



Social Acceptance

*~ threats to effective smart grid deployment
and power systems resilience*

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The Engineering Strait Jacket?

Culture of Disengagement (E A Cech, 2014)

How do students' public welfare beliefs change during their engineering education?

How do engineering programs address social issues?

How does program emphasis affect students' public welfare beliefs?

Science, Technology, and Human Values; January 2014; 30:1; pp42 - 72

The Engineering Strait Jacket?

Culture of Disengagement (E A Cech, 2014)

"Concern and commitment to social welfare declines *significantly* over the course of engineering degree programs"

Engineering programs have ideological pillars that discount social consideration

Science, Technology, and Human Values; January 2014; 30:1; pp42 - 72

Effect on Engineering Design?

Technically effective, socially unacceptable products

Misconceptions of product risk due to distrust

- “Smart meters cause cancer”
- “Smart meters lead to price hikes”
- “the NSA will use the meters to monitor us”
- ...

Why does Social Engagement Matter?

DOE Pillars for Effective Smart Grid Performance

1. Self Healing Capabilities
2. Resilient Operation against Physical or Cyber Attacks

1. Demand Response

Active Customer Participation

Load Smoothing and Dynamic/Responsive Pricing

Study of Consumer Engagement...

Technology Acceptance Model

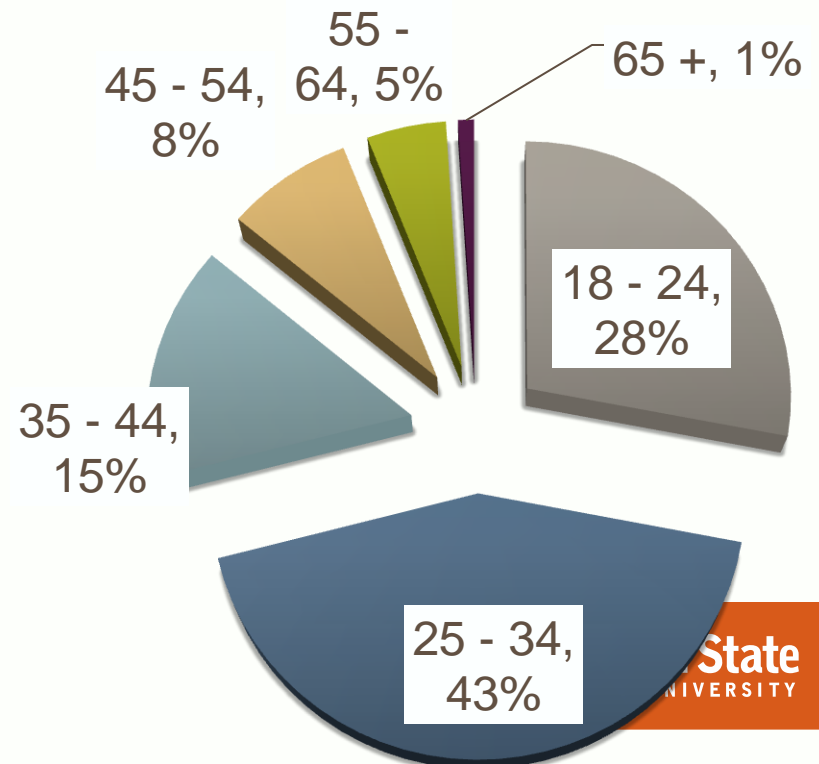
Trust, Perceived Risk, Performance Expectancy, and Ease of Use, determine “Intent to Adopt”

Survey Analysis

7-point Likert Scale

Cronbach alpha validation (> 0.7)

n = 1396



Root Cause of Aversion to Smart Meters...

Technology Acceptance Model

Trust, Perceived Risk, Performance Expectancy, and Ease of Use, determine “Intent to Adopt”

H1: Trust in a utility company has a positive impact on Intention to Use

Insignificant

H2: Trust in utility companies will have a negative impact on Perceived Risk

Supported

H3: Perceived Risk will have a negative impact on Intention to Use

Supported

Additional Hypotheses...

H4: Trust in utility companies will have a positive impact on Expected Utility

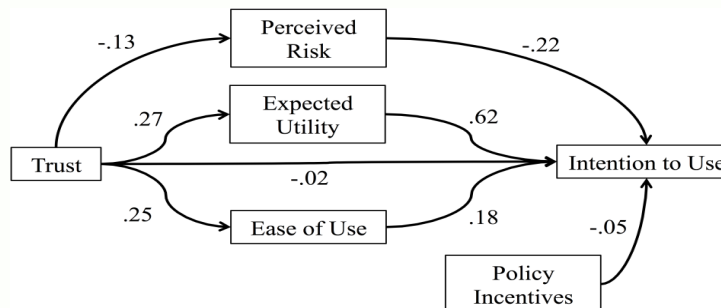
Supported

H5: Expected Utility will have a positive impact on Intention to Use

Supported

H6: Trust in utility companies will have a positive impact on Ease of Use

Supported



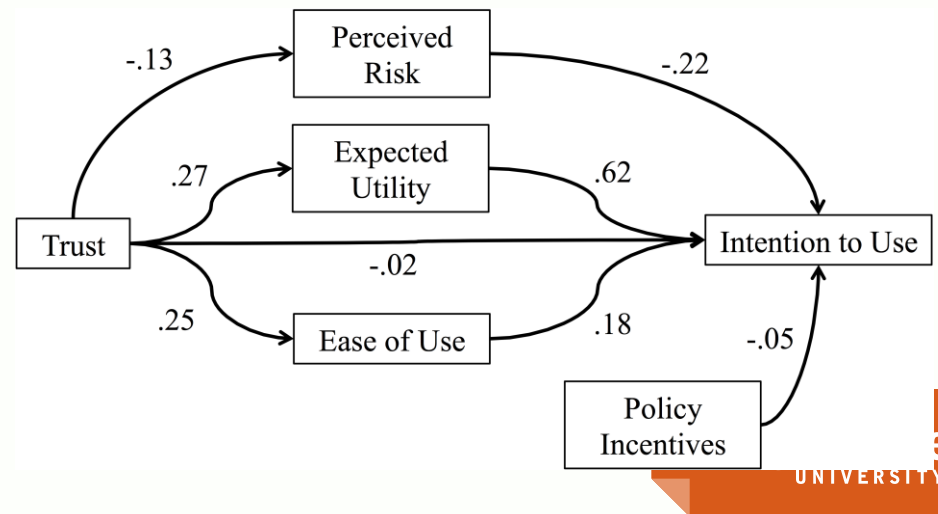
Additional Hypotheses...

H7: Ease of Use will increase the Intention to Use smart grid technology

Supported

H8: Policy Incentives increase Intention to Use

Insignificant



Conclusion

Trust is essential for consideration, but does not imply intent to adopt technology

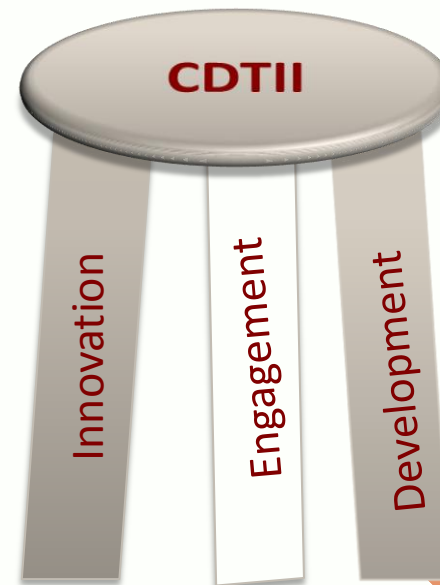
Trust gives opportunity to demonstrate effectiveness, ease of use, and other benefits

Next steps: How can we help Engineering students retain social awareness in addition to professional growth?

Implications for Engineering Education

Community Driven Technology Innovation and Investment

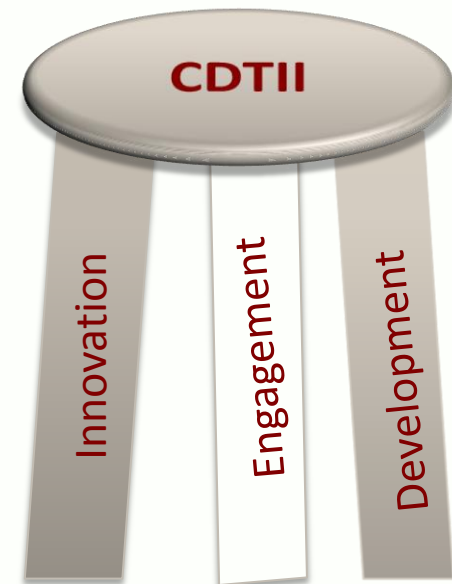
Facilitating environments in which engineering students retain social engagement values.



Engineering Engagement? Let's Create a Model!

Broad Phases of Design

1. Conceptual Design
2. Detailed Design
3. Implementation



Community Opportunity-Phase 1

1. Underutilized Assets
2. Persistent Needs

Community Partnership

1. CL@SE & Rural Studies (engagement and need articulation)
2. Engineering Resource (technical requirement articulation)

Sustainable Community Wellbeing

1. Community investment partnership (policy, local and external funding, etc)
2. Impact Evaluation (CL@SE, Rural Studies, & Engineering Resource)

Sustainable Partnership - CDTII

Community Benefit

1. Jobs!
2. Implementation (partnership with Engineering Teams)
3. Effectiveness and sustainability (partnership with CL@SE, Rural Studies and ENGR Resource)
4. Workforce capability
5. Asset Utilization

OSU

Phase 1:
Assessment &
Conceptual
Design

Phase 2:
Detailed Design

Phase 3:
Implementation

Workforce Development

1. Use development process in curriculum development
2. Community involvement in design process (Engineering Test & Implementation Teams)

Oregon State
UNIVERSITY

Phase 1: Sopas in Monroe!



Engagement Roadmap

Internal Coalition Building - OSU



CL@SE

OSU Open Campus

OSU Rural Studies

Oregon State
UNIVERSITY

Regards 2 Rural, June 2013

- Clear idea of Certification Standard
- Clear idea of cost.
- Moving Cost est.

(Wheeler Co.) Inconsistent Cellular /Internet Access /Electricity for visitor info kiosks/wi-fi

English study of cost of cleanup - Formulated as Land development

Barriers & Supports

Engineers ① who love golf
② Can take limits
③ Could live in Brandon

CITY GOVERNMENT "ON BOARD" WITH CONCEPT OF PROJECT,
COMMUNITY IS ENGAGED - MYRTLE CREEK

(Wheeler Co.) New + dynamic regional tourism group & county, city support.
EVA.

Intergovernmental Agreement -

"the town (3500 pop) made a new water treatment and knew the nuke to start 10 years ago but leadership shrank it down the road (let's wait for it)". Now it is getting renewed. We have less \$ and decided to get it on hold and hope inspiration will strike 2015.

The Oregon Census on Tule River County was one function, then a 75 percent successful voyage.
That it is the primary distribution of her history. Called by the National Task Force -
it is the first step. Next, some new, detailed studies - comparisons
between, called, we have a Post-Settler Order which there has been a
"Pioneer" - and we are Oregonians. We have developed a third group
with a still new one. Then, to have the way to complete the Revolution.
We have an entire prepared advice - and will all see
there is a new one.

* The "Coming Home" Wild Salmon Viewing & Habitat Restoration Project - LEYTE CREEK, OR, w/ ECONOMIC DEVELOPMENT & EDUCATION COMPONENTS - CURRENTLY IN

Current Opportunities

Energy/Water Regret in Water design, just through. Consideration
at the same time conserve water without impacting water rights.

Development of county wide tourism information system + safer transportation routes for bicyclists and motorists. Western Wheeler County - John Day Fossil Beds National Monument

Acquisition of Boiss water front property for redevelopment

Future Opportunities

Engagement Roadmap

Community and Engineering Resource Identification, August 2013 – January 2014

Community Visit

Senior design team recruitment

Managing expectations

Commitment to listen to “voice of the community”



Engagement Roadmap

Conceptual and Detailed Design – Winter & Spring 2014

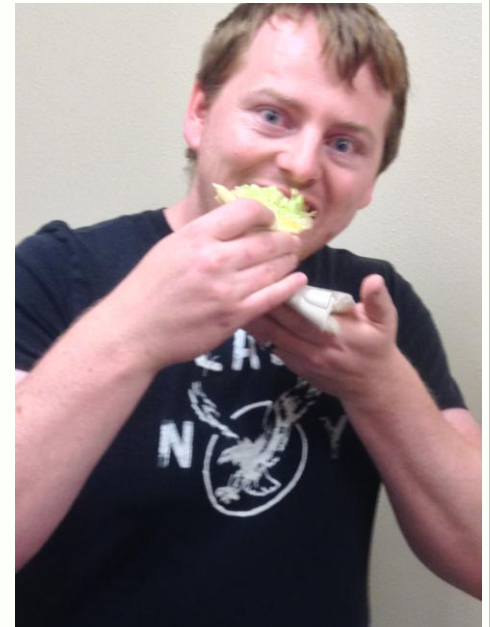
Ongoing Discussions (in Monroe and Corvallis)

Friday night meetings

Liaison with potential customers (Co-op)

Managing expectations

Commitment to listen to “voice of the community”



Engagement Roadmap

Implementation & Next Steps - Ongoing

Ongoing Partnership with Del Corazon

Commitment to listen to “voice of the community”



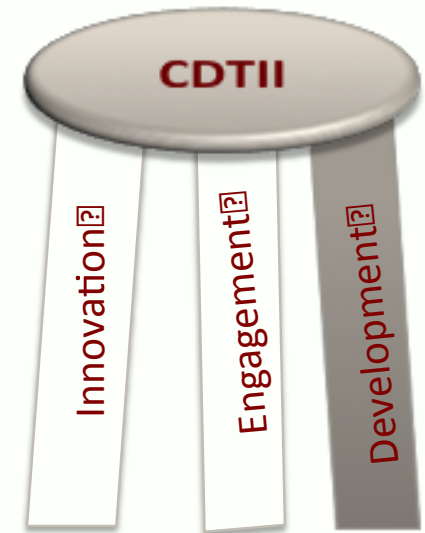
Next Steps...learning from Del Corazon

- **More CDTII projects:** Applied learning and USDA
- **Cross Disciplinary Graduate Students:** Sociology/Public Policy and Engineering?



Long Term Partnership

- **Year 1:** Senior Design Teams.
 - Engineering Analysis
 - Social implications
 - Recommendations for implementation
- **Year 2:** Senior Design Teams with OSU labs
 - Engineering and social analysis
 - Recommendations for implementation or for innovation
- **Year 10:** OSU teams of community students with OSU
 - Community problem
 - Engineering analysis and design
 - Community based start-up company?





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Community-University Relationships

Late 1800's



**Rural Oregon
Communities**

Industrial revolution
Changing social class



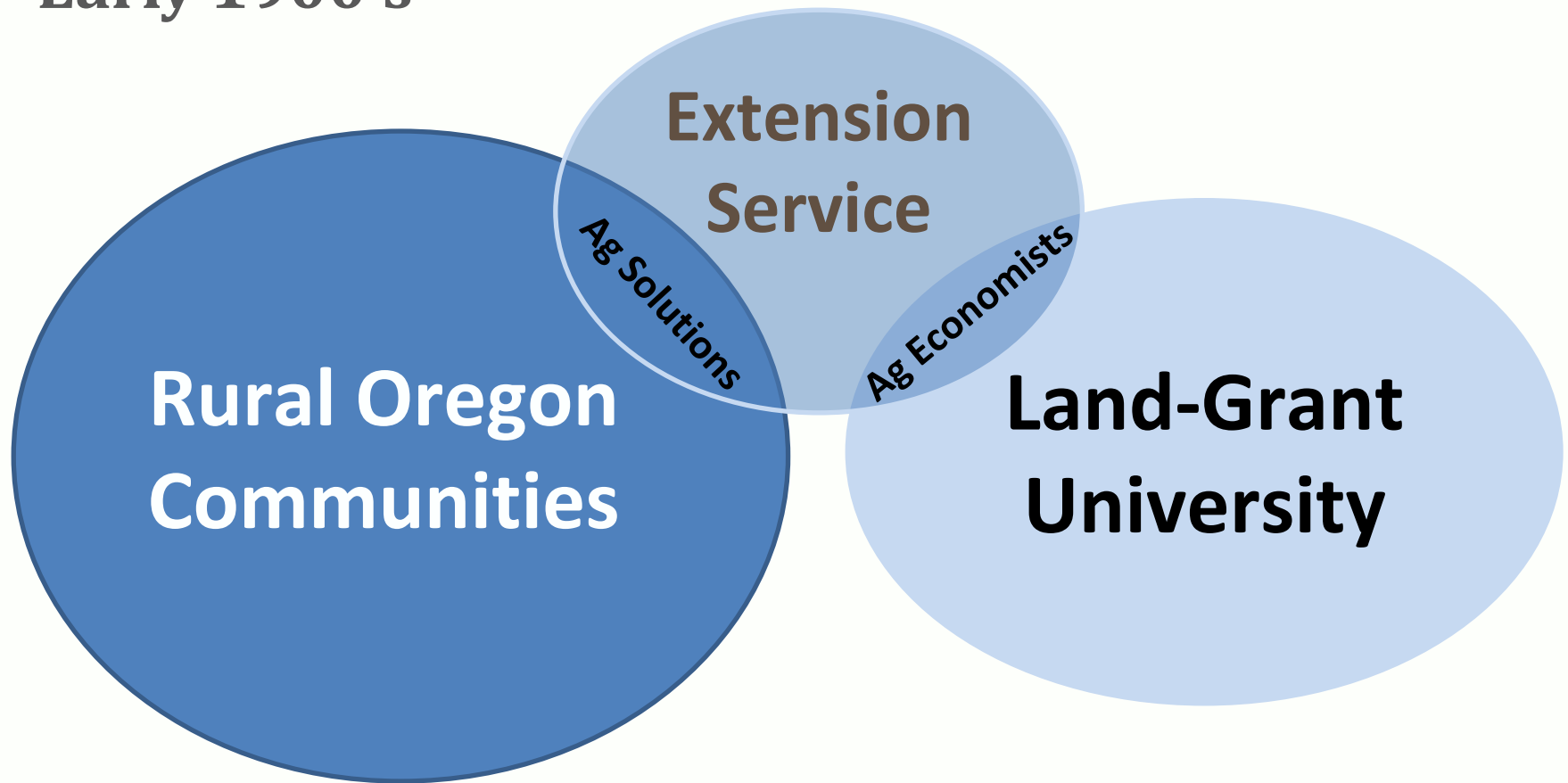
**Land-Grant
University**

Circa 1862: Teaching of practical
agriculture, science, military science
and engineering

Circa 1887: Pass along new information,
especially ... soil minerals and plant
growth

Community-University Relationships

Early 1900's



Circa 1914: Cooperative extension — the sending of agents into rural areas to help bring the results of agricultural research to the end users.

The Importance of Customer Participation – Resilience!

Critical Infrastructure Resilience

Increasing demand on aging infrastructure

Top-down *push* versus bottom-up *pull*

Skeptical, sometimes hostile, customer base

Barriers: Infrastructure, value proposition and **consumer engagement** (Bettencourt, 2014)