# Open e-Business Standard Development and Adoption: An Integrated Perspective

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# Agenda

- What's so special about e-Business standards
- Research questions
- Literature review: economics of standard setting
- The model and our findings
- Future research directions

# E-Business Standards

- Standards for information systems to talk to each other for e-Business operations
- XML (the eXtensible Markup Language): a language for information exchange between programs, web sites and inter-organizational information systems
- Issue: lack of standards
  - **XML: the vocabulary**
  - **Standard: the semantics**

# Firms Need a Standard to Realize the Potential of e-Business

- The value of e-Business lies in the information sharing and interoperability
  - **Reduce costs through reduction of inventory, lead times and human errors**
  - **Generate new revenue through better joint demand forecasting**
  - **New business opportunities thanks to cooperation between partners**
- Yet, without a standard, all the above is empty promises

# What's So Special About e-Business Standards?

- Enormous scope makes the cooperation in developing standard mandatory
  - **Cooperation of the competitors: coopetition**
- The same developers are also future adopters
- Open, neutral standard is the trend: no dominant firms in the standard development
  - **Firms want to make maximum impact in forming the standard**
  - **Firms are leery of vendor-dominated monopolies or oligopolies in standard setting**
  - **Standards have to be open and neutral to attract new adopters for developers to increase payoff due to network externalities**

# Anecdotal Evidence that Firms Take Standards Development Seriously

- GM has “four people working full-time deciding *what* standards are important to the company and what kind of participation in standards groups is appropriate”. These employees are supported by five staff members plus employees  of EDS, GM’s outsourcer (Chen 2003)
- W.W. Grainger has five developers working on W3C standards, each of whom devoting 10 to 20% of his or her time (Chen 2003)

# Examples of Consortium-based e-Business Standards Development

- The Interactive Financial eXchange Forum (ifxforum.org)
  - **A consortium to develop financial web services standard**
  - **Members: Bank of America, Citibank, Wachovia, Wells Fargo, CheckFree, MasterCard (29 total)**
- The Open Travel Alliance: opentravel.org
  - **Goal: to create and implement industry-wide, open e-business specifications for the travel services industry**
  - **Members: American Airlines, United Airlines, Delta, Amtrak, Hyatt, Dollar, Thrifty (124)**
- RosettaNet: the hi-tech industry

# RosettaNet

- A hi-tech standard consortium co-founded by 40 companies (e.g. Motorola, Intel, Cisco, Oracle, NEC, HP) in 1998, RosettaNet has more than 400 member companies
- The hi-tech industry is in dire need of inter-firm e-Business information sharing standards, due to complexity and modularity of products, vast outsourcing, fast depreciation, short product cycles, etc.
- Partner Interface Processes: standard for shared processes between partners

# Research Questions

- In a neutral, open standard-setting consortium:
  - **Equilibrium**
    - **What kind of companies would be leading developers and which are expected to be adopters in the standard setting process?**
    - **How much effort would the developers exert? What are the factors that would affect this effort?**
  - **Efficiency**
    - **From the consortium's perspective, how to induce firms' incentive to participate in the standard development and adoption process so as to increase the total social value of the standard?**

# Literature on Economics of Standards

- Standards are exogenous—developers first create it then try to convince potential users it's worth the cost and risk to adopt (Shapiro and Varian 1999)
- Often treat developers and adopters of a standard as separate entities (David 1985, Farrell and Saloner 1988, Farrell 1996)

# Novelty of Our Model

- Standard development in a neutral, consortium setting
- Standard development by future adopters
- Endogenous formation of two networks: the model reflect firms' actual decision problem
  - **Firms join the developer network if and only if, ex ante, the expected payoff is higher than otherwise**
  - **Firms act as pure adopters if and only if doing so is better than being a developer or a non-adopter**
- Interaction between the two stages due to network externalities
  - **Developer payoff is a function of the size of adopters**
  - **Adopter payoff is a function of standard's quality, which is developers' aggregate efforts**

# The Development and Adoption Game

- Stage 1: (Developer Network Formation)
  - **Firms simultaneously determine whether to join the consortium**
- Stage 2: (Standard Development)
  - **Firms in the developer network determine optimal individual effort level to maximize their payoff. Standard is developed.**
- Stage 3: (Adoption)
  - **Remaining firms determine whether to adopt the standard.**

# Model Setup

- *N* firms (*N* large number)
- Each firm *i* has an intrinsic valuation of the upcoming standard, , which has a uniform distribution [0,1]
- For a developer firm, the development cost is a convex function of its effort
- The quality of the standard is a concave function of the collective effort

# Model Setup (Cont'd)

- All adopters incur an adoption cost .
- The network externalities co-efficient is , i.e. utility from network externalities is

- The insider effect for developers, .
- Assumption: developers will always adopt.

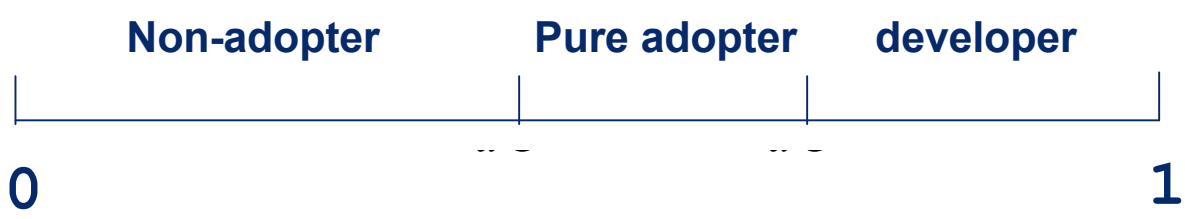
# Utility Functions

- Pure adopter's payoff:

- Developer's payoff:

# Firm's Choice

- Depending on firm's valuation , a firm will choose to be a developer, a pure adopter or a non-adopter.
- We need to find the marginal developer and the marginal adopter to understand the equilibrium



# Solving the Model: Stage 3

- We can use backward induction to solve the model
- In Stage 3, because the marginal adopter is indifferent between adopting and non-adopting, we have

- Proposition 1: The size of the adopter network, , is increasing on the network effect and the quality of the standard, decreasing on the adoption cost

# The Optimal Investment of A Developer (Stage 2)

- Solving the developer's optimization problem, we find:

- Proposition 2:
  - **a) The optimal effort level is increasing in the network effect and total number of firms interested in the standard**
  - **b) The individual valuation, , does not affect developers' individual effort.**

# The Size of the Developer Network: Stage 1

- The marginal developer is indifferent between being a developer or a pure adopter
- The developer network size, therefore, is

- Proposition 3.a: The size of the developer network is increasing in the insider effect and the network effect ( is decreasing in )

# The Effect of Myopia

- Proposition 3.b:
  - **If firms are myopic, i.e. they only consider the network effect within the developer network in Stage 2, firms optimal effort level will be lower than before.**
- The consortium should discourage firm's myopic behavior by educating firms on the long-term value of the standard

# Efficiency

- Consortium's goal vs. reality:
  - **The effort level from developer firms that maximizes the social welfare, i.e. sum of all developer and adopter firms' payoff, may not be equal to the effort level that the firms actually exert based on their own optimization**
  - **Consortium can change some parameters to change the gap between the optimal payoff and actual payoff, e.g. change the insider effect (RosettaNet)**

# Future Research

- Standard development
  - **More complex setting**
    - **Repeated game: standard updates**
  - **More governance issues in consortium-based standard development**
    - **Voting mechanism**
  - **Empirical study: Nelson and Shaw (2003)**
- The governance structure of consortia
  - **Between market and hierarchy**
  - **How to coordinate firms' incentives**
  - **How to achieve optimal social welfare**