, air pollution, and building materials.

The main activities developed during the 5-Day Workshop were:

1. Introduction and get-to-know
2. Group formation

3. Ideas exploration
4. Deliverables production
5. Feedback sessions
6. Final pitch and way forward



With close advice from trainers and mentors, at the end of the week the start-ups formed were able to draft a work plan in order to collaborate and work remotely together throughout the second semester to investigate the biological systems of their selected NBS solution, create prototypes, and develop the start-up business plans.

Milestones:

- Get-to-know each other for a smooth remote cooperation
- Creation of 5 interdisciplinary start-ups
- Agreement on the semester assignments and deadlines
  - Midway Pitch (March 2020)
  - Online challenge (April 2020)
  - Final Pitch (June 2020)
  - Production of final prototypes (July 2020)

Educational Resources:

- Group formation techniques
- Lean start-up methodology resources
- Personality tests
- Pitch advising
- Peer sessions
- Experts feedback sessions
- Team Building activities
- Hubspots
- Online BUILDs resources:
  - Recommended readings
  - Case studies

- Examples of European eco-businesses
- Educational videos

SECOND SEMESTER

BUILDs second semester starts right after the 5-Day Intensive Workshop with each HEIs' students undertaking their own courses. In order to facilitate the integration of BUILDs One-Year Programme into the development of these courses and to allow a smooth remote communication with all discipline' trainers and within the start-ups groups, the following methodology of work was agreed:

1. **Courses**: each HEI will undertake their courses as established in their Syllabuses:
    a. IAAC > Digital Design For Living Systems Course, on a weekly basis;
    b. WU > Creating Green Business Solutions for the Cities of our Future;
    c. UL > internship programme.
2. **Start-up online meetings**: each start-up meets online at least three times a month. They stay in constant communication with each other using online platforms such as email, Slack, Whatsapp, Zoom, Skype, Asana, etc.
3. **Trainers office hours**: all discipline' trainers offer weekly office hours to all start-ups' members, on demand.
4. **Feedback questionnaires**: start-ups fill and deliver on the first Monday of every month a template questionnaire to report on their advances and challenges (see Annex 1).
5. **Internal trainers' meetings**: every first Wednesday of every month (two days after the start-ups submission of their feedback questionnaires), trainers and mentors meet online to analyse such student questionnaires from the perspective of the three disciplines. A common message and guidelines will be decided to deliver to each start-up.
6. **Feedback meetings**: during the following 10 days after the feedback questionnaire submission, a meeting will be scheduled in order to convey the commonly agreed message to the start-up students, so they can use the advice to advance in their product idea development.
7. **Skills sharing events**: peer-to-peer WU sessions dedicated to co-learning and mutual support offered throughout the semester.
8. **Specific training by GTC and CF partners**: along the semester, GTC and CF partners provide students with specific learning tools, tips, pitch sessions, and overall training for an efficient green business development.
9. **Mid-way Pitch:** in the middle of the semester every start-up pitches its product idea to give a brief overview of the progress they made so far. Teachers, trainers, and mentors from all disciplines give feedback.
10. **Online Challenge and Final Pitch**: with the support of GTC and CF, at the end of the semester all start-ups submit all the requested materials for the online challenge that will consist of a Final Pitch in front of an external panel of business and renowned industry experts that will select the best start-up

idea. This winning start-up will be offered the opportunity to participate in the Accelerator Programme of Bloxhub in Copenhagen.

The BUILDs One-Year Programme concluded with the Final Pitch and the selection of the best start-up group at the end of the second semester. This start-up is given the opportunity to go to the Bloxhub Incubator in Copenhagen to participate in the Accelerator Programme that will help the 6 students' start-up to transform their idea into a real business, in just a month. Along this way, higher education teaching staff and company staff will learn and experiment with the students how to implement business mindset in transdisciplinary projects in the fields of biology, architecture, and business.

Milestones:

- Start-ups development
- Smooth remote communication and work using online platforms
- Regular consultation sessions of the three different disciplines
- Selection of the best start-up that will participate in the Accelerator Programme
- Start-up participation at external events and contests

Educational Resources:

- In-class lessons
- Consultation hours
- Pitch sessions
- External expert advice on business development
- Online working platforms: email, Slack, WhatsApp, Zoom, Skype, Asana, etc.
- Online BUILDs resources:
  - Recommended readings
  - Case studies
  - Examples of European eco-businesses
  - Educational videos
- Progress reportings
- Self-evaluations
- Shareholder's Agreement
- 3 minute pitch format and structure
- Lean Sustainable Business Model Canvas
- Glossary for interdisciplinary communication

4 - OUTPUTS

4.1. 5-Days Intensive Workshop

The 5-Day Intensive Workshop took place during 13-17 January 2020, at IAAC premises, in Barcelona, Spain.

As mentioned above, the main objective of this Workshop was to foster a family atmosphere in which all students could get to know each other and learn about their interests in order to form solid start-up groups and brainstorm about the NBS idea they wanted to develop throughout the semester.

Find in this link the Workshop agenda.

The activities during the first two days were about team building. Games and interactive tasks such as the egg-drop challenge, marshmallow challenge, personality bingo, etc., were adapted to the session and clearly showed an outstanding potential for promoting a friendly environment to strengthen cooperation. In order to introduce multidisciplinarity, 3 mixed groups of students had a guided expert tour session across the city to explore 3 hubspots: 1) SuperBlock of Poblenou, to introduce innovative architecture solutions; 2) Ciutadella Park, to explore biodiversity in our cities; 3) WeWork[1], to learn about green business solutions.

Along the week, several inspiring lectures (on team building, green business management, entrepreneurship and sustainable development) were introduced to motivate students to think out of the box and to integrate new disciplines ideas into their way of solving problems.

Once the 5 groups were formed (composed by 2 students from each discipline), they were challenged with a series of tasks and activities aimed at helping them to develop their newborn ideas: in each start-up, biology students had to make a risk assessment of the viability of the living solution selected; design students had to elaborate and fabricate the pretotype; and business students were in charge of developing a business plan following the *SWOT* and *playing to win* strategies. Furthermore, each start-up had to record a video-diary about their advancements and challenges that they faced every day. Constant support was given by trainers and mentors.

At the end of the week, the five start-ups presented their product idea proposal in the form of an investor pitch deck: in less than three minutes, they had to sell their idea with a clear and simple message, showing the sketches of the

[1] The business session couldn't be realized at WeWork and happened as an indoor workshop at the IAAC premises where students were introduced to the concept of business sustainability 0.0, 1.0, 2.0 and 3.0 by Dyllick and Muff, followed by a discussion on the topic and interactive games on pitching ideas and inspiring others.

sellable pretotype, the market entry plan, and plans for future. This was followed by an in-depth analysis and feedback from trainers.

The final session conducted by GreenTech Challenge consisted of a series of organizational advice for an effective remote start-up group management (as each start-up was going to work remotely from three different locations: Barcelona, Nancy, and Vienna). These were the main tips:

Communication:

1. Establish regular start-up team meetings. Every meeting should finish with a list of next steps, and with the next interaction date fixed.
2. Suggested channels of communication > email, Slack, Rocket.chat, etc. Set up the start-up website

Project management:

3. Develop a list of prospective clients.
4. Set a list of measurable milestones.
5. Establish an internal voting system.
6. Use project management tools such as Asana, Monday.com, Trello, etc.
7. CRM: hubspot, pipedrive
8. Create an online shared folders system

Team spirit:

9. Empathy: eat and sleep well! Be mindful of others' schedules and deadlines and understand non-immediate responses.
10. Stay happy, stay hungry.
11. Show gratefulness and appreciation.
12. Promote frequent touch base.

Together with this motivational advise and as a mode of conclusion, a clear roadmap (mentioned above) was shared with the students so that they can start planning their semester:

1. Start-up online meetings, weekly (plan, now that all students are together, the next 3 meetings and fix them in everyone' calendars).
2. Trainers office hours on demand.
3. Feedback questionnaires.
4. Feedback meetings.
5. Skills sharing events.
6. Specific training by GTC and CF partners on learning tools, tips, pitch sessions, and overall training for an efficient green business development.
7. Mid-way Pitch.
8. Online Challenge and Final Pitch.

4.2. Start-ups

The multidisciplinary student' groups worked very hard during the second semester and created the following 5 start-ups. Teachers and trainers had the role of mentors in order to reinforce students' ownership of their work, guiding them and challenging them to think outside the box, rather than providing answers. These are the results:

aero SQAIR	**Product idea:** aeroSQAIR addresses the problem of poor indoor air quality with modular, fully automated moss panels. The product solution takes advantage of the natural ability of mosses to clean the air by absorbing particulate matter and heavy metals. It combines the advantages of technical air filters with the benefits of wall greening. In this way, a significant improvement of the indoor climate can be achieved. aeroSQAIR innovatively combines nature and technology in its product solution. An integrated sensor system regulates lighting, irrigation and ventilation, creating a stable microclimate and guaranteeing optimal living conditions for the moss. **Members:** IAAC: Harsh Vora and Bharath Lakshmesh UL: Chloé Sachot and Nastia Martinet WU: Patrick N.Frank and Esther Hummel. **Online platforms:** https://aerosqair.com/ https://www.facebook.com/pg/aeroSQAIR/about/?ref=page_internal https://www.linkedin.com/company/aerosqair/ https://www.instagram.com/aeroSQAIR/




Renderings (above) and prototype pictures (below)

C:aire

Product idea: C:aire uses natured-based air filtration to improve the life of all those who would like to breathe freely inside their four walls.

Members:
IAAC: Mario Sequeira Valadez and Xhilda Kulla
UL: Ninon Dell'Acqua and Mélanie Bascon
WU: Sophia Keyner and Jasmo Nickol

Online platforms:
https://www.caire-solutions.com/
https://www.linkedin.com/company/wecaire/
https://www.instagram.com/we.caire/



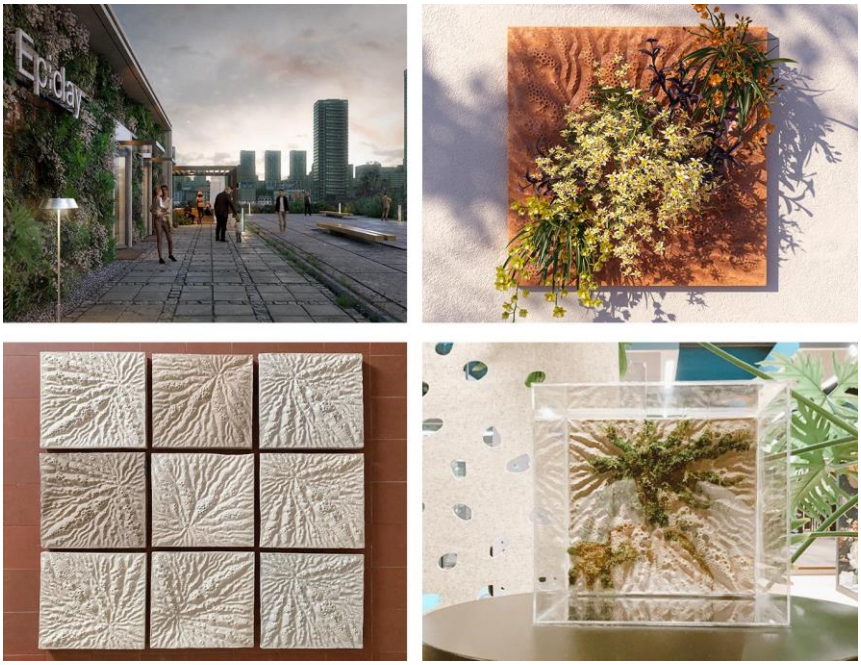
Prototype pictures

epiclay

Product idea: Epiclay's main objective is to make urban areas more livable and healthy for its inhabitants by creating a modular green wall system, which can be easily implemented on any facade or indoor walls with as little as maintenance as possible.

Members:
IAAC: Mauricio Casian and Sumit Nemmaniwar
UL: Mary-Eve Henrotte and Alice Ubelmann
WU: Christoph Hornik and Melanie Kálmán.

Online platforms:
https://epiclay.eu/
https://www.linkedin.com/company/epiclay/
https://www.instagram.com/epiclay.eu/?hl=en



Renderings (above) and prototype pictures (below)

Product idea: PlayJungle is a nature-based solution for play spaces in urban environments. Basically, it's a playground for kids made out of Eco materials like wood, cork and ropes instead of plastics, where they can spend their free time and learn different aspects of nature.
The playground consists of some play structures, spaces with aromatic herbs (basil, mint, rosemary, etc.) that produce nice smell and make air cleaner, a natural construction that creates shade for hot days in summer and an educational zone where kids can learn about aspects of nature.

Members:
IAAC: Saurabh Singla and Vinay Prabhakar
UL: Juliette Gravis and Alexandra Martin
WU: Anastasia Meshkova and Veronika Nesterenko

Online platforms:
https://www.linkedin.com/company/playjungle/

Renderings

Product idea: Since plastic waste production increasingly proliferates almost all known and unknown regions of the planet, many methods and efforts to degrade, eliminate, and convert these compounds are being investigated. Worm Generation investigates the use of biological agents, mealworms and superworms, to directly convert plastic into organic matter using their natural digestive process.

Members:
IAAC: Eve Nnaji and Madhavi Ojha
UL: Vincent Heurtel and Myriam Planque
WU: Malte Paschen and Karolina Sliwa

Online platforms:
https://wormgeneration.com/
https://www.linkedin.com/company/worm-generation/

Prototype pictures

4.3. Online challenge and Final Pitch

At the end of the second semester, BUILDs organized an Online Challenge where all the 5-start-ups had to present their start-up product idea by uploading the following set of materials that will be reviewed by trainers and by a selected jury of renowned experts:

- start-up description
- pretotype

- business plan: one of Lean Model (Sustainable) Canvas or (Sustainable) Business Canvas
- go-to-market plan for first 5-20 customers
- pass/fail hypotheses regarding product-market fit
- architectural preliminary research as to where their solutions could be used in the Urban Space
- 3D renderings of their solutions
- customer and end-user interviews and notes
- test of biological parameters for their solutions' feasibility
- slidedeck with 3 minute pitch
- other materials they wanted feedback on

The Final Pitch took place on 8 June 2020. The students presented their work, in a pitch of just 3 minutes, to an international jury composed by business experts, lawyers, and investors:

- Morten Hoegh (ACCOUNTING AND VALUATION: KPMG)
- Jytte Prieem Balle (INTELLECTUAL PROPERTY RIGHTS: Awa)
- Matias Wilhelm Warnøe Nilsen (LAW: Moalem Weitemeyer Bendtsen Advokatpartnerselskab)
- Jesper Andersen Carvalho (INVESTOR: Equity Ventures SGPS and Green Equity SGPS)
- Martin P Klee (INVESTOR: http://seed-funding.dk/)
- James Digby (INVESTOR: 3 BN Ventures)
- João Ferrão dos Santos (INVESTOR: Maze Impact)

All start-ups did an amazing job! These were their presentations:

aeroSQAIR

C:aire

Epiclay

PlayJungle

Worm Generation

After a tight deliberation, the external jury selected Epiclay as the most promising start-up! Their decision was based on which startup they would a) like to invest in; b) which startup they predicted would succeed and make a positive environmental impact.

4.4. Accelerator Programme

After the One-Year Programme concluded in June 2020, BUILDs organized an Accelerator Programme, led by City Facilitators and GreenTech Challenge, to help Epiclay launch its business idea to the market[2].

Copenhagen is a leading European hub for innovative climate and city solutions with a strong ecosystem of business, universities, venture capital, experts, and dealmakers. The BUILDs customised Accelerator Programme was a unique path to fast track Epiclay into such an ecosystem with the aim of scaling their innovative business idea that will help to create more sustainable cities.

The Accelerator Programme took place in four intensive weeks from August 31st to September 25th, 2020. The programme was located at the interdisciplinary innovation hub and co-working place BLOXHUB in Copenhagen, which is the heart of the smart city ecosystem in Copenhagen. With the assistance of City Facilitators, GreenTech Challenge, and BUILDs business experts, Epiclay received tailored and exclusive training, mentoring, and networking; pitches advice; had meetings with municipalities, architect studios, investors; among other activities, that helped them launch to the market their amazing green wall system.

The frame of the BUILD Solutions Accelerator was designed to be able to fit the different backgrounds of the students as well as the different foci of the start-ups. All 4 weeks of the programme had a similar format. Every week they had a so-called “knowledge injection” where they met consultants for input on general business processes (Accounting, Law, IPR, PR, etc.). They had meetings with potential customers and collaborators, time for product development and refinement, as well as team time where the student start-up would have the time to digest input, refine pitches and presentations and set goals for the time in Copenhagen.

Companies need to sell, or they die. For this reason, and to ensure the right product was being developed, considerable efforts were invested into training Epiclay in sales. Cold calling sessions were used to reach stakeholders, and City Facilitators provided experienced business developers to attend every meeting Epiclay had during the month in Copenhagen. Before calling (and meeting), Epiclay also learned how to identify the potential clients and do desk research on the companies and persons they were about to contact. The practical training also included personal feedback after the meetings/calls. The goal was for Epiclay to land pilot project partners, customer interest, and potential investors and collaboration partners.

Epiclay also received a lot of pitch training. A pitch is a short presentation of a company and its product. For instance, the team got the opportunity to participate

[2] Despite only one start-up had the chance to go to the Accelerator Programme, the other 4 start-up groups continued receiving mentoring support from BUILDs trainers.

in an event where they pitched in front of 30 investors – potentially raising capital for the company. Also, Epiclay pitched to a leading Danish architectural company, 3XN, as well as their independent innovation department, GXN. The team also attended networking events where they had to pitch their ideas for various people.

Finally, Epiclay met with a lot of potential customers and collaboration partners such as several municipalities, urban planners, architectural companies, as well as Rockwool, a large Danish multinational corporation that is a leading player globally within insulation solutions. All meetings were with senior officials. The purpose was both to attract customer interest and generate sales, but also to inform product development.

The Accelerator Programme concluded with a demo day, on 24th of September 2020, where the participating students presented their solutions in front of an exclusive audience including the partners involved along the process.

Check out the detailed schedule here. Please see Deliverable 5.3 for a detailed description of the activity and main outcomes.

4.5. One-Year Programme Pictures

5 - CONCLUSIONS AND LESSONS LEARNED

The BUILDs One-Year Programme has proved to be a successful interdisciplinary higher educational programme able to incorporate an innovative business mindset in its core. The main lessons learned are the following:

Knowledge exchange and remote multidisciplinary collaboration

The One-Year Programme is organized in a collaborative way that allows 30 students to work remotely with their other discipline colleagues, thanks to the formation of 5 start-up groups composed by 2 students of each of the three disciplines. This way, by using the latest online platforms of communication (such as Google Drive, Slack, Skype, and similar) and a set of regular programmed activities (such as consultation hours, weekly follow-up sessions, monthly feedback questionnaires submissions, monthly feedback trainers-to-students meetings, monthly skills sharing events, pitch mock-up sessions, etc.), BUILDs has set a comprehensive platform that allows continuous knowledge sharing and multidisciplinary co-creation.

Multidisciplinary education

From the students' perspective, being part of the One-Year Academic Programme of BUILDs entails not only working with other students from other European Universities but also from other Schools and backgrounds. By working each start-up towards the same goal, this team diversity brings consciousness about the different lenses and perspectives of a same challenge and therefore the sensitivity to address it holistically. Moreover, it offers students the opportunity to work closely with trainers from other Universities and from other countries as well as being coached by experienced entrepreneurs of the green economic sector, therefore acquiring at the same time a strong theoretical foundation and entrepreneurial advice.

Innovative Knowledge Sharing Methodologies

BUILDs has been able to develop a pioneering educational experience across disciplines, sectors, and countries, by bridging together cutting-edge research techniques with an entrepreneurial approach at its center. By introducing new methodologies such as project-based learning and learning-by-doing techniques, the One-Year Programme has been able to facilitate an innovative knowledge exchange across disciplines.

As described in detail in the previous chapter, the One-Year Programme developed a set of educational resources with the aim of facilitating and enhancing educational transdisciplinarity.

With the objective of exploring innovative living solutions for greener and more resilient cities, BUILDs was able to put together students and trainers from three different courses and disciplines: UL and ECONICK trainers brought the experience from high-tech biology and agronomy research applied to the urban realm; IAAC, one of the main Fab-labs in Europe, in collaboration with Plant-e and Ersilia, offered creative design and tech know-how on how to build nature and metabolic artefacts and systems; WU, CF, and GTC, brought together their expertise and experiences in boosting eco-businesses and start-ups.

During two semesters, biology students (UL), design students (IAAC), and business students (WU) and their trainers and mentors, worked together following this roadmap:

1. Each HEI undertakes their own courses as established in their Syllabuses
2. Start-ups weekly online meetings.
3. Trainers office hours on demand.
4. Feedback questionnaires sent to trainers.
5. Feedback meetings to students.
6. Skills sharing events.
7. Specific training on learning tools, tips, pitch sessions, and overall advice for an efficient green business development.
8. Mid-way Pitch.
9. Online Challenge and Final Pitch.

Alongside this roadmap, a series of educational resources and learning tools were deployed:

Before start-ups groups formation (first semester)

- In-class lessons and interactive workshops
- Online Consultation hours with BUILDs trainers
- Online working platforms: email, Slack, WhatsApp, Zoom, Skype, Asana, etc.
- Online BUILDs resources:
  - Recommended readings
  - Case studies
  - Examples of European eco-businesses
  - Educational videos
- Experts feedback sessions
- Bibliography and materials

After start-ups groups formation (second semester)

- In-class lessons and interactive workshops
- Online Consultation hours with BUILDs trainers
- Online working platforms: email, Slack, WhatsApp, Zoom, Skype, Asana, etc.

- Coaching sessions and external expert advice on business development
- Online BUILDs resources:
  - Recommended readings
  - Case studies
  - Examples of European eco-businesses
  - Educational videos
- Group formation techniques
- Lean start-up methodology resources
- Personality tests
- Pitch advising
- Peer sessions
- Experts feedback sessions
- Bibliography and materials

Entrepreneurship development

One of the main key objectives of BUILDs was to stimulate entrepreneurial skills in higher education. During the One-Year Programme, students and trainers were provided with tools, skills, and motivational resources in order to think out-of-the box, work transdisciplinarily, from a result-driven approach.

First, trainers and researchers worked together with business specialists and coaching experts in order to develop the content, structure, and tools of the One-Year Academic Programme in order to bring together the three disciplines, ensuring that they are fully interconnected, and that it incorporates a business mindset. Secondly, the activities set in the One-Year Programme were structured using the learning-by-doing methodology where students developed their projects by testing biology concepts, fabricating prototypes, and simulating performances on the market. Along the way they received mentorship from the three disciplines' trainers and by business specialists.

European research and market consolidation

The multi-partnership present in the One-Year Programme has allowed a solid exchange flow of the latest innovative scientific and technological knowledge, the best academic excellence, and the most promising green economy business practices. By merging three disciplines in one educational setting, it has allowed students to build a powerful holistic system for finding the most sustainable and resilient living design solutions.

From a trainers' perspective, BUILDs has offered an outstanding opportunity for them to go beyond their University silo structures, bureaucracies, and research trajectories in the search of new platforms of concepts, methods, and knowledge exchange. They have been able to get familiar with other disciplines' content and, more importantly, with other learning methodologies. The result is this pioneer One-Year Programme, that can serve as a successful experience for other European HEIs and business partners to encourage them to work collaboratively. This outcome will,

moreover, help strengthen academic mobility and knowledge exchange across institutions and sectors, consolidating the European research excellence and solidarity values.

Finally, the One-Year Programme has proved that an efficient collaboration between European HEIs and business specialists is possible: it has established a solid cooperative framework between teachers and researchers (IAAC, UL, WU) with SME practitioners (CF, GTC, Plant-e, ECONICK, Ersilia), experts in the green sector. Their own connections with both the public administration and private sector stakeholders, have ensured a wide and effective dissemination of the ongoing project results to a wider audience across Europe and the world and serve as a model of best practice for future replication.

Overall, BUILDs One-Year Programme have shown to strongly contribute to strengthen the European know-how by bringing into the academic discussion the latest and most innovative research and market products in the field of NBS to address the most pressing urban and global challenges. By focusing on capacity building and knowledge exchange at the levels of students, trainers, and entrepreneurs, the project helps position Europe to consolidate its leadership towards sustainable and green development.

5.1. Feedback experience from BUILDs start-ups

These are the testimonials from the start-ups:

aero SQAIR	*"When the BUILDs program started in January 2020, little did we know what we had signed up for. What started as six students brainstorming ideas for potential products to help make the world a better place has now led us to come up with aeroSQAIR, a team of over ten members. The combination of Architecture - Biology - Business, has given us an edge, we have had our difficulties and sleepless nights like most startups, but what keeps us going is the motivation each one of us has and how our diversity in backgrounds helped us to complement each other's strengths.* *The exposure to numerous different experts in relevant fields and the countless hours spent in training, mentoring and guiding sessions have helped us grow, evolve and understand the needs of what it takes to get our company out there. We*

	are grateful to have been exposed to such a program and we're lucky to have come across this once in a lifetime opportunity".
C:aire	*"It was a great experience working with such a diverse team regarding personal as well as professional backgrounds. Regardless of not knowing each other beforehand we grew quickly as a team and were able to perform high even when working remotely. Passion and great mutual learnings enabled this fruitful start-up environment. Working in a start-up can be stressful due to high levels of self-responsibility but also fulfilling when achieving milestones creating success stories".*
epiclay	*"Working on the startup has been a great experience so far. It was very challenging to work from different locations virtually during the lockdown. But eventually we managed to put things together. The time we spent working together in Copenhagen helped us tremendously to further envision our startup. Working under the same roof for around 4 weeks helped us understand each other and how we all see Epiclay in the future individually. Meeting new people in Copenhagen and receiving great feedback have given us fresh perspectives. We are excited and positive to see Epiclay develop further".*
PLAY JUNGLE PLAY. EDUCATE. PLANT	*"This was a great experience to get a feeling of working on something from scratch and adapting, modifying it. It was interesting to work with people from different disciplines and countries. We felt an enormous support from the BUILDs team: the doors were open for us whenever we had a doubt or a question. Everyone involved in the project was willing to share their experience with us or just give advice".*

WORM GENERATION	*"Attending BUILDS was a rather intriguing experience for all of us. Having people from different backgrounds and them being from different countries brought lots of content on the table. In the process of making our own startup we learnt a lot about how the industry of startups are evolving and how people are looking forward to green startups. The guides helped us a lot in every perspective needed. In total this will be one of the greatest opportunities we got to explore the things we are learning in practice".*

5.2. Start-ups progress beyond BUILDs

Despite the conclusion of the One-Year Programme, it is of paramount importance highlighting that almost all the BUILDs born start-ups have decided to move forward with their NBS product idea and are progressing with solid business, communication, and dissemination plans by their own.

These are their webpages and social media accounts:

aero SQAIR	https://aerosqair.com/ https://www.facebook.com/pg/aeroSQAIR https://www.linkedin.com/company/aerosqair/ https://www.instagram.com/aeroSQAIR/
C:aire	https://www.caire-solutions.com/ https://www.linkedin.com/company/wecaire/ https://www.instagram.com/we.caire/
epiclay	https://epiclay.eu/ https://www.linkedin.com/company/epiclay/ https://www.instagram.com/epiclay.eu/?hl=en

PLAY JUNGLE PLAY. EDUCATE. PLANT	https://www.linkedin.com/company/playjungle/
WORM GENERATION	https://wormgeneration.com/ https://www.linkedin.com/company/worm-generation/

On the other hand, during these last months (June, to end of 2020), some of the start-ups have been presenting their pioneering living solutions ideas to international events, contests and fairs, and we are very proud to say that they are being very successful! Check out some of the main events and prizes:

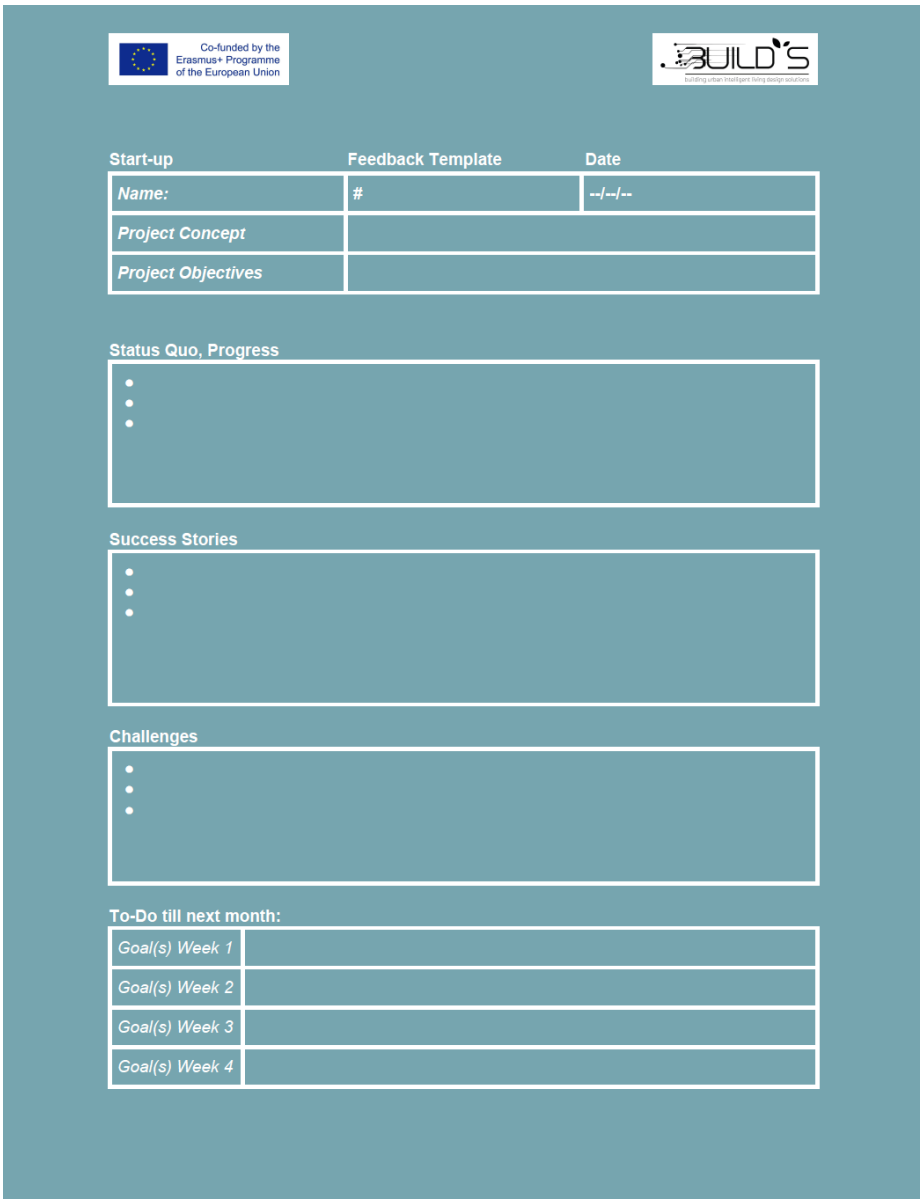
- Entrepreneurship Avenue Conference: Europe's largest student-based Entrepreneurship Event Series. 4 out of the 5 BUILDs startups that participated in this event were among the 10 shortlisted ones, whereas:
  - **Epiclay** won the first place
  - **aeroSQAIR** won the second place
- Wien Energie Student Innovation Challenge: Program for smart city solutions to shape the city of the future (prize award of 30.000€ develop a concept for a pilot project with the Wiener Linien -Local Subway Operator).
  - **aeroSQAIR** was one of the five startups that were chosen to participate in the programme. It led to a concept for a pilot project with the Local Subway Operator in Vienna.
- Incubation program "Re:Wien: initiated by Ökobusiness Wien & Impact Hub Vienna, RE:WIEN supports startups that are developing new solutions to create a positive impact on the city of Vienna.
  - **aeroSQAIR** was one of 10 startups accepted into the 6-month incubation program
- Science Park Graz: Start-up Idea Competition for disruptive innovations
  - **aeroSQAIR** won the first prize in Energy & Environment 2020 (2000.- prize money)
- Climate Launchpad 2020 program: one of the world's largest green business ideas competitions.
  - **aeroSQAIR** was among the three finalists! It was accepted into the incubation program and therefore is representing Austria in the European Regional Finals.
- Barcelona Park(ing) Day 2020

    - **Epiclay, Worm Generation** and **aeroSQAIR** showcased their innovative Nature-Based Solutions in Barcelona showing citizens that greener and resilient cities are possible!
- ReBUILD Expo Barcelona
    - **Epiclay, aeroSQAIR** and **C:aire**, exhibited their designed and digitally manufactured NBS products
- Barcelona Design Week
    - **Epiclay** and **C:aire** showcased their beautiful prototypes during the Barcelona Design Week event from 17-26 November.
- 2020 University Startup World Cup
    - **Epiclay** was selected as the best early-stage university startup in the world!
- Circle 17- Austrian Startups: Circle 17 organised by Austria Startups is a platform for sustainable business solutions to connect and meet key stakeholders.
    - **aeroSQAIR** & **Epiclay** were allowed to pitch their ideas.
- Global Graduate Show: Over 100 online and physical events covering architecture, product design, interiors, multimedia, and graphic design that takes place during the Dubai Design Week. The six-day program includes the trade fair Downtown Design, Global Grad Show (GGS) which exhibits university projects from around the world alongside talks and workshops. Two BUILDs startups are exhibiting their products:
    - **Epiclay**
    - **Worm Generation**
- aws First Incubation program 2021: one of the most renowned incubation programmes for early-stage business ideas in Austria.
    - **aeroSQAIR** was accepted as one of the nine ventures in the 1-year programme for 2021.

All these experiences and results reinforce even more the successful development of BUILDs One-Year Programme and demonstrate its strong sustainability power and its potential for future replication.

6 - ANNEXES

ANNEX 1 - FEEDBACK QUESTIONNAIRES



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Start-up	Feedback Template	Date
Name:	#	--/--/--
Project Concept		
Project Objectives		

Status Quo, Progress

-
-
-

Success Stories

-
-
-

Challenges

-
-
-

To-Do till next month:

Goal(s) Week 1	
Goal(s) Week 2	
Goal(s) Week 3	
Goal(s) Week 4	

Goal(s) Week 5	

Input needed from architecture:

-
-

Input needed from business:

-
-

Input needed from biology:

-
-

Other input needed/ support for networking:

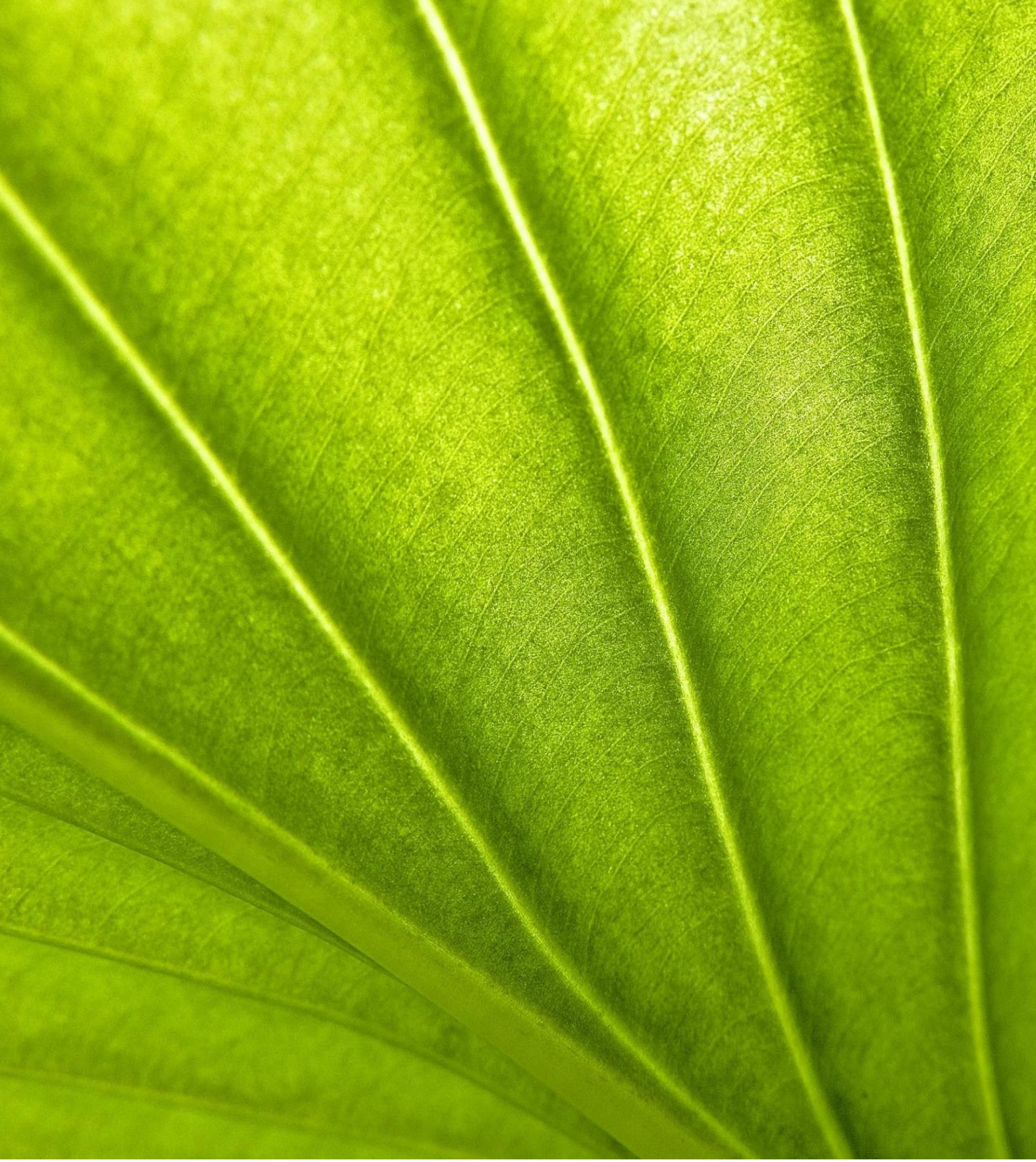
-
-

Feedback/insight to share:

-
-

Where do you see yourselves on the journey of becoming a Start-up? *(add an X on the line)*

Idea_____Start-up



Building Urban Intelligent Living Design Solutions, 2018-2021

BUILD'S

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WU

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Plant-e Spark of nature

CITY FACILITATORS for Urban Challenges

GREENTECH CHALLENGE