The Impact of Innovation in the Logging Industry on Biomass Supply

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Why Study This

- To many contractors this is a new market and product
- Literature on logging innovation is extremely limited
  - Specifics on biomass harvesting even more so
- Most research related to biomass focuses on:
  - Operational productivity, environmental impact, material recovery, and similar logistical issues (Dirkswager et al. 2011)
- It is not safe to assume this will just happen
  - As Gifford Pinchot said “Innovations rarely happen as planned”
Defining Innovation

- **Lots of innovation definitions exist** (Schumpeter 1934; Nelson and Winter 1977; Rogers 2003; OECD and Eurostat 2005; Rametsteiner and Weiss 2006)

- **Oslo Manual** (OECD and Eurostat 2005): *an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations.*

- Multiple types and firm set as adoption unit

- Biomass production falls into product and process categories
Theories of Innovation Development and Adoption: Diffusion Theory

- Diffusion developed by Rogers (2003) describes how the linear adoption process is at the center of this theory.
Theories of Innovation Development and Adoption: Diffusion Theory

Innovation System Connections and Influences

Prior Conditions

1. Adoption
2. Rejection

1. Continued Adoption
   - Later Adoption
   - Discontinuance
2. Continued Rejection

Reproduced from Rogers (2003)
Diffusion Cont.

- Also must consider firm innovativeness (how fast they adopt)
- Rogers separates these into 5 classes: Innovators (quickest), early adopters, early and late majority, laggard (last)

Distribution of a theoretical population of 1,500 loggers based on Rogers (2003) model population.
Essentially interconnected units influencing innovations with the firm at the center


A blended approach is possible

Reproduced from the Oslo Manual (OECD Eurostat 2005)
What do we know about biomass harvesting innovations?

- Not much, but body of literature is growing
  - Existing literature shows that markets, cost, adaptability, profitability, and policy have influence (Dirkswager et al. 2011, Greene et al 2011, Allen et al. 2008)

- Focus typically on forest products industry changes (Soderholm and Lundmark 2009) or things like district heating plants (Madlener 2007)

- There are several relevant harvesting studies, but:
  - No innovation framework driven studies
  - More importantly no Maine or Northeast focused study
Study Objectives

- Overall Objective: to better understand biomass harvesting innovation activities among logging contractors in Maine

- Specific Objectives
  1. use the linear adoption process to better understand the factors leading to biomass adoption, rejection, or discontinuance by a logging firm
  2. determine components of the innovation system that are most important to biomass development and identify areas for improvement in the system.
Methods

• Case Study Approach
  • Studied innovators, which is extremity sampling (Eisenhardt 1989)
• Used phone survey of forest industry groups to identify innovators
  • 60% response rate with 73.2% mean response across groups
• Selected firms based on how often they were mentioned, how they were ranked, the regional nature of the response, and the uniqueness of their innovation activities
• 13 firms identified and 10 agreed to participate
  • Performed in depth interviews with owners along with site visits
  • All firms produced biomass at one point or another
Results:
What goes into biomass adoption

• Biomass production and related innovation directly dependent on market price and stability.
  • “The consuming mills just have too strong a hold..... they’re ultimately controlling the price of chips and it’s just not a profitable venture at this point.”
What goes into biomass adoption

- Biomass production and related innovation directly dependent on market price and stability
- Markets play the biggest role in adoption decision

“Only if the price of chips comes back. It’s very simple. The whole thing is about money and no matter what you do in logging it comes back to the dollar.”
What goes into biomass adoption

- Biomass production and related innovation directly dependent on market price and stability
- Markets play the biggest role in adoption decision
- Biomass was viewed as a byproduct
- Biomass has other uses to contractors
What goes into biomass adoption

- Biomass production and related innovation directly dependent on market price and stability
- Markets play the biggest role in adoption decision
- Biomass was viewed as a byproduct
- Biomass has other uses to contractors
- High focus on productivity and profitability, capital #1 barrier to logging innovation in general
- Innovative contractors have advanced organizational systems to monitor costs and production
Biomass Harvesting Linear Adoption

Knowledge
- Existing Markets
- Cost
- Knowledge from the innovation system
- Prior experience
- Existing Policies

Evaluation
- Potential Effectiveness
- Testability
- Potential investment return
- Support from the innovation system
- Applicability to forest management issues and goals

Decision
- Favorable evaluation leads to adoption while unfavorable leads to rejection
- Unfavorable reevaluation leads to abandonment or continued rejection
- Favorable reevaluation leads to continued adoption or late adoption

Implementation
- Performs as expected
- Actual return on investment
- Approval of results from others
- Cost of operation
- Benefits realized

Confirmation
- Continued market demand and stable prices
- Continued investment return
- Continued support from the innovation system
- Reliability and effectiveness
- Adaptability and flexibility
- New Policies
Examples

- John Deere 1490D
  - Too expensive
  - No facilities buy bundles
- Grinders
  - Often grindings price is lower
  - But productivity higher
  - Contractors with grinders knew the exact price point to operate
- Dominance of chippers and “add-ons"
Innovation system

- Firm is most important
- Markets and Industry Infrastructure most important outside firm
- Lack of collaboration and idea transfer
- Weak connection to public research centers
- Policies that impact markets can have big impacts
What can be done to strengthen innovation system

- Landowners can provide testing areas and incentives through long term contract
  - Biomass is a way to increase future stand values
- Equipment needs to be well designed and well supported
  - Cases that had worked with manufacturers had successful innovations
- Collaboration among the supply chain units is essential to successful biomass harvesting development
- European countries emphasize healthy innovation systems (Hansen 2010), might explain success at biomass development
BCAP: A Case of Policy Intervention

- Feds rolled out the Biomass Crop Assistance Program Winter 2009-2010 (Federal Registrar 2009, 2010)
- Did it generate innovation? NO!
  - No new technologies adopted, disliked by all 10 cases
  - Caused price drops, caused one case to give up biomass harvesting innovation
  - 2 cases experimented with harvesting smaller material
- Similar to conclusions of other studies (Greene et al 2011 and Rametsteiner and Weiss 2006)
- All suggests that subsidies and capital injections not effective, may be harmful
Conclusions

- Combined model approach is very effective
- Markets are key
- Biomass harvesting innovations have to be easy to integrate and not capital intensive
- Biomass harvesting development heavily dependent on multiple actors working together and support
- Increasing collaboration and idea transfer could assist innovation efforts
  - More connection with public research and education
- BCAP ineffective at generating innovation and actual was harmful
  - Subsidies and capital injections are not the answer
Future Research

- Focus on the innovation system’s strength and weaknesses and potential improvements
- Study adoption among multiple supply chain units and public in addition to logistics and environmental impact
- The combined linear adoption and innovation system model can be applied to any adopter group in any industry or public unit
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References


Questions

Want more information?
Contact: Ian Stone ian.stone@umit.maine.edu
Also look for upcoming publications in the Journal of Forestry and the Forest Products Journal