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# DESIGNING SUSTAINABILITY FOR ALL

Edited by Marcelo Ambrosio and Carlo Vezzoli

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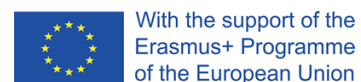
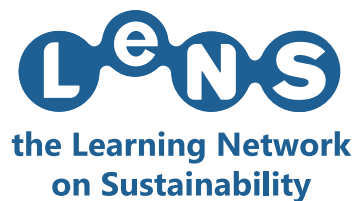
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Milano, Mexico City, Beijing, Bangalore, Curitiba, Cape Town,  
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# CONTENTS

## VOLUME 1 (*paper in this volume*)

FOREWORD	I
LENSIN PROJECT	II
THE LENS CONFERENCE	III
LENS MANIFESTO	IV
<b>1.KEY NOTE PAPERS</b>	
TOWARDS SUSTAINABLE DESIGN VALUES: EVOLUTIONARY CONCEPTS AND PRACTICES Xiaobo Lu	001
CIRCULAR ECONOMY, SYSTEMIC DESIGN AND SOCIAL DEVELOPMENT GUIDELINES FOR EMERGING ECONOMIES Leonardo Castillo	005
DESIGNING TO CREATE A SHARED UNDERSTANDING OF OUR COLLECTIVE CONCERNS Poonam Bir Kasturi	012
DESIGNERS FACING GLOBAL CHALLENGES Julio Frías Peña	015
SOUTH AFRICAN KEYNOTE SPEECH FOR LENS WORLD DISTRIBUTED CONFERENCE DESIGNING SUSTAINABILITY FOR ALL Angus Donald Campbell	019
THE CIRCULAR INDUSTRIAL ECONOMY IN A NUTSHELL Walter R. Stahel	024
<b>2. PRODUCT-SERVICE SYSTEM DESIGN FOR SUSTAINABILITY</b>	
SUSTAINABLE PRODUCT-SERVICE SYSTEM REQUIREMENTS IN FASHION RETAIL Alana Emily Dorigon, Maria Auxiliadora Cannarozzo Tinoco, Jonatas Ost Scherer, Arthur Marcon	1
1TRASTOCAR. INTERACTIVE ART-DESIGN TO MAKE VISIBLE ENVIRONMENTAL IMPACT Ana Carolina Robles Salvador, Rodrigo Rosales González	6
PRODUCT-SERVICE SYSTEMS DEVELOPMENT PROCESS: SYSTEMATIC LITERATURE REVIEW Barbara Tokarz, Bruno Tokarz, Délcio Pereira, Alexandre Borges Fagundes, Fernanda Hänsch Beuren	12
INTRODUCING SYSTEMIC SOLUTIONS FOR SUSTAINABILITY AT THE DESIGN COURSES IN UAM CUAJIMALPA. STUDY CASE: BOOK CLUB IN MEXICO CITY Leonel Sagahon, Brenda García	16
IMPLEMENTATION OF THE LENS PROJECT AT THE UNIVERSIDADE DO ESTADO DO PARÁ (UEPA) Camilla Dandara Pereira Leite, Alayna de Cássia Moreira Navegantes, Antonio Erlindo Braga Jr	20

INITIAL PROPOSALS FOR THE IMPLEMENTATION OF THE PRODUCT-SERVICE SYSTEM AT THE UNIVERSIDADE DO ESTADO DO PARÁ (UEPA) Camilla Dandara Pereira Leite, Jamille Santos dos Santos, Alayna de Cássia Moreira Navegantes, Vinícius Lopes Braga, Agatha Cristina Nogueira de Oliveira da Silva, Antonio Erlindo Braga Jr.	24
ASPECTS OF THE PRODUCT-SERVICE SYSTEM IN BRAZILIAN LITERATURE Camilla Dandara Pereira Leite, Antonio Erlindo Braga Jr.	27
“LIBRARY OF STUFF”: A CASE OF PRODUCT SHARING SYSTEM PRACTICE IN TURKEY Can Uckan Yuksel, Cigdem Kaya Pazarbas	31
RESEARCH ON SERVICE SYSTEM DESIGN BASED ON VISUALIZATION OF SUSTAINABLE PRODUCT CARBON FOOTPRINT Chenyang Sun, Jun Zhang	37
INNOVATIVE SCHEME RESEARCH OF SHIMEN CITRUS’ LIFE CYCLE BASED ON PRODUCT-SERVICE DESIGN THINKING Chuyao Zhou, Jixing Shi, Jeff Lai, Amber Tan, Yuan Luo, Yongshi Liu, Shaohua Han	42
PRODUCT-SERVICE SYSTEMS (PSS): THE USE OF PRINCIPLES IN THE CREATIVE PROCESS OF PSS Emanuela Lima Silveira, Aguinaldo dos Santos	47
STUDY ON THE SERVICE DESIGN OF URBAN YOUNG DRIFTERS COMMUNITY Fei Hu, Yimeng Jin , Xing Xu	53
URBAN AGRICULTURE STARTUP CASE STUDY FOR SERVICE DESIGN IN BRAZIL Gabriela Garcez Duarte, Elenice Lopes, Lucas Lobato da Costa, Mariana Schmitz Gonçalves, Aguinaldo dos Santos	59
DEVELOPMENT MECHANISM ON CHINA’S INDUSTRIAL DESIGN PARKS THEMED DESIGN ENTREPRENEURSHIP Hongbin Jiang, Qiao Zhang	65
RESEARCH OF SUSTAINABLE PRODUCT SERVICE SYSTEMS ON CHINESE MINORITY BRAND CONTEXT Hong Hu, Feiran Bai, Daitao Hao, Jie Zhou	69
CHILDREN’S TOY SHARING SYSTEM FROM THE PERSPECTIVE OF SUSTAINABLE COMMUNITY CONCEPT Zhong Huixian, He Yi, Chen Chaojie	75
PRODUCT SERVICE SYSTEM APPLIED TO AIR-ENERGY PRODUCT BUSINESS MODEL INNOVATION Jiahuan Qiu, Jun Zhang	81
DESIGN AND RESEARCH OF RESOURCE RECYCLING SERVICE SYSTEM IN TOURIST ATTRACTIONS: TAKING INTERNATIONAL CRUISES AS AN EXAMPLE Jingrui Shen, Jun Zhang	85
RESEARCH AND PRACTICE ON INTELLIGENT AGRICULTURAL MACHINERY PRODUCTS AND SUSTAINABLE BUSINESS MODEL DESIGN Jun Zhang, Caizhi Zhou	90
THE CORPORATE SOCIAL RESPONSIBILITY (CSR) AND STRATEGIC MANAGEMENT FOR THE MEXICAN SPECIALIZED PUBLISHING SMES Lupita Guillén Mandujano, Bertha Palomino Villavicencio, Gerardo Francisco Kloss Fernández del Castillo	96
SLOC MODEL BASED SERVICE DESIGN STRATEGIES AND PRACTICE ON ECOLOGICAL AGRICULTURE Lyu Ji, Miaosen Gong	101

APPLICATION OF THE CARD SORTING TECHNIQUE ASSOCIATED WITH THE STORYTELLING APPROACH IN A PSS FOR SUSTAINABILITY Manuela Gortz, Alison Alfred Klein, Evelyne Pretti Rodrigues, Félix Vieira Varejão Neto, Henrique Kozlowiski Buzatto, Aguinaldo dos Santos	106
EMOTIONAL DESIGN IN FUNCTIONAL ECONOMY AND PSS TOWARDS BEHAVIOR CHANGE Manuela Gortz, Décio Estevão do Nascimento	111
SOUTH-TO-SOUTH SOLUTIONS: AN EXCHANGE OF AUSTRALIAN AND LATIN AMERICAN DESIGN APPROACHES TO THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS Mariano Ramirez	117
DESIGN AND SUSTAINABILITY: SYSTEMATIC REVIEW OF LITERATURE IN BRAZILIAN PHD THESES Marina Arakaki, Conrado Renan da Silva, Tomas Queiroz Ferreira Barata, Olímpio José Pinheiro, Mariano Lopes de Andrade Neto	123
COMPARATIVE STUDY OF PRODUCT SERVICE SYSTEM BASED ON LIFE CYCLE ANALYSIS— INNOVATIVE LUNCH TAKEAWAY SERVICE SYSTEM DESIGN Nan Xia	129
SERVICE DESIGN FOR INNOVATION: THE STRATEGIC ROLE OF SERVICE DESIGN IN INNOVATION FOR MANUFACTURING COMPANIES Naotake Fukushima, Aguinaldo dos Santos	135
WICKED PROBLEMS AND DESIGN IN EMERGING ECONOMIES: REFLECTIONS ABOUT THE DESIGN OF SYSTEMIC APPROACHES FOCUSED ON FOOD AND TERRITORY Priscilla R. Lepre, Leonardo Castillo, Lia Krucken	141
HORTALIÇÁRIO: GARDEN FOR ANY SPACE Rita de Castro Engler, Thalita Vanessa Barbalho, Letícia Hilário Guimarães, Ana Carolina Lacerda	147
A DESIGN TOOLKIT TO INTEGRATE DISTRIBUTED MANUFACTURING INTO PRODUCT-SERVICE SYSTEMS DEVELOPMENT Aine Petruleityte, Fabrizio Ceschin, Eujin Pei, David Harrison	154
DESIGN FOR SUSTAINABILITY APPLIED TO WORKSPACES Susana Soto Bustamante, Elena Elgani, Francesco Scullica, Ricardo Marques Sastre, Marcia Elisa Echeveste, Maria Auxiliadora Cannarozzo Tinoco, Fabiane Tubino Garcia, Arthur Marcon	160
MECHANISM ANALYSIS AND APPLICATION STUDY OF SUSTAINABILITY EVALUATION TOOL FOR FURNITURE E-COMMERCE(ICSFE) Chuyao Zhou, Fang Liu, Suqin Tan, Tianwei Sun, Guixian Li, Shaohua Han	174
SUSTAINABLE PRODUCT SERVICE SYSTEMS: A NEW APPROACH TO SUSTAINABLE FASHION Yaone Rapitsenyane, Sophia Njeru, Richie Moalosi	180
PRODUCT-SERVICE SYSTEM DESIGN OF HOUSEHOLD MEDICAL WASTE MANAGEMENT FOR DIABETICS Yiting Zhang, Miaosen Gong, Dongjuan Xiao, Yuan Hu	185
BUSINESS MODEL DESIGN BASED ON THE CONCEPT OF SUSTAINABLE DEVELOPMENT—A SERVICE DESIGN OF THE PHYSICAL IDLE MALL AS AN EXAMPLE Luo Yuqing	190

### 3. DISTRIBUTED ECONOMIES DESIGN FOR SUSTAINABILITY

DISTRIBUTED MANUFACTURING APPLIED TO PRODUCT-SERVICE SYSTEMS: A SET OF NEAR-FUTURE SCENARIOS Aine Petrułaityte, Fabrizio Ceschin, Eujin Pei, David Harrison	196
METHODS AND TOOLS FOR COMMUNITY BASED RESEARCH PROJECTS: DISTRIBUTED DESIGN AND DISTRIBUTED INFORMATION FOR VOLUNTEER ORGANISATIONS IN SOUTH AFRICA Arnaud Nzawou, Ephias Ruhode	202
RECOVERY AND RECYCLING OF A BIOPOLYMER AS AN ALTERNATIVE OF SUSTAINABILITY FOR 3D PRINTING Camilla Dandara Pereira Leite, Leticia Faria Teixeira, Lauro Arthur Farias Paiva Cohen, Nubia Suely Silva Santos	207
EXPLORING SCENARIOS TO FACILITATE THE ACCESS TO 3D PRINTING TECHNOLOGY IN EGYPT THROUGH SUSTAINABLE PSS APPLIED TO DISTRIBUTED MANUFACTURING Doaa Mohamed	211
INVESTIGATION OF THE IMPACT OF SUSTAINABILITY ON 3D PRINTING TECHNOLOGIES Emilio Rossi, Massimo Di Nicolantonio, Paola Barcarolo, Jessica Lagatta, Alessio D’Onofrio Design of abandoned vegetable and fruit transportation system based on sustainable distributed economy Haiwei Yan, Ruolin Gao, Yuanbo Sun, Ke Jiang	218
DESIGN OF ABANDONED VEGETABLE AND FRUIT TRANSPORTATION SYSTEM BASED ON SUSTAINABLE DISTRIBUTED ECONOMY Haiwei Yan	224
DISTRIBUTED PRODUCTION AND SUSTAINABILITY STRATEGIES FOR FASHION Alba Cappellieri, Livia Tenuta, Susanna Testa,	228
SUSTAINABLE PRODUCT SERVICE SYSTEMS: CASES FROM OCEANIA Mariano Ramirez	233
VISUALISING STAKEHOLDER CONFIGURATIONS IN DESIGNING SUSTAINABLE PRODUCT-SERVICE SYSTEMS APPLIED TO DISTRIBUTED ECONOMIES Meng Gao, Carlo Vezzoli	239
LAMPS - ‘DESIGNERLY WAYS’ FOR SUSTAINABLE DISTRIBUTED ECONOMY Prarthana Majumdar, Sharmistha Banerjee, Jan-Carel Diehl, J.M.L.van Engelen	245
THE THIRD SECTOR AS A VECTOR TO FOSTER DISTRIBUTED DESIGN AND DISTRIBUTED ECONOMY INITIATIVES: A CASE STUDY Priscilla Ramalho Lepre, Leonardo Castillo	251
‘SHKEN’ NATURALLY YOURS – SOCIAL DIMENSIONS OF SUSTAINING RURAL DISTRIBUTED BAMBOO CRAFT ENTERPRISES OF NORTH EAST INDIA Punekar Ravi Mokashi, Avinash Shende, Mandar Rane	257
DISTRIBUTED SUSTAINABLE MARKET DESIGN BASED ON COMMUNITY Ruolin Gao, Haiwei Yan, Ke Jiang, Yuanbo Sun	261
PURA FRAMEWORK - A MODEL FOR DISTRIBUTED ECONOMY FOR INDIA Sharmistha Banerjee	265

CONTEXTUALIZING SUSTAINABLE PRODUCT-SERVICE SYSTEM DESIGN METHODS FOR DISTRIBUTED ECONOMIES OF INDIA Sharmistha Banerjee, Pankaj Upadhyay, Ravi Mokashi Punekar	270
DISTRIBUTED ELECTRIC VEHICLE CHARGING SERVICE SYSTEM DESIGN BASED ON BLOCKCHAIN TECHNOLOGY Wandong Cheng, Jun Zhang	276
MODEL FOR THE DEVELOPMENT OF OPEN SOURCE PRODUCTS MOD+RE+CO+DE Willmar Ricardo Rugeles Joya, Sandra Gomez Puertas, Nataly Guataquira Sarmiento	280
RESEARCH AND TEACHING PRACTICE OF PRODUCT SERVICE SYSTEM APPLIED TO DISTRIBUTED ECONOMY Yao Wang, Jun Zhang	285

## VOLUME 2

### 4. SYSTEM AND CIRCULAR DESIGN FOR SUSTAINABILITY

SYSTEM DESIGN FOR TERRITORIAL CYCLE TOURISM Alessio D'Onofrio	291
DESIGN TOOLKIT FOR SUSTAINABLE IDEATION Ameya Dabholkar, Shivangi Pande, Puneet Tandon	296
THE SUSTAINABILITY OF PACKAGING FOR E-COMMERCE: FROM SYSTEM TO PRODUCT. Amina Pereno, Silvia Barbero	301
SUSTAINABLE INTERACTION FOR MOBILITY SYSTEM Andrea Arcoraci, Andrea Di Salvo, Paolo Marco Tamborrini	308
DESIGN AND AGRIFOOD FOR NEW SUSTAINABLE LOCAL DEVELOPMENT C. Anna Catania , Aurora Modica	313
ZERO KILOMETRE PLANTS PRODUCTION. AN INTEGRATED DESIGN APPLICATION Attilio Nebuloni, Giorgio Buratti, Matteo Meraviglia	319
DESIGN FOR CIRCULAR ECONOMY - A RE-THINKING PROGRESS IN THE WAY WE MAKE, BUY AND USE THINGS Barbara Wong	325
DESIGNING SUSTAINABLE AND HEALTHY FOOD SYSTEMS THROUGH CATERING: THE ROLE OF DESIGNERS Berill Takacs	333
SYSTEMIC DESIGN DELIVERING POLICY FOR FLOURISHING CIRCULAR REGIONS Carolina Giraldo Nohra	339
SUSTAINABLE CYCLE DESIGN AND EXPLORATION BASED ON TRADITIONAL GARBAGE COLLECTION MODEL Cheng Lin He	345
WHAT REALLY MATTERS? SYSTEMIC DESIGN, MOTIVATIONS AND VALUES OF THE CIRCULAR ECONOMY COMPANIES IN ITALY Chiara Battistoni, Silvia Barbero	351



IS DESIGN PLAYING A ROLE IN THE REALISATION OF CIRCULAR ECONOMY PROJECTS IN EUROPE? A CASE STUDY ANALYSIS.	356
“THE SEVEN TREES SIGNIFICANCE”. THE BENEDICTINE MONKS’ AGROSILVOPASTORAL PRODUCTIVE SYSTEM Prof. arch. Claudio Gambardella, Dott. Raoul Romano	362
ECOLOGICAL DESIGN THINKING FOR THE 21 <sup>ST</sup> CENTURY David Sánchez Ruano, PhD	366
DESIGN FOR SUSTAINABILITY TRANSITIONS AND SUFFICIENT CONSUMPTION SCENARIOS:A SYSTEMATIC REVIEW Iana Uliana Perez, Mônica Moura, Suzana Barreto Martins, Jacob Mathew, Faiqa Halim	371
DESIGN FOR A SUSTAINABLE INNOVATION OF THE ITALIAN COMPANIES: THE ECODESIGNLAB EXPERIENCE Jacopo Mascitti, Daniele Galloppo	384
DESIGN AND TRANSITION MANAGEMENT: VALUE OF SYNERGY FOR SUSTAINABILITY Jotte de Koning	390
DESIGN AND NATURE: NEW WAYS OF KNOWING FOR SUSTAINABILITY Kate Fletcher, Louise St Pierre, Mathilda Tham	396
CO-DESIGNING A COMMUNITY CENTRE IN USING MULTI-MODAL INTERVENTIONS Kim Berman (Visual Art), Boitumelo Kembo-Tolo (Multi-Media)	401
CRAFTING SUSTAINABILITY THROUGH SMALL, LOCAL, OPEN AND CONNECTED ENTERPRISES ON THE CANADIAN PRAIRIES: THE CASE OF MANITOBAN CRAFT BREWERIES Iain Davidson-Hunt, Kurtis Ulrich, Hannah Muhajarine	406
CASULO VERDE PROJECT: A SYSTEMIC APPROACH TO DESIGN MANAGEMENT. Larissa Fontoura Berlatto, Isabel Cristina Moreira Victoria, Luiz Fernando Gonçalves de Figueiredo,	412
MAPPING & CLASSIFYING BUSINESS MODELS TO REPLACE SINGLE-USE PACKAGING IN THE FOOD & BEVERAGE INDUSTRY: A STRATEGIC DESIGN TOOL Noha Mansour, Fabrizio Ceschin, David Harrison, Yuan Long	418
CLIMATE SWITCH: DESIGN LED SYSTEM RESPONSE TO CLIMATE CHANGE INDUCED BY CONSUMPTION Palash Ghawde, Bindiya Mutum, Praveen Nahar	424
FARM ONTOLOGY: A SYSTEM THINKING APPROACH FOR PLANNING AND MONITORING FARM ACTIVITIES Pasqualina Sacco, Raimondo Gallo, Fabrizio Mazzetto	429
INCLUSIVE CIRCULAR ECONOMY: AN APPROACH FOR EMERGING ECONOMIES Priscilla R. Lepre, Leonardo Castillo	435
PARTICIPATORY AND SUSTAINABLE STRATEGY-MAKING FOR COMMUNITY RENEWAL: THE CASE OF IAO HON IN MACAO Yan Xiaoyi, Zhou Long, Guoqiang Shen	441
<b>5. DESIGN FOR SOCIAL EQUITY, INCLUSION AND COHESION</b>	
TRANSDISCIPLINARY AND INTERCULTURAL FIELD STUDY AS A NEW APPROACH TO ADDRESS CLIMATE CHANGE DESIGNERLY Yue Zou, Zhiyuan Ou,	448

CERNE PROJECT AND REMEXE COLLECTION: ACTIONS IN SOCIAL DESIGN IN SEARCH OF SOCIAL INNOVATIONS OF SYSTEMIC CHARACTER Juliana Pontes Ribeiro, Adriana Tonani Mazzeiro, Gabriel Julian Wendling	454
TOWARDS INCLUSIVITY: EXPLORING THE IMPLICATIONS OF MULTI-SENSORY AND PARTICIPATORY DESIGN APPROACHES IN A SOUTH AFRICAN CONTEXT Alexis Wellman, Karolien Perold-Bull,	459
THE OPPORTUNITIES OF SUSTAINABLE HOUSING TO PROMOTE GENDER EQUALITY Anahí Ramírez Ortíz	467
DESIGN FOR ALL TO SUSTAINABILITY FOR ALL SOCIETY Antonio Marano, Giuseppe Di Bucchianico	473
INTILANGA: THE HUMAN-CENTRED DESIGN OF AN OFF-GRID FOOD PROCESSING SYSTEM FOR MICRO-ENTERPRISES WITHIN JOHANNESBURG Antonio Marin, Martin Bolton	478
SOCIAL SUSTAINABILITY AND VIRTUAL REALITY HEAD-MOUNTED DISPLAYS: A REVIEW OF THE USE OF IMMERSIVE SYSTEMS IN THE AID OF WELL-BEING Antônio Roberto Miranda de Oliveira, Amilton José Vieira de Arruda	484
RESEARCH ON DESIGN EMPOWERMENT OPPORTUNITIES FOR THE ELDERLY IN COMMUNITY Binbin Zheng, Miaosen Gong, Zi Yang	490
FRAMEWORK OF ANALYTICAL DIMENSIONS AND DESIGN APPROACHES FOR SOCIAL INNOVATION Camila Ferrari Krassuski, Liliane Iten Chaves	496
COLLECTIVIZATION OF DESIGN AND DIGITAL MANUFACTURING: SOCIAL LABORATORIES Daniel Llermaly Larraín	502
FOSTERING SOCIAL INNOVATION THROUGH SOCIAL INCUBATORS AND CORPORATE SOCIAL INCUBATORS: EVIDENCE FROM ITALY Davide Vigliani, Paolo Landoni	507
UN-NUANCES OF CO-DESIGNING AND CO-CREATING: A DESIGN THINKING APPROACH WITHIN A ‘ZONGO’ COMMUNITY IN GHANA Patrick Gyamfi, Edward Appiah, Ralitsa Debrah	513
THE DESIGN OF BANYANKOLE TRADITIONAL HOUSE: POWER DIMENSIONS, HOSPITALITY AND BEDROOM DYNAMICS Emmanuel Mutungi	518
CHALLENGE BASED INNOVATION FOR HUMANITARIAN PURPOSES:DESIGNING A WEB-APP TO FIGHT OBESITY. RESULTS OF THEPORT_2018 PIER 32 Eveline Wandl-Vogt, Amelie Dorn, Enric Senabre Hidalgo, James Jennings,eGiuseppe Reale,	
KAROLOS POTAMIANOS	524
USER EXPERIENCE IN DESIGN TARGETING POVERTY ALLEVIATION: A CASE STUDY OF “SHANJU RENOVATION” ACTIVITY IN MAGANG VILLAGE	
FEI HU, JIXING SHI,	529
DESIGNING SUSTAINABLE MOBILITY FOR PEOPLE AT RISK OF SOCIAL ISOLATION – TWO CULTURAL PERSPECTIVES FROM SINGAPORE AND FRANCE Henriette Cornet, Penny Kong, Flore Vallet, Anna Lane, Yin Leng Theng	535

RESEARCH ON THE DESIGN OF SUSTAINABLE BATH EQUIPMENT IN POOR RURAL AREAS OF HEBEI HuHong, Li Heng	541
MAKING A COMIC ABOUT WESTBURY'S ANTI-APARTHEID ACTIVIST, FLORRIE DANIELS Florrie Daniels, Jean Bollweg	546
FROM ROBOTS TO HUMANS: PROSTHETICS FOR ALL Maria Rosanna Fossati, Manuel Giuseppe Catalano, Giorgio Grioli, Antonio Bicchi	552
DESIGNING SUSTAINABILITY FOR ALL OR CO-DESIGNING SUSTAINABILITY WITH ALL? Marie Davidová	558
DESIGN FOR SOCIAL INNOVATION WITHIN A VULNERABLE GROUP. LESSONS LEARNT FROM THE EXPERIMENTATION VIVICALUSCA IN ITALY Daniela Selloni, Martina Rossi	564
SUSTAINABLE DESIGN IDEA FOR ALL PEOPLE Dong Meihui	570
THE FUTURE IS FRUGAL Naga Nandini Dasgupta, Sudipto Dasgupta	574
#ECOTERACY, DESIGNING AN INFO INCLUSIVE AND UNIVERSAL LANGUAGE OF SUSTAINABILITY Nina Costa, Alexandra Duborjal Cabral, Cristóvão Gonçalves, Andreia Duborjal Cabral, Isabel Vasconcelos, Dânia Ascensão, Adriana Duarte	580
CULTURAL AND NATURAL HERITAGE FOR ALL: SUSTAINABLE FRUITION OF SITES BEYOND PHYSICAL ACCESSIBILITY Paola Barcarolo, Emilio Rossi	585
ADOPTION OF BIO-BASED ECONOMIES IN RURAL KENYA FOR IMPROVED LIVELIHOODS Pauline N. Mutura, Wairimu Maina, Peter Kamau	591
DESIGN DISCRIMINATION—REFLECTION FOR CRITICAL THINKING Ravi Mani	597
ORGANIC FARMING AS A LIVELIHOOD OPPORTUNITY AND WELL BEING FOR SUNDARBAN FARMERS Sanjukta Ghosh	602
ERSILIALAB IN MILAN. A PARTICIPATORY EXPERIENCE TO DESIGN NEW WAYS FOR ROMA'S SOCIAL INCLUSION Silvia Nessi, Beatrice Galimberti	608
REVITALIZING MARGINALIZED COMMUNITIES FOR SUSTAINABLE DEVELOPMENT BY DESIGN Tao Huang, Eric Anderson	614
THE CONTRIBUTION OF COMMUNICATION DESIGN TO ENCOURAGE GENDER EQUALITY Valeria Bucchetti, Francesca Casnati	619
APPLYING HUMAN-CENTERED TECHNOLOGICAL APPROACH FOR SUSTAINABLE BUSINESSES IN INDIAN INFORMAL ECONOMIES Vivek Chondagar	624
STUDY ON SUSTAINABILITY OF WATER MANAGEMENT SYSTEM IN TRADITIONAL VILLAGES IN WESTERN ZHEJIANG PROVINCE - TAKING SHEN'AO VILLAGE IN ZHEJIANG PROVINCE AS AN EXAMPLE Zhang Yao, Zhou Haoming	629

SUSTAINABLE RURAL TOURISM SERVICE SYSTEM DESIGN THAT BALANCES LOCAL REVITALIZATION AND EXTERNAL INVOLVEMENT—TAKING THE AKEKE AS AN EXAMPLE Yiting Zhao, Jun Zhang	634
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## VOLUME 3

### 6. DESIGN FOR SUSTAINABLE CULTURAL AND BEHAVIORAL CHANGE

ARTISTIC CRAFTSMANSHIP VS DEGRADATION RISK OF HISTORICAL AREAS Adriano Magliocco, Maria Canepa	639
STRATEGIES FOR ECO-SOCIAL TRANSFORMATION: COMPARING EFFICIENCY, SUFFICIENCY AND CONSISTENCY Andreas Metzner-Szigeth	644
SYNTHESIZING SOLUTIONS: EXPLORING SOCIALIST DESIGN AND ITS MODERN RELEVANCE THROUGH THE MEDIUM OF PLASTICS Aniruddha Gupte	650
MOTHERS FROM INOSEL: AN EXERCISE IN COLLABORATION TOWARDS A MORE SUSTAINABLE SOCIETY Bárbara de Oliveira e Cruz, Rita Maria de Souza Couto, Roberta Portas Gonçalves Rodrigues	655
THE ECOLOGICAL AESTHETIC CONNOTATIONS IN CHINESE TRADITIONAL ENVIRONMENT CONSTRUCTION SKILLS Changliang Tan	661
UPCYCLING IN COMMUNITIES: LOW CARBON DESIGN PROMOTES PUBLIC ENVIRONMENTAL AWARENESS AND OPTIMIZES SOCIAL Qiu Dengke, Peng Jinqi, David Bramston, Qiu Zhiyun, Chen Danrong	667
FASHION DESIGN FOR SUSTAINABILITY: A FRAMEWORK FOR PARTICIPATORY PRACTICE Dilys Williams	672
A DIFFERENT DEFINITION OF GENERATIVE DESIGN Erika Marlene Cortés López	678
SUSTAINABILITY AND DEMOCRACY WIDESPREAD COLLABORATIVE DESIGN INTELLIGENCE Ezio Manzini	682
UTSTAL: HEADING HEARTS AND JOINING COMMUNITIES Fernando Rafael Calzadilla Sánchez, Francisco Emanuel Pérez Mejía	687
SUSTAINABLE DESIGN AND AESTHETICS IN THE SOFT SCIENCE AGE Francesca La Rocca, Chiara Scarpitti	690
THE SOCIAL CONSTRUCTION OF ENVIRONMENTAL CRISIS AND REFLECTIONS ON THE SUSTAINABILITY DEBATE Gabriela Sandoval Andrade	696
DESIGN FOR HUMAN FLOURISHING: PERCEPTUAL MAPPING OF DIFFERENT DESIGN APPROACHES TOWARDS HAPPINESS AND WELL-BEING Guilherme Toledo	700
USING EMOTIONAL DURABILITY FOR SUSTAINABLE PACKAGING DESIGN PRACTICE BASED ON USAGE SCENARIO Jifa Zhang	706

THE VALORIZATION OF INDIGENOUS CULTURE THROUGH UPCYCLING Jordana de Oliveira Bennemann, Eduarda Regina da Veiga, Ana Luisa Boavista Lustosa Cavalcante	711
CLOTHING LANDSCAPES: INTERDISCIPLINARY MAPMAKING METHODS FOR A RELATIONAL UNDERSTANDING OF FASHION BEHAVIOURS AND PLACE Katelyn Toth-Fejel	715
INTEGRATION OF ART OF HOSTING METHODOLOGIES AND PRINCIPLES INTO THE SOCIAL INNOVATION LAB PRACTICE: Lewis Muirhead, Rosamund Mosse	720
DESIGN AS DEMOCRACY: THE DEMOCRATIC POTENTIAL OF DESIGN Luiz Lagares Izidio, Dijon De Moraes	727
REGENERATIVE FOOD SERVING SYSTEM FOR A SUSTAINABLE UNIVERSITY CAMPUS LIFESTYLE: A SOCIAL AND BEHAVIOURAL STUDY Nariman G. Lotfi, Sara Khedre	732
DESIGNING FURNITURE BASED ON STUDENT’S LIFESTYLE AND MERGING WITH A SUSTAINABLE CAMPUS Neha Priolkar, Franklin Kristi	737
PERIOD. A CARD GAME ON SOCIAL TABOOS AROUND MENSTRUATION Devika Saraogi, Gayatri Chudekar, Nikita Pathak, Sreya Majumdar	742
ESTABLISHING A QUANTITATIVE EVALUATION MODEL FOR CULTURE-BASED PRODUCT DESIGN Pan Li, Baosheng Wang	748
SUSTAINING CULTURAL HERITAGE : DERIVING THE CONTEMPORARY FROM THE IDIOM OF TRADITIONAL CRAFTS Puja Anand, Alok Bhasin	753
EMPATHY SQUARE: AN AID FOR SERVICE DESIGN FOR BEHAVIOUR CHANGE TO SUPPORT SUSTAINABILITY Ravi Mahamuni, Anna Meroni, Pramod Khambete, Ravi Mokashi Puneekar	759
ECOMUSEUM AS A DESIGN TOOL FOR SUSTAINABLE SOCIAL INNOVATION Rita de Castro Engler, Gabrielle Lana Linhares	764
MISLEADING IDENTITIES: DO PERCEPTUAL ATTRIBUTES OF MATERIALS DRIVE THE DISPOSAL OF SINGLE-USE PACKAGING IN THE CORRECT WASTE STREAM? Romina Santi, Agnese Piselli, Graziano Elegir, Barbara Del Curto	770
I TAKE CARE OF MY PLACES—PROJECT BY ALESSANDRO MANZONI HIGH SCHOOL, LECCO Rossana Papagni, Anna Niccolai, Eugenia Chiara, Laura Todde	776
THE ESPERANÇA COMMUNITY GARDEN AND THE CHALLENGES OF INTEGRAL SUSTAINABILITY Samantha de Oliveira Nery, Ediméia Maria Ribeiro de Mello, Rosângela Miriam Lemos Oliveira Mendonça	780
SPIRAL DYNAMICS: A VISIONARY SET OF VALUES FOR HUMANITY’S SUSTAINABLE DEVELOPMENT Sergio Dávila Urrutia	785
CRAFT CHANGE: BEHAVIOUR PROGRESSION FRAMEWORK – EVALUATION IN QUASI PARTICIPATORY DESIGN SETTING Shivani Sharma, Ravi Mahamuni, Sylvan Lobo, Bhaskarjyoti Das, Ulemba Hirom, Radhika Verma, Malay Dhamelia	791

FOR AN AESTHETICS FOCUSED ON SUSTAINABILITY: STUDIES FOR THE CONFIGURATION OF ECOLOGICALLY ORIENTED PACKAGING Thamyres Oliveira Clementino, Amilton José Vieira de Arruda, Itamar Ferreira da Silva	796
CRITICAL ZONE: THE EARTH BELOW OUR FEET Vasanthi Mariadass	800
SERIOUS GAME AS A NEW WAY OF HANDICRAFT INHERITANCE—A CASE STUDY ON “HUAYAO CROSS-STITCH MASTER GROWTH RECORD” Xile Wang, Duoduo Zhang, Yuanyuan Yang	807
<b>7. PRODUCT DESIGN FOR SUSTAINABILITY</b>	
PROPOSAL OF RECOMMENDATIONS FOR DESIGN UNDER A SUSTAINABLE APPROACH: LCA CASE. Bonifaz Ramírez Adonis Wenceslao, González Leopoldo Adrián	812
CIRCULAR DESIGN AND HOUSEHOLD MEDICATION: A STUDY ON THE VOLUNTARY DRUG DISPOSAL PROGRAM OF THE CITY OF BETIM MUNICIPALITY Aline Rodrigues Fonseca, Rita de Castro Engler, Armindo de Souza Teodósio, Luiz Fernando de Freitas Júnior, Mariana Costa Laktim, Travis Higgins	817
DESIGN FOR SUSTAINABLE FASHION: A SUSTAINABILITY DESIGN-ORIENTING TOOL FOR FASHION Barbara Azzi, Carlo Vezzoli, Giovanni Maria Conti	823
DESIGN PRACTICE FOR SUSTAINABILITY: DEVELOPMENT OF A LOW-COST ORTHOSIS Caelen Teger, Isabella de Souza Sierra, Dominique Leite Adam, Maria Lúcia Leite Ribeiro Okimoto, José Aguiomar Foggiatto	831
MECHANISM ANALYSIS AND APPLICATION STUDY OF SUSTAINABILITY EVALUATION TOOL FOR FURNITURE E-COMMERCE(ICSFE) Chuyao Zhou, Fang Liu, Suqin Tan, Tianwei Sun, Guixian Li, Shaohua Han*	837
ANUVAD: CREATING SUSTAINABLE SMART TEXTILES THROUGH THE MEDIUM OF TRADITIONAL CRAFTS Chhail Khalsa	843
DESIGN FOR SUSTAINABILITY FRAMEWORK APPLIED TO THE PROBLEM OF GARMENT WASTE: A BRAZILIAN STUDY Cláudio Pereira de Sampaio, Suzana Barreto Martins	848
LIFE CYCLE DESIGN (LCD) GUIDELINES FOR ENVIRONMENTALLY SUSTAINABLE CLOTHING CARE SYSTEMS: AN OPEN AND OPERATIVE TOOL FOR DESIGNERS Carlo Vezzoli, Giovanni Maria Conti	854
THE RESEARCH OF YI ETHNICITY FURNITURE DESIGN BASED ON ARCHITECTURAL SPACE Ding Yang	860
DESIGN FOR SUSTAINABILITY AND ICT: A HOUSEHOLD PROTOTYPE FOR WASTE WATER RECYCLING Fiammetta Costa, Marco Aureggi, Luciana Migliore, Paolo Perego, Margherita Pillan, Carlo Emilio Standoli, Giorgio Vignati	864
OPEN-ENDED DESIGN. LOCAL RE-APPROPRIATIONS THROUGH IMPERFECTION Francesca Ostuzzi, Valentina Rognoli, Francesco Fittipaldi, Patrizia Ranzo, Rosanna Veneziano, Gustavo R. P. Nascimento, Victor J.D. S. Baldan, T. M. Ponciano, Janaina M. H. Costa, Eduvaldo P. Sichierri, Javier M. Pablos	868
ANALYSIS OF THE POTENTIAL APPLICATION OF RECYCLED THERMOFIX INDUSTRIAL POLYURETHANE RESIDUE IN SCHOOL DESKS Gustavo Ribeiro Palma Nascimento, Victor José Dos Santos Baldan, Thales Martins Ponciano, Janaina M. H. Costa	

Eduvaldo Paulo Sichieri, Javier Mazariegos Pablos	880
RE-DESIGNING RECOVERED MATERIALS. CASE STUDY: FIBERGLASS IN THE NAUTICAL SECTOR Helga Aversa, Valentina Rognoli, Carla Langella	884
UNFINISHEDISM Huanhuan Peng	890
CRITICAL FUTURES TODAY: BACK-CASTING SPECULATIVE PRODUCT DESIGN TOWARDS LONG-TERM SUSTAINABILITY Jomy Joseph Jomy Joseph, Mariana Costa Laktim, Larissa Duarte Oliveira, Rita de Castro Engler, Aline Fonseca, Camilla Borelli, Julia Baruque-Ramos	899
HOME TEXTILE: AN ANALYSIS OF ENVIRONMENTAL AND ECONOMICAL IMPACTS IN BRAZIL Mariana Costa Laktim, Larissa Duarte Oliveira, Rita de Castro Engler, Aline Fonseca, Camilla Borelli, Julia Baruque-Ramos	905
PRODUCT DESIGN FOR SUSTAINABILITY – GUIDELINES FOR THE LIFE CYCLE DESIGN OF OFFICE FURNITURE Lena Plaschke, Carlo Vezzoli, Francesco Scullica	910
ON THE COLLABORATIVE MODELS FOR DESIGN SCHOOLS ENGAGING IN THE SUSTAINABLE DEVELOPMENT OF TRADITIONAL BAMBOO CRAFTS Li Zhang, Hai Fang	915
EXPERIMENTAL MATERIAL DEVELOPMENT LEADING TO SUSTAINABLE PRODUCT DESIGN Martin Bolton	921
AUTOMATIC COMPOSTER FOR HOME USE Maycon Manoel Sagaz, Paulo Cesar Machado Ferroli	926
SUSTAINABILITY IN THE PRODUCT LIFE CYCLE OF PAPER Qian Yang	932
BIOINSPIRED STRUCTURES IN LIGHTWEIGHT PRODUCT DESIGN WITH ADDITIVE MANUFACTURING Owen Gagnon, Brenton Whanger, Hao Zhang, Ji Xu	936
SMART HOME GRID: TOWARDS INTERCONNECTED AND INTEROPERABLE ELECTRICAL MODEL TO IMPROVE THE USAGE AWARENESS Paolo Perego, Gregorio Stano	941
ZERO WASTE: EXPLORING ALTERNATIVES THROUGH FOLDING Pragya Sharma	946
ENVIRONMENTAL PRODUCT OPTIMISATION: AN INTEGRAL APPROACH Reino Veenstra, Henri C. Moll	953
SUSTAINABLE DESIGN 4.0: METHODS AND TECHNIQUES OF THE CONTEMPORARY DESIGNER IN THE KNOWLEDGE SOCIETY Roberta Angari, Gabriele Pontillo	959
NEM, NEAPOLITAN EVOLUTION MEN’S WEAR: A BIO PROJECT OF MEN’S TAILORING Roberto Liberti	965
NEW SUSTAINABLE COSMETIC PRODUCTS FROM FOOD WASTE: A JOINED-UP APPROACH BETWEEN DESIGN AND FOOD CHEMISTRY Severina Pacifico, Simona Piccolella, Rosanna Veneziano	970

CHILDREN FURNITURE DESIGN FOR SUSTAINABILITY Xiang Wang, Lulu Chai, Ren Fu	975
STUDY ON THE DESIGN OF TENON AND MORTISE JOINTS FOR NEW TYPE SUSTAINABLE EXPRESS PACKAGING BASED ON THE CONCEPT OF INTEGRATED CYCLING Xue-ying Wang, Jiao Yi	981
<b>8. DESIGN FOR SUSTAINABLE TECHNOLOGIES AND RESOURCES</b>	
INTERACTIVE DESIGN STRATEGY FOR SUSTAINABLE BEHAVIOR CHANGE BASED ON OPEN SOURCE HARDWARE Yongshi Liu, Jing Ou, Yunshuang Zheng, Jun Zhang	988
DESIGN-DRIVEN STRATEGY FOR THE SUSTAINABLE TEXTILE HERITAGE COMMUNITY IN CHINA Yuxin Yang, Eleonora Lupo	994
EXPLORING THE DESIGN ETHICS OF THE FUTURE INFORMATION SOCIETY: A BRIEF DESIGN ETHICS STUDY OF “DIDI GLOBAL” AS A SOCIALITY INTERNET PRODUCT Zhilong Luan, Xiaobo Lu	1000
GLEBANITE® FOR MODELS AND MOULDS IN SHIPYARDS APPLICATIONS RATHER RESORTING TO MONOMATERIC SOLUTIONS Andrea Ratti, Mauro Ceconello, Cristian Ferretti, Carlo Proserpio, Giacomo Bonaiti, Enrico Benco	1006
PROJECT REMA: THE REGIONAL ECO-MATERIALS ARCHIVE Y.H. Brian Lee, Ding Benny Leong	1010
MATERIALS CLASSIFICATION IN FURNITURE DESIGN – FOCUS ON SUSTAINABILITY Paulo Cesar Machado Ferroli, Emanuele de Castro Nascimento, Lisiane Ilha Librelotto, Franchesca Medina, Luana Torralles Carbonari	1015
THE SUSTAINABILITY OF BIOMIMETIC SYSTEM DESIGN: FROM ORGANISM TO ECOLOGY Fan Wu, Jun Zhang	1021
SUSTAINABILITY DESIGNED WITH(OUT) PEOPLE? UNDERSTANDING FOR WHAT ENERGY IS (OVER-)USED BY TENANTS IN AN ENERGY EFFICIENT PUBLIC HOUSING IN MILAN Giuseppe Salvia, Federica Rotondo, Eugenio Morello, Andrea Sangalli, Lorenzo Pagliano, Francesco Causone	1027
RESEARCH ON BIOMASS ENERGY UTILIZATION IN RURAL AREAS BASED ON SUSTAINABLE DESIGN CONCEPT Haiwei Yan, Ruolin Gao, Ke Jiang, Yuanbo Sun	1032
LIFE THE TOUGH GET GOING PROJECT: IMPROVING THE EFFICIENCY OF THE PDO CHEESE PRODUCTION CHAINS BY A DEDICATED SOFTWARE Jacopo Famiglietti, Carlo Proserpio, Pieter Ravaglia, Mauro Ceconello	1035
RETHINKING AND RECONSTITUTED MATERIALS FOR A SUSTAINABLE FUTURE — “RECONSTITUTING-PLAN” PROJECT AS AN EXAMPLE Jiajia Song	1040
BAMBOO SUPPLY CHAIN: OPPORTUNITY FOR CIRCULAR AND CREATIVE ECONOMY Lisiane Ilha Librelotto, Franchesca Medina, Paulo Cesar Ferroli, Emanuele de Castro Nascimento, Luana Torralles Carbonari	1046
ALTERNATIVE MATERIALS TO IMPROVE THE ASSEMBLY PROCESS OF FURNITURE FOCUSED ON SUSTAINABILITY DESIGN Paulo Cesar Machado Ferroli, Lisiane Ilha Librelotto, Natália Geraldo	1051



SUSTAINABLE DESIGN PRINCIPLES FOR USING BAMBOO STEMS Ping Wu, Tao Huang	1056
SUSTAINABLE MATERIALS AND PROCESSES DESIGN: THE CASE STUDY OF POLY-PAPER Romina Santi, Silvia Farè, Barbara Del Curto, Alberto Cigada	1061
ENABLING USER KNOWLEDGE TO SUPPORT THE DECISION-MAKING PROCESS IN ENERGY RETROFITTING OF PUBLIC HOUSING: A CASE STUDY IN MILAN Giuseppe Salvia, Federica Rotondo, Eugenio Morello	1067
EFFECTS OF COLOURED AMBIENT LIGHT ON PERCEIVED TEMPERATURE FOR ENERGY EFFICIENCY: A PRELIMINARY STUDY IN VIRTUAL REALITY Siyuan Huang, Giulia W. Scurati, Roberta Etzi, Francesco Ferrise, Serena Graziosi, Lavinia C. Tagliabue, Alberto Gallace, Monica Bordegoni	1073
BUILDING INTEGRATED PHOTOVOLTAICS (BIPV): SYSTEM APPLICATION GUIDELINES AND ALBEDO ASPECTS Sofia Hinckel Dias, Flávia Silveira, Aloísio Schmid	1079

## VOLUME 4

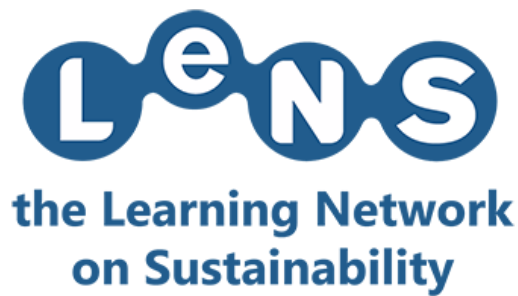
### 9. ARCHITECTURAL AND INTERIOR DESIGN FOR SUSTAINABILITY

SUSTAINABLE-ORIENTED CHANGE MANAGEMENT FOR ALL BUILDING DESIGN PRACTICE Anna Dalla Valle, Monica Lavagna, Andrea Campioli,	1083
RELIGIOUS BUILDINGS AND SUSTAINABLE BEHAVIOUR: UNDERSTANDING IMPACT OF DESIGN ELEMENTS ON HUMAN BEHAVIOUR Ashish Saxena	1088
RESTRICTING FACTORS IN THE SELECTION AND SPECIFICATION OF SUSTAINABLE MATERIALS: AN INTERIOR DESIGN PERSPECTIVE. Emmerencia Petronella Marisca Deminey, Amanda Breytenbach	1094
OPTIMIZATION AND LCSA-BASED DESIGN METHOD FOR ENERGY RETROFITTING OF EXISTING BUILDINGS Hashem Amini Toosi, Monica Lavagna	1101
INDOOR ENVIRONMENTAL QUALITY DESIGN OF HOTELS IN THE UNITED STATES AND EUROPE Ivan Alvarez Leon, Elena Elgani, Francesco Scullica	1106
SUSTAINABLE TECHNIQUES TO IMPROVE THE INDOOR AIR QUALITY (IAQ) AND THERMAL COMFORT IN HOT AND ARID CLIMATE. Laura Dominici, Sanam Ilkhanlar, Sara Etminan, Elena Comino	1112
DEVELOPMENT AND PROPOSITION OF A TOOL TO EVALUATE THE ECOLOGICAL IDENTITY OF PRODUCTS: FURNITURE CASE Onur Y. Demiröz, Meltem Özkaraman Sen	1117
INTERVENING ON 'BUILDING AS A PRODUCT' AND 'HABITATION AS A SERVICE' IN CONTEMPORARY URBAN SETTINGS FOR ADAPTIVE MICRO HABITATION DESIGN Shiva Ji, Ravi Mokashi Puneekar	1123
RESEARCH ON THE SUSTAINABLE DESIGN OF TRADITIONAL ARCHITECTURAL NARRATIVE CULTURE OF BEIJING HUTONG BLOCKS: A CASE STUDY OF NANLUOGUXIANG STREET Xin Wen, Fan Zhang	1129

SUSTAINABILITY INVOLVES EMOTION: AN INTERPRETATION ON THE EMOTIONAL CHARACTERISTICS OF SUSTAINABLE ARCHITECTURE Yun-Ting Gao	1134
<b>10. LANDSCAPE AND URBAN DESIGN FOR SUSTAINABILITY</b>	
TOWARD SUSTAINABLE CITIES THROUGH FUTURISTIC DESIGN MODEL: A CONSUMERISTIC SOCIETY PERSPECTIVE Azadeh Razzagh Shoar, Hassan Sadeghi Naeini	1141
STUDY ON SUSTAINABLE DESIGN OF RAINWATER LANDSCAPE IN EXISTING URBAN RESIDENTIAL COMMUNITY Di Gao, Xuerong Teng	1145
DESIGN FOR PUBLIC TOILETS: CHALLENGES AND CONTRIBUTION TO THE REESTABLISHMENT OF PUBLIC VALUE Fang Zhong, Xin Liu, Nan Xia	1151
DESIGNING COMMUNITY THROUGH URBAN GARDENING Gloria Elena Matiella Castro,	1157
EXPLORING FOG HARVESTING IN EUROPE: CHARACTERISTICS AND GUIDELINES FOR A SUSTAINABLE CITY MODEL Gloria Morichi, Dr. Gabriela Fernandez, Lucas B. Calixto	1161
CHARACTERIZATION OF TWO URBAN FARMS IN THE CUAUHEMOC BOROUGH OF MEXICO CITY Iskar Jasmani Waluyo Moreno	1166
THE CHALLENGES OF USING PUBLIC LAND SUSTAINABLY IN MEXICO FOR OUTDOORS RECREATION: CAN SERVICE DESIGN HELP BRIDGE THE GAP? Ivan Osorio Avila	1171
INTERCITY RELATIONSHIPS WITHIN URBAN AGGLOMERATION AND THEIR IMPACTS ON URBAN ECONOMIC DEVELOPMENT Jianhua Zhang	1177
URBAN-RURAL NETWORK TOOL FOR DESIGNING SYSTEMS THAT SUCCESSFULLY INTEGRATE COMPANIES AND COMMUNITIES TOWARDS SUSTAINABILITY AND RESILIENCE Juan Montalván, Akie Manrique, Santiago Velasquez, Lucia Rivera, Helen Jara, Luis Quispe	1183
SOCIAL INEQUITY IN PUBLIC TRANSPORT INFRASTRUCTURE & ITS IMPACT ON A CITY'S SUSTAINABILITY Lakshmi Srinivasan	1188
A TOOLKIT: FOSTERING A PARTICIPATORY STUDY OF SUSTAINABLE PAVEMENT DEVELOPMENT Lulu Yin, Eujin Pei	1194
THE LOGIC OF PLACE-MAKING TOWARDS SUSTAINABLE NEW URBAN AREAS IN HANOI: FROM ZERO TO HERO? Minh Tung Tran, Ngoc Huyen Chu, Pham Thuy Linh	1200
MATI- FINDING SELF AND COMMUNITY THROUGH LAND RECLAMATION Srishti Srivastava, Shivangi Pant, Sahil Raina	1206
THE PATTERN AND METHODS CONCERNING THE MICRO-RENEWAL OF THE URBAN ENVIRONMENT Tingting Liu	1211
RITICAL ZONE: THE EARTH BELOW OUR FEET Vasanthi Mariadass	1216

STUDY ON THE LANDSCAPE POLICY AND USAGE SITUATION : A CASE OF XIADU PARK IN YANQING COUNTY, BEIJING Yuanyuan Zhang	1223
AN ANALYSIS AND APPLICATION OF AFFORDANCE THEORY IN DESIGN OF URBAN RAIL TRANSIT Yu-Feng Zhang	1228
DISCUSSION ON THE SUSTAINABLE MODE OF NEW RURAL CONSTRUCTION IN CHINA FROM THE PERSPECTIVE OF ENVIRONMENTAL CONSTRUCTION Zhong Zhen	1234
<b>11. EDUCATION AND DIFFUSION OF DESIGN FOR SUSTAINABILITY</b>	
DSXC: TOOLKIT TO SUPPORT DESIGN EDUCATION PROCESSES FOR SUSTAINABILITY Adolfo Vargas Espitia, Álvarez Quintero, Willmar Ricardo Rugeles Joya	1239
UPSCALING LOCAL AND NATIONAL EXPERIENCES ON EDUCATION FOR SOCIAL DESIGN AND SUSTAINABILITY FOR ALL TO A WIDER INTERNATIONAL ARENA: CONSIDERATIONS AND CHALLENGES Ana Margarida Ferreira, Nicos Souleles, Stefania Savva	1244
INTERDISCIPLINARY HIGH EDUCATION IN PLACE BASED SOCIAL-TECH: THE EXPERIENCE OF THE TAMBALI FII PROJECT IN DAKAR Andrea Ratti, Francesco Gerli, Arianna Bionda, Irene Bengo	1248
EDUCATION STRATEGIES AND BEHAVIORAL ACTIONS TO MITIGATE ENERGY POVERTY Anna Realini, Simone Maggiore, Marina Varvesi, Valentina Castello, Corrado Milito	1254
DESIGNING FOR CLIMATE CHANGE FOR ALL—A MEDIA AND COMMUNICATION DESIGN COURSE TO INCREASE PUBLIC AWARENESS Bo Gao, Glenda Drew, Jesse Drew,	1260
DESIGN PEDAGOGY FOR SUSTAINABILITY: DEVELOPING QUALITIES OF TRANSFORMATIVE AGENTIVE LEARNING. Bruce Snaddon, Andrea Grant Broom	1265
ENVIRONMENTAL ASPECTS IN THE UEL DESIGN COURSE: LEGAL CONCEPTIONS AND REALITY Camila Santos Doubek Lopes, Gabriela Namie Komatsu Yoshida	1270
EDUCATION FOR SUSTAINABLE DEVELOPMENT. CASE OF AN INDUSTRIAL ENGINEERING PROGRAM IN COLOMBIA. Carolina Montoya-Rodríguez	1275
USING DESIGN THINKING AND FACEBOOK TO HELP MOROCCAN WOMEN ADAPT TO CLIMATE CHANGE IMPACTS Diane Pruneau, Abdellatif Khattabi, Boutaina El Jai, Maroua Mahjoub	1281
DESIGN FOR SOCIAL SUSTAINABILITY: DECOLONISING DESIGN EDUCATION Elmarie Costandius, Neeske Alexander	1286
A SUSTAINABLE DESIGN-ORIENTED PROCESS FOR CONVERTING AND SHARING KNOW-HOW Emilio Rossi	1292
FASHION DESIGN EDUCATION AND SUSTAINABILITY. A CHALLENGE ACCEPTED. Erminia D'Itria	1297
TRANSITION DESIGN – PRESENTATION AND EDUCATIONAL APPROACH Erwan Geffroy, Manuel Irlés, Xavier Moulin	1303
SOCIAL INNOVATION THROUGH DESIGN IN THE TRAINING OF YOUNG APPRENTICES: EXPERIENCING SOCIO-EDUCATIONAL PROJECTS Karina Pereira Weber, Isabel Cristina Moreira Victoria, Marco Antonio Weiss, Luiz Fernando Gonçalves De Figueiredo	1309

INSPIRING STUDENTS TO BE AGENTS OF CHANGE: A SOUTH AFRICAN PERSPECTIVE Laskarina Yiannakaris	1314
THE TECHNOLOGICAL MEDIATION OF SUSTAINABILITY: DESIGN AS A MODE OF INQUIRY Lisa Thomas, Stuart Walker, Lynne Blair	1320
DESIGN FOR SUSTAINABILITY. STATE OF THE ART IN BRAZILIAN UNDERGRADUATE COURSES Marcelo Ambrósio, Maria Cecília Loschiavo dos Santos	1326
SUSTAINABLE DESIGN TRENDS WITHIN CREATIVE LEARNING ENVIRONMENTS Mireille Anja Oberholster, Francesco Scullica	1331
MODEL-MAKING COURSES AND APPROACHES IN TERMS OF SUSTAINABILITY: EXAMINATION OF INDUSTRIAL DESIGN SCHOOLS IN TURKEY Necla Ilknur Sevinc Gokmen	1336
SUSTAINABILITY IN UNDERGRADUATE ARCHITECTURAL EDUCATION: A CASE STUDY FROM KAZGASA, KAZAKHSTAN Nurgul Nsanbayeva	1342
ENCOURAGING DFE IN DESIGN EDUCATION TO PROMOTE SUSTAINABLE MEDICAL PRODUCT DESIGN Pranay Arun Kumar, Stephen Jia Wang	1348
INCORPORATING SUSTAINABILITY INTO RESEARCH PROJECTS Rosana Aparecida Vasques, Maria Cecilia Loschiavo dos Santos	1354
TEACHING DESIGN FOR SUSTAINABILITY BEYOND THE ENVIRONMENTAL DIMENSION: A TOOLKIT AND TEACHING STRATEGIES Rosana Aparecida Vasques	1359
ROLE OF DESIGN EDUCATION IN IMPARTING VALUES OF SUSTAINABILITY AS SOCIAL RESPONSIBILITY OF DESIGNERS Sanjeev Bothra	1365
SPREADING GOOD SUSTAINABILITY PRACTICES THROUGH TEMPORARY RETAIL SHOPS Silvia Piardi	1370
FASHION DESIGN-RELATED DOCTORAL STUDIES IN SELECTED KENYAN UNIVERSITIES: ADVANCING APPLIED RESEARCH IN SUSTAINABILITY Sophia N. Njeru. Mugendi K. M'riithaa	1375
TRANSDISCIPLINARY FUTURES: WHERE DO EMBODIMENT, ETHICS AND EDUCATION MEET FOR SUSTAINABILITY LEADERSHIP? Srisrividhiya Kalyanasundaram, Sandhiya Kalyanasundaram,	1382
DESIGN: A REFLEXIVE, REFLECTIVE AND PEDAGOGICAL INQUIRY INTO SUSTAINABILITY Sudebi Thakurata	1388
URBAN MINE REDESIGN COURSE: RESEARCH AND TEACHING PRACTICE Xin Liu, Fang Zhong	1394
TRANSFORMING FOOD SYSTEMS IN CHINA: THE ROLES OF FOOD LITERACY EDUCATION IN ALTERNATIVE FOOD MOVEMENTS Yanxia Li, Hongyi Tao	1400
SUSTAINABILITY AND CREATIVE EDUCATION: DEVELOPING A SUSTAINABILITY CULTURE OF HIGHER EDUCATION IN CHINA Dr Yan Yan Lam, Sheng Feng Duan,	1406



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## DESIGN FOR SUSTAINABILITY APPLIED TO WORKSPACES

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### ABSTRACT

Due to the behavioral changes of society in a dynamic and interconnected world, workspaces have gotten a new meaning. Designers must understand the needs and desires of the final users in order to create something that fulfills them and creates a whole experience out of it. By adopting living systems “ecological” worldview, design will require a higher level of interrelationships between natural, human and built systems, and the disciplines within them (Boecher et al, 2009, p xii) describe the achievement of a broader integration of systems within the sustainability movement as an “Integrative Design Process (IPD)”.

The aim of this paper is to comprehend how Product-Service System Design methodologies can be applied in Interior Design with the means of designing a workspace that by being co-created by the users, can become more sustainable and that can satisfy better the end user. Besides, the relation of Interior Design and Sustainability, that comes after the comprehension of it in two levels. The first one is a social level, associated to the well-being of the end user in a workspace (lighting, insulation and many other specs of the spaces), while the second level is the study of the environmental design of the spaces (materials & products) supported by Life Cycle Assessments (LCA) studies, to cognize about the carbon footprint left in the world through all the life cycle phases. These different studies become crucial on the decision making, since they can change the perception we have about materials or furniture chosen within a project.

Finally, with means of supporting the ideas exposed and to have a better understanding of it, we expose some case studies. The aforementioned research is part of the outcome of an ongoing thesis held for a Master of PSSD at the Design Department of Politecnico di Milano and part of the Farb Research (ISBN: 9788891777201).

Keywords: Product-ServiceSystems, Interior Design, Sustainability, Co-Design

## 1. EVOLUTION OF WORKSPACES & NEW TRENDS

The growth of the world population and the increase of inhabitants in urban settlements, together with the constant technological developments, impose a continuous rethinking of ways and places in which we live (Heidegger, 1954). It is estimated that by 2050 the earth will reach 10 billion inhabitants, from which 66% of the world population will live in megapolis and large cities<sup>1</sup>.

Over time, living has increasingly become a more composite and multifaceted, both in relation to the numerous declinations of individuality and with respect to technological developments and socio-economic changes, because “the environment that surrounds us is a dynamic intersection of fast and complex social, cultural and environmental entities” (Sayegh, 2018, p.9). In addition, the fast development of many typologies of spaces as a result of the transformation of the activities performed inside them, the experience of motion, and the technological advances in transports, has led to the possibility of traveling to an increasing number of individuals. (Scullica, 2018).

The sociologists John Urry and Mimi Sheller, who have long studied the mobility of individuals, stated that:

“all the world seems to be on the move. Asylum seekers, international students, terrorists, members of diasporas, holidaymakers, business people, sports stars, refugees, backpackers, commuters, the early retired, young mobile professionals, prostitutes, armed forces -these and many others fill the world’s airports, buses, ships, and trains. The scale of this travelling is immense. Internationally there are over 700 million legal passenger arrivals each year” (Urry and Sheller, 2006, p.207).

According to the sociologist Urry and Elliott (Elliott, Urry, 2010) mobile life, is changing the behavior of societies, from the way in which people think and interact to the physical space and connections in which they live. These factors are now an essential condition -in particular interiors -and they must be considered.

During the ‘90s the home office phenomenon started due to the possibility of working home by the new computer technologies. Since then, communication technologies have increased and evolved in a way that nowadays work can be easily carried out everywhere, and it is above all connected with the new spaces for “living, working and travelling”, leading to the new working model, smart working<sup>2</sup>. (Scullica, Elgani, 2018)

“Nowadays, offices are no longer just a system of workstations -they are slowly transformed to match with new lifestyles”<sup>3</sup> (Berberi, 2017). Mobility has become an existential dimension based on eradication, related to one’s personal identity, relations in between a community in which it is not linked a physical space nor a given time.

In a global dimension where individuality and isolation prevail, many people share the need to be part of a “light community”, based on lifestyles, tastes and similar interests (Manzini, 2018), in which distinct solitudes can be connected to each other by sharing a sensory experience.

Workspaces have evolved in a dramatic way on the past decades due to many changes of the behavior of society and in the whole working system. Likewise, internet has brought people closer by being virtually connected. Nowadays, there is no need to have physical contact to share information or knowledge, this leads to the rise of “working nomads” or “knowledge workers”, who can be defined as people that work independently in different locations and that thanks to the internet access, smartphones and voice over internet protocol (VoIP) are able to keep contact with clients and employers all over the world, no matter the location.

The rise of rent prices and real estate is making rethink and reorganize the distribution and working areas inside companies. Due to this fact, and thanks to the IoTs that allow people to continue to be connected even from far away, corporations are applying different working systems to have less people inside the working space. Some of these methodologies are to reduce the number of square meters by outsourcing services, using teleworking systems for fixed workers or even using a hot-desking concept inside the workplace.

In addition, the high costs for companies in terms of salaries, taxation systems and workspaces has brought to the demand of outsourcing system services instead of hiring people for fixed-job positions. Thus, the market of freelancers or knowledge workers is increasing in the population -and in response, the rising demand of coworking spaces.

Furthermore, most of knowledge workers who used to have their own space are not able to pay the high rents of private offices anymore. This has led to the demand of spaces capable to suit multi-functions that can easily adapt to different situations and to shared spaces by workers of different fields who are able to share knowledge and build new networks.

Communication through the network has become a central and fundamental element in the work field: in first place, as cause of the IoTs the exchange of information between individuals has increased in a level that it has brought new varieties of collaborations and relationship in informal and formal ways. The comprehension between people, spaces and objects is possible because environments has become progressively smart and able to interact with individuals (Elgani, 2018).

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<sup>1</sup> retrieved from [www.esa.un.org/unpd/wpp/](http://www.esa.un.org/unpd/wpp/)

<sup>2</sup> The Italian law n. 81 of 22 May 2017 defines by rule Smart Working -a management model that allows people to work from a distance and increases worker’s freedom and autonomy. In Italy this phenomenon is monitored by the Smart Working Observatory of the School of Management of the Politecnico di Milan

<sup>3</sup> Berberi L. “Benvenuti nella casa-ufficio di Milano, gli studi del Politecnico per ripensare il posto di lavoro: diventera uno spazio ibrido tra dovere, riposo e piacere”, in *Corriere della Sera*, 3rd April 2017.

The way in which work is conceived and organized has been radically transformed, even before the physical workspaces. In order to achieve a shared goal, there is the wish to create “community” -a word that the Italian entrepreneur Adriano Olivetti had strongly connected to the work field (Olivetti, 2013) -because of the current need to share complex processes among professionals with different skills. Meanwhile, the users need individual workspaces where they can have privacy and silence to achieve more productivity or concentration.

Flexibility, creativity, speed and adaptation become essential requirements for the nowadays workers. They must learn to relate with increasingly sophisticated tools and machines.

As written by Michele De Lucchi in *Domus*<sup>4</sup>, from an architectural point of view we witness a dematerialization of the workspaces because at present many professionals can easily work from home or from public spaces, like a bar and a restaurant, or while travelling from a place to another by simply having access to a device with internet connection.

Technological and design evolution have allowed the creation of complex devices that are small and easily transportable, and integrated systems for spaces and furnishings that are increasingly capable of relate with the users. Presently, it is possible to organize meetings in real time with people located in different parts of the globe, without the need to meet physically; Pajevic and Shearmur define this phenomenon as “workplace mobility «with reference to “the ability of workers to carry out work-related activities at any time and at any place as a result of the computerization of work-related activities, workplace technology miniaturization, and IoTs” (Pajevic, Shearmur, 2017).

For the previous exposed, we can conclude that social behaviors and the evolution in technologies -between other facts -have led to an extreme change in the working environment. Companies have less fixed workers but focus more on supporting them with an environment that looks after their human needs, taking in count not just the physical space but supporting their health in a holistic way. On the other side, knowledge workers are in continuous search for places where to develop their activities and build new networks, thus, the appearance of coworking spaces and hubs focus on bringing to their users ‘spaces and commodities user-based.

Workspaces -both for smart workers or fixed workers -are mainly places that are currently following sustainable trends in two senses. The first one, is to choose the right materials, furniture and to add the technical solutions to achieve a sustainable environment. The second one, is to achieve sustainability by understanding the ongoing social behaviors to support the wellbeing of the users, achieving a nature minded mindset.

In order to achieve sustainable spaces, designers need to understand the meaning of environmental spaces, for creating afterwards hybrid spaces where smart and modular furniture can adapt to changing situations within some quick changes while maintaining the existence of private spaces, intermediate spaces and public spaces -in which sometimes can be included “hot-desking areas”-. Another topic is to understand the needs and desires of the users to create user-based service-systems that supports the wellbeing of them while allowing the progress of their professional activities.

## 2. PRODUCT SERVICE SYSTEM DESIGN & CO-CREATION

Due to the societal lifestyle shifts, priorities of the users have changed from owning to experiencing, this means that people are not looking after the sense of belonging goods anymore but the sense of being fulfilled by having the best experience out of something. Therefore, Product-Service System Design (PSSD) is increasingly getting more importance in the design world.

PSSD consists on a mix of tangible products and services designed and combined so that they jointly are capable of fulfilling final customer needs (A. Tukker, U. Tischner, 2006). Product-Service Systems are a specific type of value proposition that a business (network) offers to (or co-produces) with its clients which end up being the final users (Tukker, Tischner, 2006). Having as an outcome user-based PSS.

The evolution in design research from a user-centered approach to co-designing is changing the roles of the designer, the researcher and the person formerly known as the ‘user’. The implications of this, shift for the education of designers and researchers are enormous. The evolution in design research from a user-centered approach to co-designing is changing the landscape of design practice as well, creating new domains of collective creativity. i.e. creativity that is shared by two or more people. (Sanders, Stappers, 2008), thus, co-design is a specific instance of co-creation, referring to experienced designers and inexperienced people working together through the development of the design process to achieve a holistic system where tangibles and intangibles -together -fulfil of the needs and desires of the users.

Before the decade of ‘70s designers took practice of human centered design (fig.1), using people as the center of the study and exploring their needs and desires. On the other hand, with the evolution and further studies of the design practices, it has been proved that it is more efficient to involve the final users as stakeholders into the design process in order to have a better outcome. Therefore, co-design gets the roles mixed up (fig.2), positioning the person who will use the product or service as an expert through the design process, playing a main role in the design process and idea generation. Instead, the designer plays the role of researcher, collaborating and using different tools through the process of idea generation.

<sup>4</sup>“On my travels around the world, coffee chains are my favorite offices: Pret a Manger, Starbucks... I can have breakfast, lunch and dinner, sitting all the day with Wi-Fi and aroma of bread and croissants in the air. I can look around and be surprised by people’s different habits, and I can invite people and easily organize my meetings. Sure, personality is lacking, but no one interrupts me and the efficiency is first class.” De Lucchi M., “With the artificial intelligence, offices are becoming places of ideas” in *Domus* n.1022 March 2018, p. 34.

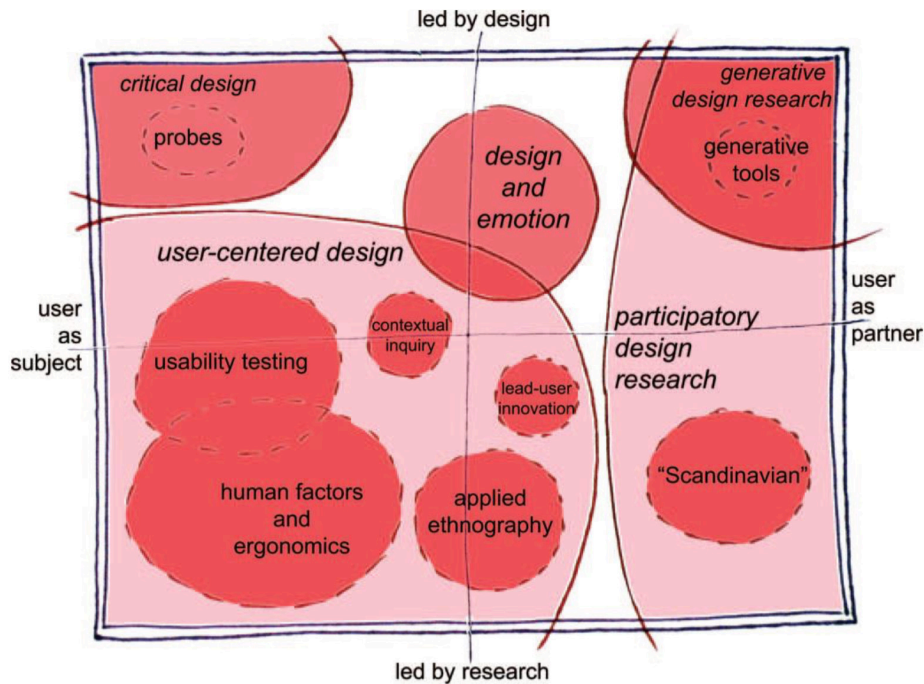


Fig 1.-The current landscape of human-centered design research as practiced in the design and development of products and services. E.B. -N Sanders and P.J. Stappers, 2008

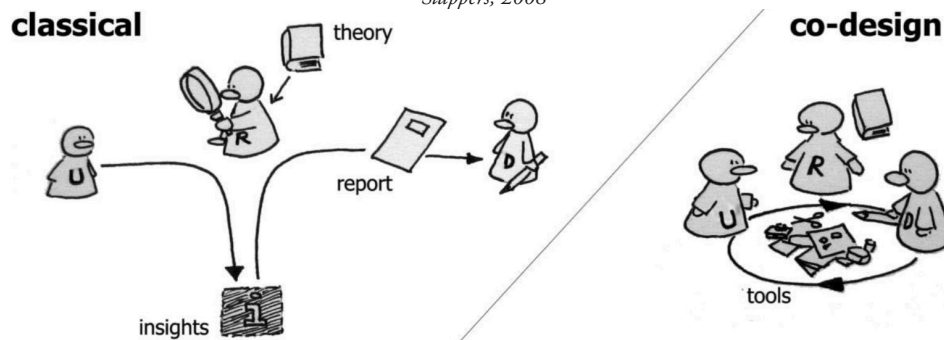


Fig 2.-Classical roles of users, researchers and designers in the design process (on the left) and how they are merging in co-designing process (on the right) -Graphic by Sanders and Stappers, 2008

According to Sanders and Stappers, even though co-design and co-creation are terms that are being used just during the past years, the practice of collective creativity has been used for around 40 years under the term “participatory design”. This was used mainly in Nordic countries and used to increase the value of industrial production by engaging the users in the development of the systems for the workplaces. The approach, thus, built on the workers’ own experiences and provided them with the resources to be able to act in their current situation (Bodker, 1996).

Co-creation practiced on an early stage of the design process tends to have a positive impact with long-range consequences, however, participatory design is getting importance in the interior design of workspaces. The decisions and outcomes created in this stage may vary, but they are helping to reconfigure the way of interior design in a more holistic way by understanding humans in the most basic level. (Institute of Noetic Sciences, 2007)

Techniques used for the concept development such as co-creation and co-design, explain how they work and how this helps designers to have a most accurate -and efficient -design, merging tangibles and intangibles, which ideally become more sustainable.

Co-designing require creative initiative on the part of the entire team: researchers, designers, clients and the people who will ultimately benefit from the co-designing experience (Sanders and Stappers, 2008). We are not only designing interiors, but furthermore, experiences for interconnected societies. We are moving from the design of categories of “Products” to designing people’s purposes -from space design to emotion design, from architecture to serving, from planning to transforming -where the designer gains the skills needed to expertly conceive and give shape to products such as brand identities, interior spaces, buildings, etc. (Sanders, Stappers, 2008).

**2.1 Case Study – Gusto by Gensler – San Francisco, CA <sup>5</sup>**

Apple Park employees were said to be ‘in revolt’ over Norman Foster’s valley of a plan in their new headquarters. Gensler saw in this as an opportunity to draw a flexible line: in order to make working styles as democratic as possible, instead of equalizing they decided to respect the preferred layout of each team member. During the design process, workshops and questionnaires were filled by each of the 500 employees where they could choose from a variety of spaces, both open and enclosed, public or private, to accommodate their focus styles. Therefore, co-creating the spaces as the end users desired them and following the linings and forms of the company.

<sup>5</sup>(data retrieved from:https://www.frameweb.com/news/gensler-gusto-headquarters; www.gensler.com).



They involved in a HR services company to -by the development of several workshops -understand the main transformation to be integrated into its human resources and to create a menu of furniture and finishes (FF&E) to define the look and feel of the new space. They created an opening day tour using VR tech allowing their employees understand how would spaces look like. This process not only helped Gusto workers and Gensler designers to have a complete user-based outcome but gave the employees a sense of ownership and compromise them with the brand, bringing positive results not only in the wellbeing of the workers but also in their working development.



*Picture retrieved from: [www.gensler.com](http://www.gensler.com)*



*Picture retrieved from: [www.gensler.com](http://www.gensler.com)*

### 3. WORKSPACES & SUSTAINABILITY

The way of designing workspaces needs to have a drastic change from the way it was practiced in the beginning of time. Aforetime, the purpose of working places was entirely functional, subsequently people wanted places with an aesthetical value, reason why interior designers had to work harder to please their clients. Later, ergonomics and hi-tech came into the scene, challenging designers in another level at the time of designing them.

“The environmental issue, understood as the impact of the production-consumption system on ecological equilibrium, began to be raised on the second half of the 1960’s, as a consequence of the accelerating and spreading industrialization” (Vezzoli, Kothala, Srinivasan, 2014)

Due to the consumerism and abuse of resources in which the world has been living in the past decades, there is now a lack of resources. This evidence has brought new generations to the demand of new practices, where sustainability and “echo-building” prevail in the scene. Thus, interior designers have a big role since they can create a big impact on the environment by designing in a sustainable way and by choosing the right finishings, products and furniture used in a workspace understood within all the life stages of the product.

According to the book of Product Service-System Design for Sustainability (Vezzoli, Kothala, Srinivasan, 2014), there are different practices in design to reduce or eliminate the negative impact in the environment by the comprehension of the life cycles applied to interiors. Sustainable design needs to be practiced on many dimensions

(fig. 3), such as environmental, economic and socio-ethical, looking after the wellbeing of the users and the equity of resources on society. (Vezzoli, Kothala, Srinivasa, 2014).

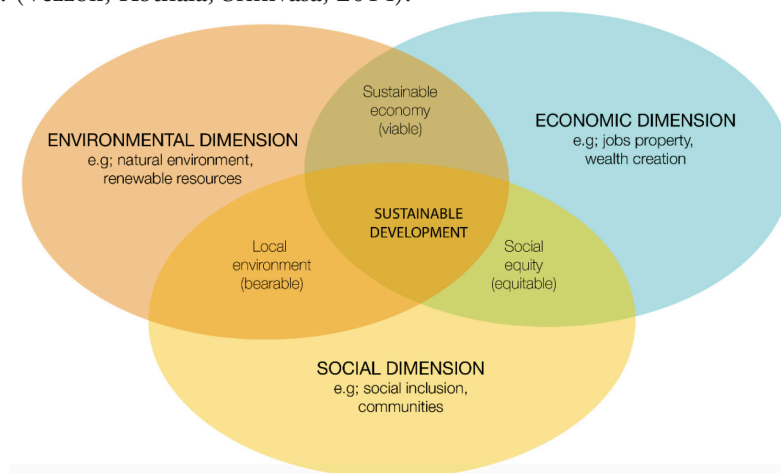


Fig 3.-Dimensions of sustainability

There are many theories and researches about the selection of materials and energy resources with low environmental impact through the different life cycle stages of a product. Topics as selection of toxic and harmful materials, recyclability and incineration, taking in account that design for recycling and reuse must cover all the life stages (Fig. 4) (collection, transportation, disassembly, cleaning, identification and production of secondary raw materials and identifying the opportunities for the re-application).

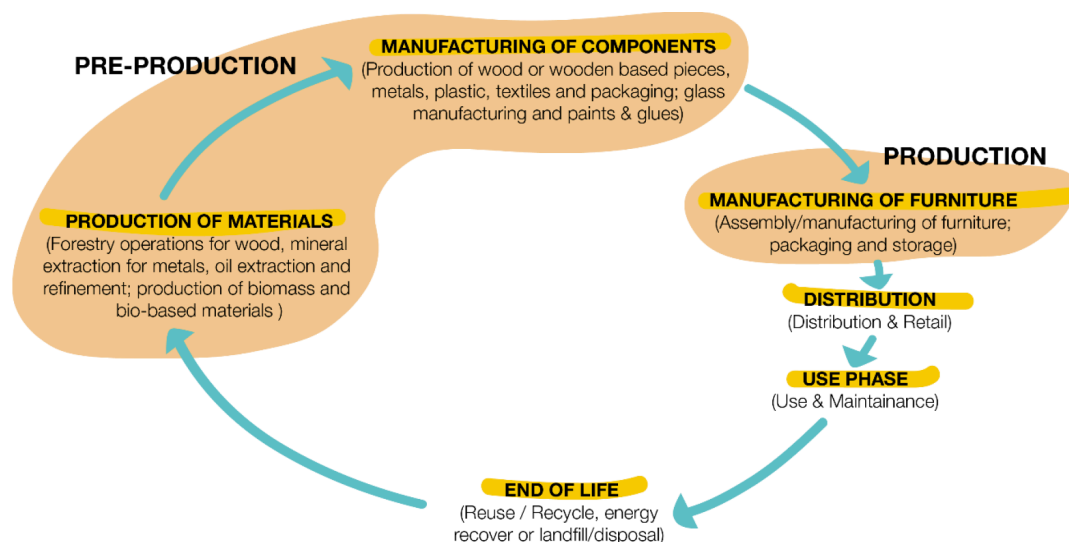


Fig.-4 -Life Cycle Stages of a Product

One ongoing debate intersubjective of biodegradability: an environmental quality that has raised many misinterpretations. It is important for materials to be re-integrable with ecosystems. Many biodegradable materials may pose a problem in the sense of a premature expiration date; this in turn creates new production and distribution processes for both substituting and discarding reasons. (Vezzoli, Kothala, Srinivasan, 2014)

In order to create an eco-efficient system, there exist different design criteria 'sand guidelines to be practiced where the optimization of resources, the efficiency of distribution, the waste minimization and the toxicity reduction can bring the whole system to have a lower impact and in the same time to be more efficient comprehending the different environmental dimensions

Thus, when designing a workspace, it is necessary to understand the impact that a product or a whole workspace carries by the comprehension of the LCA through all its phases. To take the right and conscious decisions at the time of selecting the pieces, being aware of the impact created through all the life of the products while understanding how these can be optimized, especially during the use phase and end of life phase -since are the ones that concern more to the workspace, and therefore to the end users -.

Some efficient practices are by using service-systems to prolong the life phase, where repairing, adapting and relocating furniture helps to decrease the impact by boosting the life of a product or efficiently re-inserting it by using pieces to create a new one.

### 3.1 Case Study – The Edge by Deloitte – Amsterdam, NL

The Edge is a Deloitte Building located in Amsterdam that that opened its doors on 2015. It is promoted as "the greenest & most intelligent building in the world" (the British rating agency BREEAM, gave it the highest sustainability score ever awarded: 98.4 p%). They use service-system with the help of IoTs to shape the way the

user works, personalizing the needs and preferences of lighting, temperature control and space management. Smartphones rule this place, everything works through an app that lets the workers find colleagues, adjust the heating of their workstation and manage their daily routines.

Approaching the environmental perspective, the energy building resources come from solar panels which create more electricity than the actual consumption of the building. About 2500 workers share 1000 desks, using the “hot desking” concept with the goal of encouraging human interaction between the workers. Besides it hosts cafes, exhibition area and conference rooms. Work, space is more focused on the tasks that need to be done and the community that can be created in between the workers.

Ron Bakker, architect of the Edge at London-based PLP Architecture. “We’re starting to notice that office space is not so much about the workspace itself; it’s really about making a working community, and for people to have a place that they want to come to, where ideas are nurtured, and the future is determined.”

Deloitte’s proposal, is a good practice worth to follow since from all the dimensions of environmental consciousness. It does not only approach sustainability on the environmental dimension, but also on the socio-ethical dimension, since they look after the wellbeing of the users by personalizing the preferences and needs of each of the user with the service system run by an internal app where everyone can personalize the space to be used according to their needs. Besides, thanks to the solar panel system used, the savings in energy are worth the investment that the company did.



[Figure 5,6] Photo by Raimond Wouda

#### 4. ENVIRONMENTAL IMPACT APPLIED TO WORKSPACES

Due to the environmental effects caused by consumerism and the excess of industry production, use and disposal, during the ‘90s the attention moved to the environmental impact through a products life cycle (Keoleian and Menerrey 1993; Brezet and Hemel 1997; Manzini and Vezzoli 1998; Tischner et al. 2000; Hemel 2001; Heiskanen 2002; Ryan 2003; Sun et al. 2003; ISO 14062 2002; Nes and Cramer, 2006).

In order to understand sustainability and its implications, it is needed to understand three interlinked dimensions, the first one is the environmental dimension, where the main task is to produce without degrading the world and its resources. The second one is a socio-ethical dimension, referred to the equal redistribution of the natural resources -based on the ideology that everyone has the same access to global natural resources -. Finally, the economic dimension, understood as economical practicable solutions in a more or less norm-oriented market.

New methodologies of assessing the environmental impact of products were developed, from them, the most accepted is the Life Cycle Assessment (LCA). The most important approaches worth to mention were:

- The concept of the life cycle approach -to design and understand all the life cycle stages -activities needed to produce the materials, parts, etc.-of a product, ways of distribution until the disposal of it.
- The functional approach -the evaluation of product environmental sustainability, beginning from its function rather than the physical embodiment of the product itself.

As exposed before, due to the radical changes held in the behaviors and the consumption of societies, the attention moved to design for eco efficient Product-Service Systems where “the result of an innovative strategy that shifts the center of business from the design and sale of (physical) products alone, to the offer of product and service systems that are together able to satisfy a particular demand” (UNEP, 2002). Therefore, the design conceptualization process needs to be expanded from a purely functional approach to a satisfaction approach, to have as an outcome a wider service-system that fulfills the demands, needs and desires of the final user-. (Vezzoli, 2003a)

## 5. HOW CAN WORKSPACES BE MERGED WITH PSSD METHODOLOGIES?

As exposed before, PSSD looks after sustainable products or services based in a deep research user-based through different methodologies used in the research phase. But what if the product became the place where people walks in, interacts, lives and work? That is the case with interior design and therefore, to workspaces. All the spaces we enter and interact, work and spend our daily life affect our piques, feelings and more, therefore, it is very important to consider the interaction that the user will have with the workspace at the time of designing it.

Within this framework, the discipline of Design for Sustainability has emerged, which in its broadest and most inclusive meaning could be defined as: “a design practice, education and research that, in one way or another contributes to sustainable development”<sup>5</sup>

Some authors adopt a more stringent definition of Design for Sustainability: e.g. Tischner (2010) argues that Design for Sustainability requires generating solutions that are equally beneficial to the society and communities around us (especially unprivileged and disadvantaged populations), to the natural environment, and to economic systems (globally but especially locally).

Product-service systems can be applied into workspaces by being approached through different aspects of sustainability. The first one, approaching the socio-ethical dimension, designers can work as moderators and leaders of workshops in the early stages of the design process to understand the users in a higher level by co-designing with them, letting them to be the co-creators of the space and services that they will use afterwards, therefore the workspace outcome will adapt better to the needs and desires of the workers and in parallel the links to the traditional or non-traditional working space will be stronger .

On a later stage, approaching the environmental dimension, the comprehension and the efficient designation of materials, finishings and furniture that are included inside the workspace are fundamental to make the place have a lower impact into the environment. In these stages it is fundamental to cognize the life cycle assessments of the whole workspace through the different life stages, being conscious not just of the production or pre-production of a material but also of the end of life of the product and how this can be reused or recycled.

Finally, on the economical dimension, the creation of product-service systems can lead to a more conscious design by creating systems that may not only include interiors but entire PSS that let workspaces be more efficient and cover the needs of the users by approaching different perspectives. In the same time, by simplifying the systems and making them more efficient, the economical savings can rise to considerable amounts thanks to the reduce of energy consumption, products maintenance, between others.

At a system innovation level not only products, services and production systems are optimized, and new ways of satisfying consumption needs are found within existing institutional frameworks and infrastructures, but new infrastructures, spatial planning and incentive systems are developed and implemented that promote more sustainable lifestyles (Tukker, Tischner 2006).

## 6. CONCLUSIONS

The evolution in economy and lifestyles between other factors, have led to the creation of new working models in society. Due to these changes of behaviors, the priorities have mutated from owning to experiencing, therefore, designers now need not only to design products but furthermore intangibles that satisfy the needs of the end user.

Traditional offices are prevailing in the system while non-traditional models such as co-working spaces and hubs are appearing in the scene, bringing innovative spaces and services to different users with the main goal of creating community. Meanwhile, companies that work on the traditional model, are paying more attention to the user by creating spaces and services supporting the wellbeing of the workers.

Both, traditional and non-traditional models look on behalf to the sustainable workspace where three main aspects are taken in account: environmental, economic and socio-ethical (Vezzoli, Kohtala, Srinivasan, 2014). When applying these aspects to workspaces it becomes challenge for designers to create a system in which sustainability works in a holistic way.

From the socio-ethical point of view, workspaces need to be user based. This means they should be created with and for the user by co-designing with them. This product-service system design methodologies are developed in the early stages of design and are meant to understand the needs and desires of the users to achieve better results in the final workspace system. It is proved that in spaces where the user is more comfortable, and the environment is pleasant, the psychological and physical health of the users is better. In addition, by compromising and involving the workers in the design stages, the loyalty with the company, effectiveness and performance in work is higher.

Finally, to decrease the environmental impact it is necessary to research and comprehend the carbon footprint

that we leave with each material, finishing or lighting equipment that is included in a space. Therefore, as interior designers it is highly important to pay attention to the life cycle assessments to understand the impact that each of these pieces create through all the life cycle stages. These good practices help to take better decisions at the time of designing and will have a tremendous impact on the environment through time by having an efficient system with a low impact on the environment.

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