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NEW PARADIGMS FOR ASSESSING INNOVATIONS IN THE TECHNOLOGY SECTOR

*Non-hierarchical, horizontal approaches to empower classroom educators and
technical organizations in dealing with complex issues*

AISE Conference

**2nd International Multi-Conference on Complexity,
Information and Cybernetics (IMCIC, 2011)**

**IIS: International Institute of Informatics & Systems
Orlando, FL 2011**

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PRESENTATION PLAN

- Participative Action Research (PAR)
- Complexity Theory
- Emergent Research Design
 - Non-hierarchical Horizontal Methods
- Case Studies
 - Social justice in Netherlands Classrooms
 - Business Strategy for Novel Engineering Materials
 - Commercialization of Alternate Energy
- Conclusions

Research Questions

- What are the practical and proactive approaches to contemporary social, business and technological problems to achieve:
 - Social Justice
 - Sustainable use of resources
 - Realistic accounting of profit & loss
 - Equitable market participation & competition
 - Value pricing of goods & services

- Can scientific control-theory address the complexity inherent to human interaction in social and business environments?

Scientific Tools Used in Research

- Complexity theory
- Participative Action Research
- Grounded theory
- Emergent research designs
- Horizontal dialogues and participation

These tools can potentially show systematic ways to proactively deal with complex situations in social and technological organizations.

PARTICIPATIVE ACTION RESEARCH

Action research is an emergent enquiry process in which applied behavioral science knowledge is integrated with existing organizational knowledge and applied to solve real organizational problems

- A collective, horizontal, democratic partnership among heterogeneous agents
- Utilizes double-loop learning
- Employs horizontal, innovative forms of dialogue in order to achieve:
 - Processes of shared meaning making
 - Processes of joint strategy making beyond the level of vested interests

COMPLEXITY THEORY

- Replaces a functional, linear scientific ontology of causal explanation with
 - Explanatory accounts based on limited and contextual knowledge
 - Open and unpredictable systems
 - Complex, non-linear interactions between elements
- It leads to emergent properties and self-organizing structures and processes

EMERGENT RESEARCH DESIGN

- A research design which has defined the chief strategy and the main nuts and bolts of the research process (participants, location, data to be collected).
- It makes room for decisions to be taken by the participants, throughout the process
- It reserves space for emergent insights, as a basis for the exact planning of subsequent stages in the research.
- It leads to a *Grounded Theory*, or a theory which is formed or adjusted based on the research process and the collection of data. The underlying assumptions of the theory are tested throughout the research process



CASE STUDY

Social justice in Netherlands Classrooms

Developed as part of the research effort on *Pedagogy, Education and Praxis* (Utrecht University of Applied Sciences)

RESEARCH FOCUS

- To research classroom interaction (behaviour and communication) between teachers and pupils in the light of social justice.
- Social justice, as defined from the point of view of 'doing' rather than 'having' (Young 1990)
- How do teachers comprehend the social processes and relations that they want to achieve in classrooms in terms of social justice?
- What are the dilemmas during the realization of these social processes and relations?
- What is their understanding of the institutional, political and cultural conditions in which they seek to realize social justice in the classroom?

METHODOLOGY: AN EMERGENT DESIGN

Research Instruments	Results
<ul style="list-style-type: none">• Narrative Enquiry <u>Aim:</u> Data collection; empowerment and accommodation of teacher and student researchers; general orientation on the topic	Redefinition of social justice in terms of facilitating the increased potential of self-regulative and self-corrective behaviour of pupils
<ul style="list-style-type: none">• Model for Analyzing Social Justice (Harvey 1996) <u>Aim:</u> To create an analytical instrument for social justice in a meaningful way	Model to analyze social justice in terms of Power, Institutional & Material Practices, Values & Beliefs, Interpersonal Relations, Discourse/ Language (social identities)
<ul style="list-style-type: none">• Model for Describing & Analyzing Critical Moments <u>Aim:</u> To reflect on situations, alternatives, dilemmas.	Detailed focus for the Reconstruction Stage

CHARACTERISTICS OF FOCUS GROUPS

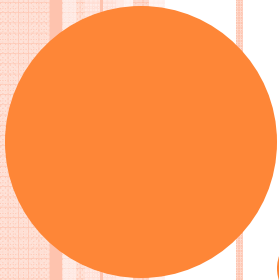
- Consisted of the combined character of group interviews, professionalization and coaching
- Allowed the research community to come to a shared understanding of social justice and to a coordinated focus throughout the research process
- Enabled discussion and “inter-vision”

RESULTS: SHARED UNDERSTANDINGS AND INSIGHTS

- Social justice understood as the facilitation of children in terms of enhancing their self-regulative capacity
- Social justice requires a balance between the seven moments: too much power or emphasis on one of the moments disturbs the balance

RESULTS: SHIFT IN DEFINITION OF DILEMMAS

Narrative enquiry	Do we admit a child or not? Shall I address this one child or shall I give my attention to the group?
Bumpy moments	Shall I intervene or let it go? Shall I intervene now or later?
Reconstruction Stage	What does social justice mean to my responsibility as a teacher? If I want to enhance the self-regulative capacity of the child, then how should I rearrange the interpersonal relation? Should I let go? Should I always do what the child wants? When do I have to use limits and when not?



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CASE STUDY

**Business Strategy for Novel Engineering
Materials**

INNOVATION INSIDE ENTERPRISE RESOURCE PLANNING (ERP) ENVIRONMENTS

- Global finance and manufacturing has led to business methods that optimize supply chains, inventory, manufacturing and R&D
- ERP methods inherently suppress out-of-the-box thinking by stressing risk-minimization
- Innovation is plucked out of day-to-day engineering and enshrined as a specialization

HOW CAN BUSINESS STRATEGIES FOSTER A RICH (COMPLEX) ENVIRONMENT THAT BREATHES INNOVATION?

The logo for PlastiComp, featuring a red stylized wave icon above the company name in a bold, red, sans-serif font.

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MISSION

To forge a partner-based global enterprise that brings transformative technology to the market
“Turnkey designs & uses of lightweight long fiber thermoplastics (LFT) to replace metals for energy conservation”

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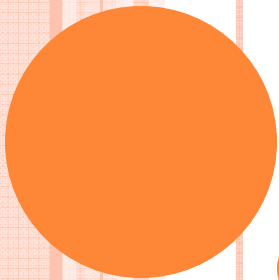
“IT ALL DEPENDS ON EVERYTHING”, STEVE BOWEN, CEO, PLASTICOMP, LLC

- Recognizing, accepting and leveraging complexity is indicative of PAR thinking at corporate levels
- PlastiComp freely licenses proprietary knowledge to multi-nationals, leading to swift creation of global markets. It does not fear loss of market-share, which it thinks of as an imaginary construct, anyway
- Although competition increases, the renewed market activity is better suited to multiple competencies and participations
- Company adopts **value pricing**, whereby, costs of goods and labor is held inviolate, but selling price is differentiated according to customer needs. Statistics have shown this approach to equal or better conventional accounting of product costs.
- Horizontal management participation internally has led to a multi-faceted (multi-talented) image in the industry
- To date, the horizontal interaction has created a company of equal and separate talents with minimal supervision

SNAPSHOT: SUCCESSFUL OUTCOME OF APPLICATION OF PAR METHODOLOGY

PlastiComp Global Business Platform in 5 Years &
Growing





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CASE STUDY

Commercialization of Alternate Energy

TERRAFORE

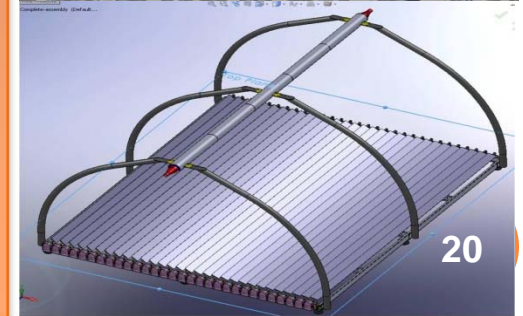
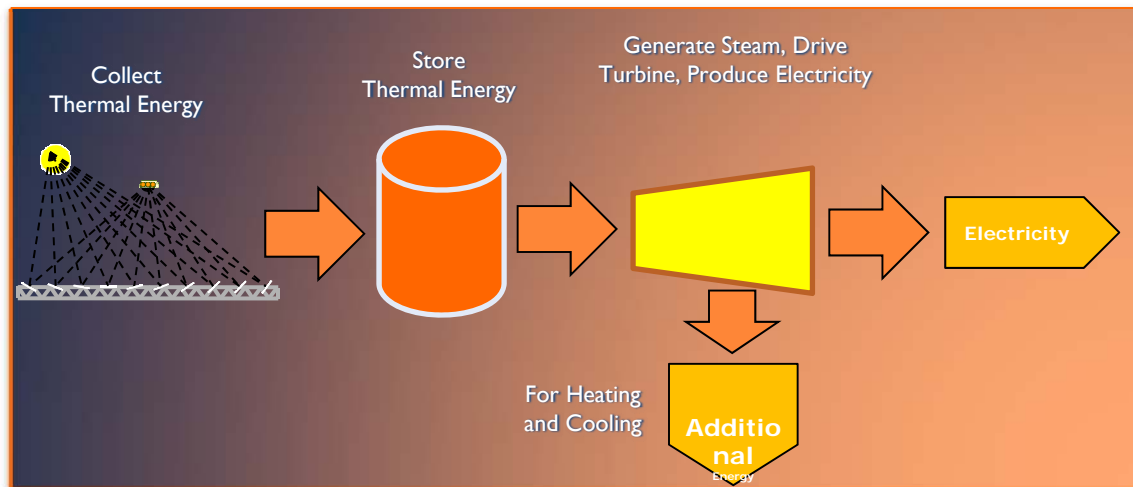


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Mission

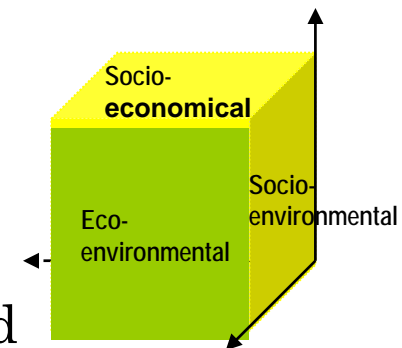
To develop and deploy sustainable and transformative technologies for :

- Efficient use of energy in buildings and industries
- Generating and storing renewable solar energy
- Intelligent control of processes, & commercial buildings



Sustainability initiatives will be forged by a synthesis of the strategic paradox of Profitability vs. Responsibility

- Sustainable or renewable energy is invariably costly over fossil energy when viewed through the lens of the profit & loss financial statements
- Using PAR processes, a horizontal research model is developed. In turn, it establishes equal status for the various stakeholders
- It leads to the “triple-bottom line” where, in addition to the economical impact, the social and environmental impact must also be measured



“SUSTAINABILITY IN THE BROADEST SENSE IS AN APPEAL FOR A NEW SOCIAL ORDER THAT REVISES INSTITUTIONAL AND ORGANIZATIONAL RELATIONSHIPS, SO THAT CHANGES IN ECONOMIC, SOCIAL AND ENVIRONMENTAL DOMAINS ARE AT ONCE TRANSPARENT AND EXPLICIT”

- Presentation of issues and social discourse is also important
 - Use of terms such as ‘subsidies’ when associated with renewable energy creates a negative image for these sustainable resources
 - Setting unrealistic goals such as \$ 1 per watt creates an impression that until this cost goal is achieved renewable energy technology is not ready

“THE ENGINEER IS GIVEN JUST THE *MEANS* TO WORK WITH. THE KNOWLEDGE ABOUT THE ENDS IS LIMITED TO A FEW PROCESS EXPERTS, OR IS LOST AS THE PROCESS DEVELOPS FROM THE LABORATORY TO THE PLANT FLOOR”

- Complexity management require us to exploit multiple knowledge sources and mechanisms to use the information (which are generally heuristic or non-linear) clustered in them
- The advanced recipe was successful in controlling the process. However, a systematic approach (ontology) such as PAR methods is necessary to gather knowledge and must be formalized

CONCLUSIONS: Practical uses of theory

- PAR, with its participative nature, the horizontal relations and its integration of social, technical and contextual knowledge is a firm tool to systematically generate new options and practices
- Complexity Theory helps to study complex realities- rather than viewing it as 'objective' abstractions. It contributes to the knowledge of complex situations and the identification of conditions for improvement
- Emergent designs help to capture multiple perspectives and develop insights for systematic research process

CONCLUSIONS: HARNESSING COMPLEXITY

- Sustainability, or a reckoning of the marginal utility of resources such as alternate energy at *Terrafore*, through the triple-bottom line is an example of harnessing complexity to elicit optimum accounting. The steering of the heat-treatment cycle of fiber-reinforced composites also highlights complexity in optimized manufacturing methods
- Embracing complexity in business strategy at *PlastiComp* led to corporate well-being and value pricing and market expansion and differentiation, so that multiple competencies and agencies emerged to champion innovation
- Horizontal participation in classroom environments, facilitated by *Utrecht University of Applied Sciences* has led to recognizable and actionable mile posts for social justice

CONCLUSIONS: EMPIRICAL MODIFICATION OF LEWIN'S INFLUENTIAL THEORY

- The three case studies point in a direction of an improvement of Kurt Lewin's (1947) influential theory: unfreezing, change, freezing.
- Whereas the original model was based on these sequential steps, our three case studies performed reflection, experimentation and observation in a systematic and simultaneous spiral
- In turn, our revised model gives rise to alternate approaches and beneficial outcomes as described in the three case studies.

Further Research

- What other disciplines need to be combined into a powerful interdisciplinary tool to create a comprehensive ontology for analyzing complex situations?
- Can Critical Discourse Analysis (CDA) as a discipline benefit analyses of complex situations? Existing discourses often reinforce old problems and prohibit adoption of newer, more sustainable social and industrial practices.
- How can policy makers routinely use practice oriented research with other actors (producers, citizens) as presented in the three case studies, to create good governance?

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