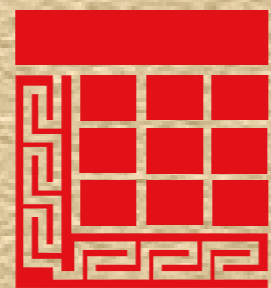


29 TH ANNUAL CONFERENCE
**INTERNATIONAL GROUP FOR
LEAN CONSTRUCTION**



IGLC 2021



July 14 - 17, 2021
LIMA, PERÚ



PUCP

IGLC 2021

Pontifical Catholic University of Perú
Civil Engineering - Department of Engineering

<http://conferencia.pucp.edu.pe/iglc2021/>

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PRESENTATION



Founded in 1993, the IGLC (www.iglc.net) is an international network and community of researchers from practice and academia in architecture, engineering, and construction (AEC) who feel that the practice, education, and research within the AEC industry has to be radically renewed in order to respond to the global challenges ahead.

We call our vision “Lean Construction”. Our goal is to better meet customer demands and dramatically improve the AEC process as well as product. To achieve this, we are developing new principles and methods for product development and production management specifically tailored to the AEC industry, but akin to those defining lean production that proved to be so successful in manufacturing.

In contrast to other industry organizations, the distinguishing trait of the IGLC is its emphasis on theory. We view that the lack of an explicit theory has been a major bottleneck for the progress in the AEC field. Conversely, we assume that the clarification of the theoretical foundation, along with principles and methods emanating from the new foundation, would be the most effective means for the renewal of the AEC industry.

The IGLC lay the foundation for the establishment of the Lean Construction Institute (US) in 1997, subsequent LCI affiliate organisations around the globe and other related organisations such as the Project Production System Laboratory (P2SL) UC Berkeley, Centre for Lean Projects, Nottingham Trent University; Project Production Institute to name but a few.

New principles, methods and practices for project delivery and production management specifically tailored to the AEC industry are constantly being designed, developed, and tested by the IGLC community. The output is showcased and reported in conference proceedings every year. The IGLC repository (iglc.net) is free to access and is the recognised body of knowledge on lean design and construction with over 1500 conference papers searchable by keyword and authors. Much of the lean principles, methods and practices used by today’s AEC industry stem from original IGLC research.

Annual conferences are the main activity of the IGLC, and their locations rotate amongst the continents. Due to the current global situation and the positive feedback received from the 28th IGLC Annual Conference organised by UC Berkeley, the 29th IGLC Annual Conference will be held 100% online and organised by the Pontifical Catholic University of Peru.

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Dr Fernando Flores

Universidad Católica de Chile

Entrepreneur, author, owner of numerous patents on the action/language approach to software design, Dr. Fernando Flores is regarded as a world class expert on how people work together to get things done. His work and writings have been discussed in thousands of publications and are taught at leading universities around the world. His insights on technology, language and management has led to a new theory of work that has had many practical applications in education and in the corporate world. He and his colleagues have worked with Fortune 500 companies from a wide array of industries, including banking, computing, manufacturing and construction. See, for example, <http://www.learning-org.com/97.06/0023.html>

After finishing his work as Senator in Chile, Dr. Flores returned to the United States, and co-founded Pluralistic Networks, Inc., a company focused on helping people and organizations to develop skills and sensibilities that are crucial for effective collaboration in pluralistic networks and for navigating an era of constant change and uncertainty.

Dr. Flores is the author of a number of books, including: *Understanding Computers and Cognition: A New Foundation for Design* (with Prof. Terry Winograd); *Building Trust: In Business, Politics, Relationships and Life* (with Prof. Robert Solomon); and *Conversations for Action and Collected Essays: Instilling a Culture of Commitment in Working Relationships*. Dr. Flores has a degree in Industrial Engineering from the Universidad Católica de Chile, and an interdisciplinary PhD in philosophy, operations research and management from the University of California at Berkeley.



Dr Guilherme Luz Tortorella

Universidad de Melbourne

PhD in Production Engineering and is a Senior Lecturer in Industrial Engineering at the University of Melbourne. With twelve years of experience as a Manufacturing Manager in the automotive industry, and seven years as a Professor and Consultant, he has worked in Brazil, Uruguay, Mexico, Australia, the USA and UK. He is the author of more than 160 research articles published in peer-reviewed and high-impact journals, 15 book chapters and 3 books. He is the Editor-in-Chief of the *Journal of Lean Systems* and an Associate Editor of the journals *Operations Research Management and Production*.

PROGRAM

Wednesday 14th, 2021

08:00-08:20 Lima Time	Welcome to IGLC29 Chairs: Dr Leonardo Rischmoller; Dr Danny Murguia Technical Chairs: Assoc. Prof. Vicente A. Gonzalez; Prof. Luis F Alarcon	
08:20-09:20 Lima Time	Keynote 1: Trust, emotionality, relationships, and productivity - some reflections for the construction industry - Dr Fernando Flores	
09:30-10:30 Lima Time	PLENARY SESSION 1 Chair: Prof. Carlos Formoso	
10:45-11:45 Lima Time	Parallel Session 1 CONTRACT AND COST MANAGEMENT Chair: Dr Cynthia Tsao	Parallel Session 2 ENABLING LEAN WITH INFORMATION TECHNOLOGY Chair: Assoc. Prof. Olli Seppanen
12:00-13:00 Lima Time	Parallel Session 1 PRODUCTION PLANNING AND CONTROL 1 Chair: Assoc. Prof. Farook Hamzeh	Parallel Session 2 LEAN AND BIM 1 Chair: Dr Clarissa Bioto
13:15-14:15 Lima Time	Parallel Session 1 PRODUCTION PLANNING AND CONTROL 2 Chair: Assoc. Prof. Farook Hamzeh	Parallel Session 2 LEAN AND BIM 2 Chair: Dr Clarissa Bioto
14:30-15:30 Lima Time	Parallel Session 1 PRODUCTION PLANNING AND CONTROL 3 Chair: Dr Shang Gao	Parallel Session 2 LEAN THEORY 1 Chair: Prof. Carlos Formoso
15:45-16:45 Lima Time	Parallel Session 1 PRODUCTION PLANNING AND CONTROL 4 Chair: Dr Mani Poshdar	Parallel Session 2 LEAN THEORY 2 Chair: Prof. Carlos Formoso

Thursday 15th, 2021

08:00-08:20 Lima Time	Gregory Howell Lean Game Session	
10:30-11:30 Lima Time	Parallel Session 1 LEARNING AND TEACHING LEAN 1 Chair: Assoc. Prof. Zofia Rybkowski	Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 1 Chair: Dr James Smith
11:45-12:45 Lima Time	Parallel Session 1 LEARNING AND TEACHING LEAN 2 Chair: Assoc. Prof. Zofia Rybkowski	Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 2 Chair: Dr James Smith
13:00-14:00 Lima Time	Parallel Session 1 LEARNING AND TEACHING LEAN 3 Chair: Assoc. Prof. Min Liu	Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 3 Chair: Prof. Emuze Fidelis
14:15-15:15 Lima Time	Parallel Session 1 PRODUCT DEVELOPMENT AND DESIGN MANAGEMENT 1 Chair: Dr Dani Dietz	Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 4 Chair: Prof. Emuze Fidelis
15:30-16:30 Lima Time	Parallel Session 1 PRODUCT DEVELOPMENT AND DESIGN MANAGEMENT 2 Chair: Dr Dani Dietz	Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 5 Chair: Prof. Emuze Fidelis

Friday 16th, 2021

08:00-09:00 Lima Time	"Keynote 2: Integrating Industry 4.0 into Lean Dr Guilherme Luz Tortorella"		
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10:30-11:30 Lima Time	Parallel Session 1 SUPPLY CHAIN MANAGEMENT AND OFF-SITE CONSTRUCTION 1 Chair: Dr Emmanuel Daniel	Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 6 Chair: Annett Schöttle	Parallel Session 3 SAFETY, QUALITY, AND GREEN-LEAN 1 Chair: Dr Laura Florez
11:45-12:45 Lima Time	Parallel Session 1 SUPPLY CHAIN MANAGEMENT AND OFF-SITE CONSTRUCTION 2 Chair: Dr Emmanuel Daniel	Parallel Session 2 PRODUCTION SYSTEM DESIGN Chair: Assoc. Prof. Frode Drevland	Parallel Session 3 SAFETY, QUALITY, AND GREEN-LEAN 2 Chair: Dr Laura Florez
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15:00-15:30 Lima Time	"Conference Closing Session Chairs: Dr Leonardo Rischmoller; Dr Danny Murguia Technical Chairs: Assoc. Prof. Vicente A. Gonzalez; Prof. Luis F Alarcon"		

Wednesday 14th, 2021

Parallel sessions 08:00 - 13:00

08:00-08:20 Lima Time	Keynote 1: Trust, emotionality, relationships, and productivity - some reflections for the construction industry - Dr Fernando Flores		
09:30-10:30 Lima Time	PLENARY SESSION 1 Chair: Prof. Carlos Formoso		
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Wednesday 14th, 2021

Parallel sessions 13:15 - 16:45

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119	LAST PLANNER® SYSTEM IMPLEMENTATION HEALTH CHECK Power, William; Sinnott, Derek; Lynch, Patrick; Solorz, Chris	148	REALITY CAPTURE CONNECTING PROJECT STAKEHOLDERS McHugh, Kevin; Koskela, Lauri; Tezal, Algan
14:30-15:30 Lima Time	Parallel Session 1 PRODUCTION PLANNING AND CONTROL 3 Chair: Dr Shang Gao	Parallel Session 2 LEAN THEORY 1 Chair: Prof. Carlos Formoso	
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167	LAST PLANNER® SYSTEM ON THE MINNEVIKA BRIDGE PROJECT Daliri, Sajad; Young, Brendan; Ladre, Ola	156	BROUGHT BY DEGREES: A FOCUS ON THE INDICATORS OF LEAN 'SMARTNESS' IN SMART CITIES Collins, Dave; Johansen, Agnar; Hamdy, Mohamed; Temeljotov-Salaj, Alenka; Kalsaas, Bo Terje
147	APPLICATION OF INFORMATION THEORY IN LAST PLANNER® SYSTEM FOR WORK PLAN RELIABILITY Sharma, Anjali Brahmanand; Trivedi, Jyoti Snehal	182	THE LIFECYCLE VALUE OF FACILITY MANAGEMENT PROFESSIONALS Thompson, Benjamin Ray; Nassereddine, Hala
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15:45-16:45 Lima Time	Parallel Session 1 PRODUCTION PLANNING AND CONTROL 4 Chair: Dr Mani Poshdar	Parallel Session 2 LEAN THEORY 2 Chair: Prof. Carlos Formoso	
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111	A MODEL TO LINK TAKT SCHEDULE AND OPERATIONS IN CONSTRUCTION Lerche, Jon; Neve, Hasse; Gross, Allan; Wandahl, Søren	188	THE ETHICAL AND SOCIAL DILEMMA OF AI USES IN THE CONSTRUCTION INDUSTRY Arroyo, Paz; Schöttle, Annett; Christensen, Randi
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Thursday 15th, 2021

Parallel sessions 08:00 - 12:45

08:00-10:00 Lima Time	Gregory Howell Lean Game Session			
	Room 1: TVD simulation (TVD for digital fabrication)		Facilitators: Ming Shan Ng (Charmaine) and Daniel M. Hall	
	Room 2: TVD Simulation		Facilitators: Ganesh Devkar, Gerogie Jacob, Nimish Sharma and Shaurya Bhatnagar	
	Room 3: Batch, Pull, Balance		Facilitator: Colin Milberg	
	Room 4: Mistakeproofing		Facilitator: Iris D. Tommelein	
	Room 5: 5S Puzzle		Facilitators: Rajeswari Obulam, under guidance of Dr. Zofia K. Rybkowski	
	Room 6: Parade of Trades		Facilitator: Cynthia Tsao	
10:30-11:30 Lima Time	Parallel Session 1 LEARNING AND TEACHING LEAN 1 Chair: Assoc. Prof. Zofia Rybkowski		Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 1 Chair: Dr James Smith	
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	203	"VIRTUAL PARADE GAME FOR LEAN TEACHING AND LEARNING IN STUDENTS FROM BRAZIL AND CHILE Biotto, Clarissa N.; Herrera, Rodrigo F.; Salazar, Luis Arturo; Perez, Cristina T.; Luna, Roberto M.; Rodigheri, Priscila; Serra, Sheyla"	194	"THE TOYOTA KATA METHODOLOGY FOR MANAGING THE MATURITY LEVEL OF LAST PLANNER SYSTEM® Perez Apaza, Jose Fernando; Ramírez Valenzuela, Ronald André; Perez Apaza, Juan Diego"
	149	"LEAN CONSTRUCTION AND ORGANIZATIONAL KNOWLEDGE CREATION Trentin, Bianca Taís; Etges, Bernardo Martim Beck da Silva"	114	"RESULTS OF KEY INDICATORS FROM LINGUISTIC ACTION PERSPECTIVE IN PANDEMIC: CASE STUDY Salazar, Luis Arturo; Pardo, Daniela; Guzmán, Sebastián"
11:45-12:45 Lima Time	Parallel Session 1 LEARNING AND TEACHING LEAN 2 Chair: Assoc. Prof. Zofia Rybkowski		Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 2 Chair: Dr James Smith	
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	117	"TEACHING TARGET VALUE DESIGN FOR DIGITAL FABRICATION IN AN ONLINE GAME: OVERVIEW AND CASE STUDY Ng, Ming Shan; Hall, Daniel Mark"	123	"AGENCY PROBLEMS AS A DRIVER FOR CRIME IN THE AEC-INDUSTRY Lohne, Jarder; Drevland, Frode Olav; Lædre, Ola"
	190	"DEVELOPMENT AND TESTING OF A SIMULATION GAME ON WASTE ELIMINATION USING LEAN PRACTICES Bhatnagar, Shaurya; Devkar, Ganesh"	180	"FEASIBILITY OF STAKEHOLDER MANAGEMENT TO IMPROVE INTEGRATION AND COMMUNICATION USING BIG ROOM, LEAN CONSTRUCTION, PMBOK AND PRINCE2 IN MULTIFAMILY PROJECTS IN TIMES OF CHANGE Sosa Córdova, Alvaro Augusto; De La Torre Salazar, Jorge Ronald"

Thursday 15th, 2021

Parallel sessions 13:00 - 16:30

13:00-14:00 Lima Time	Parallel Session 1 LEARNING AND TEACHING LEAN 3 Chair: Assoc. Prof. Min Liu	Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 3 Chair: Prof. Emuze Fidelis
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152	"DEVELOPMENT AND TESTING OF THE 5S PUZZLE GAME Obulam, Rajeswari; Rybkowski, Zofia"	158 "TRUST AND CONTROL IN THE CONTEXT OF INTEGRATED PROJECT DELIVERY Haghsheno, Shervin; Vãth, Cornelius; Schmidt, Jan-Simon; Hanau, Anna; Frantz, Lena; Budau, Maximilian Rolf-Dieter"
185	"TARGET VALUE DESIGN: DEVELOPMENT AND TESTING OF A VIRTUAL SIMULATION Jacob, Georgie; Sharma, Nimish; Rybkowski, Zofia K.; Devkar, Ganesh"	176 "LIVING LABS IN A LEAN PERSPECTIVE Soliman-Junior, Joao; Awwal, Samira; Bridi, Marcelle Engler; Tzortzopoulos, Patricia; Granja, Ariovaldo Denis; Koskela, Lauri; Gomes, Danilo"
14:15-15:15 Lima Time	Parallel Session 1 PRODUCT DEVELOPMENT AND DESIGN MANAGEMENT 1 Chair: Dr Dani Dietz	Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 4 Chair: Prof. Emuze Fidelis
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144	"STABILITY OF DESIGN PROCESS – OBSERVATIONS OF BATCH SIZE, THROUGHPUT TIME AND RELIABILITY IN DESIGN Lappalainen, Eelon Mikael; Uusitalo, Petteri; Seppänen, Olli; Peltokorpi, Antti"	207 "ASSESSING IMPACT OF ORGANIZATIONAL CHANGE FOR A SYSTEMS APPROACH TO QUALITY Gordon, Elizabeth Ann; Rawlinson, Keila; Reed, Dean"
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Friday 16th, 2021

Parallel sessions 08:00 - 15:30

08:00-09:00 Lima Time	Keynote 2: Integrating Industry 4.0 into Lean Dr Guilherme Luz Tortorella					
09:15-10:15 Lima Time	PLENARY SESSION 2 Chair: Prof. Iris Tommelein					
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	113	"IMPLEMENTING TAKT PRODUCTION IN RENOVATION PROJECTS Sahlberg, Jenni; Lehtovaara, Joonas; Seppänen, Olli"				
	146	"EXPLORING VISUAL MANAGEMENT PURPOSES Brandalise, Fernanda Marisa Pasinato; Pedó, Bárbara; Viana, Daniela Dietz; Formoso, Carlos Torres"				
10:30-11:30 Lima Time	Parallel Session 1 SUPPLY CHAIN MANAGEMENT AND OFF-SITE CONSTRUCTION 1 Chair: Dr Emmanuel Daniel	Parallel Session 2 PEOPLE, CULTURE, AND CHANGE 6 Chair: Annett Schöttle	Parallel Session 3 SAFETY, QUALITY, AND GREEN-LEAN 1 Chair: Dr Laura Florez			
	189	"USE OF VALUE STREAM MAPPING IN A CASE STUDY IN BASEMENT CONSTRUCTION Espinoza, Lisseth R.; Herrera, Rodrigo F.; Brioso, Xavier"	104	"GETTING SOUTH AFRICAN CONTRACTORS TO THINK AND ACT LEAN: A CASE STUDY Emuze, Fidelis Abumere; Mpembe, Willem"	193	"THE IMPACT OF IMPLEMENTING A SYSTEM APPROACH TO QUALITY: A GENERAL CONTRACTOR CASE STUDY Gordon, Elizabeth; Rawlinson, Keila; Eldamhoury, Ebrahim; Reed, Dean; Marosszeky, Marton"
	121	"A CONCEPTUAL MODEL TO DETERMINE THE IMPACT OF OFF-SITE CONSTRUCTION ON LABOUR PRODUCTIVITY Dijkhuizen, Martin J. van; Vrijhoef, Ruben; Bakker, Hans L.M."	125	"LEAN TEAMS AND BEHAVIORAL DYNAMICS: UNDERSTANDING THE LINK Asadian, Elnaz; Leicht, Robert M"	201	"BUILDING QUALITY BUILDERS: LESSONS LEARN FROM A COMPANYWIDE TRAINING ON BEHAVIOR-BASED QUALITY Arroyo, Paz; Gomez, Sulyn"
	132	"REVIEW OF CONSTRUCTION SUPPLY CHAIN OPTIMIZATION PAPERS FOR PERFORMANCE IMPROVEMENT Atiq Ur Rehman, Muhammad; Chaabane, Amin; Ahmed Khan, Sharfuddin"	129	"CHALLENGES OF VIRTUAL DESIGN AND CONSTRUCTION IMPLEMENTATION IN PUBLIC PROJECTS Prado Lujan, Guillermo"	138	"CONTRIBUTION OF UAS MONITORING TO SAFETY PLANNING AND CONTROL Lima, Mahara Iasmine Sampaio Cardoso; Melo, Roseneia Rodrigues Santos de; Costa, Dayana Bastos"
	155	"CHALLENGES IN INDUSTRIALIZED RENOVATION OF APARTMENT BUILDINGS Pikas, Ergo; Seppänen, Olli; Koskela, Lauri; Peltokorpi, Antti"	173	"AN EXPLORATORY STUDY OF THE MAIN BARRIERS TO LEAN CONSTRUCTION IMPLEMENTATION IN PERU Huaman Orosco, Cristian; Erazo-Rondinel, Andrews Alexander"		
11:45-12:45 Lima Time	Parallel Session 1 SUPPLY CHAIN MANAGEMENT AND OFF-SITE CONSTRUCTION 2 Chair: Dr Emmanuel Daniel	Parallel Session 2 PRODUCTION SYSTEM DESIGN Chair: Assoc. Prof. Frode Drevland	Parallel Session 3 SAFETY, QUALITY, AND GREEN-LEAN 2 Chair: Dr Laura Florez			
	120	"REDUCING CONSTRUCTION LOGISTICS COSTS AND EMBODIED CARBON WITH CCC AND KITTING: A CASE STUDY Berroir, Fabrice; Guernaccini, Pierre; Boje, Calin; Maatar, Omar"	118	"TAKT PRODUCTION AS OPERATIONS STRATEGY: CLIENT'S PERSPECTIVE TO VALUE-CREATION AND FLOW Lehtovaara, Joonas; Heinonen, Alekski; Ronkainen, Miika; Seppänen, Olli; Peltokorpi, Antti"	215	"IMPLEMENTATION OF LEAN CONSTRUCTION AS A SOLUTION FOR THE COVID-19 IMPACTS IN RESIDENTIAL CONSTRUCTION PROJECTS IN LIMA, PERU Veran, Daniel; Brioso, Xavier"
	128	"EARLY DUE LOW UNCERTAINTY (EDLU) FOR IMPROVING SUPPLY CHAIN PERFORMANCE UNDER ORDER VARIABILITY IN PRECAST CONCRETE PRODUCTION Kim, Taehoon; Kim, Yong-Woo "	150	"LEAN RENOVATION - A CASE STUDY OF PRODUCTIVITY, FLOW, AND TIME IMPROVEMENTS Johansen, Peder; Christensen, Søren; Neve, Hasse H.; Wandahl, Søren"	198	"TAKING THE SUSTAINABILITY OF CONSTRUCTION PROCESSES: AN ENVIRONMENTAL ASSESSMENT METHOD Slosharek, Benjamin; Dlouhy, Janosch; Schneider-Marin, Patricia; Lang, Werner"
	122	"IMPLEMENTATION OF BIM AND LEAN CONSTRUCTION IN OFFSITE HOUSING CONSTRUCTION: EVIDENCE FROM THE UK Marte, Jose; Daniel, Emmanuel; Fang, Yanqing"	205	"PROPOSAL MODEL FOR THE MANAGEMENT OF CONSTRUCTION BASED ON FLOWS - A COMPLEX ADAPTIVE SYSTEM Ramirez Valenzuela, Ronald Andre; Gamarra Diaz, Giancarlo Gilbero; Erazo-Rondinel, Andrews Alexander"		
	171	"BUFFER TYPES AND METHODS OF DEPLOYMENT IN CONSTRUCTION Bataglin, Fernanda Saidelles; Viana, Daniela Dietz; Coelho, Rafael Vigarío; Tommelein, Iris Denise; Formoso, Carlos Torres"	205	"PROPOSAL MODEL FOR THE MANAGEMENT OF CONSTRUCTION BASED ON FLOWS - A COMPLEX ADAPTIVE SYSTEM Ramirez Valenzuela, Ronald Andre; Gamarra Diaz, Giancarlo Gilbero; Erazo-Rondinel, Andrews Alexander"		
13:00-15:00 Lima Time	IGLC Business Meeting - open to all registered conference participants Chair: Thais Alves					
15:00-15:30 Lima Time	Conference Closing Session Chairs: Dr Leonardo Rischmoller; Dr Danny Murguia Technical Chairs: Assoc. Prof. Vicente A. Gonzalez; Prof. Luis F Alarcon					



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