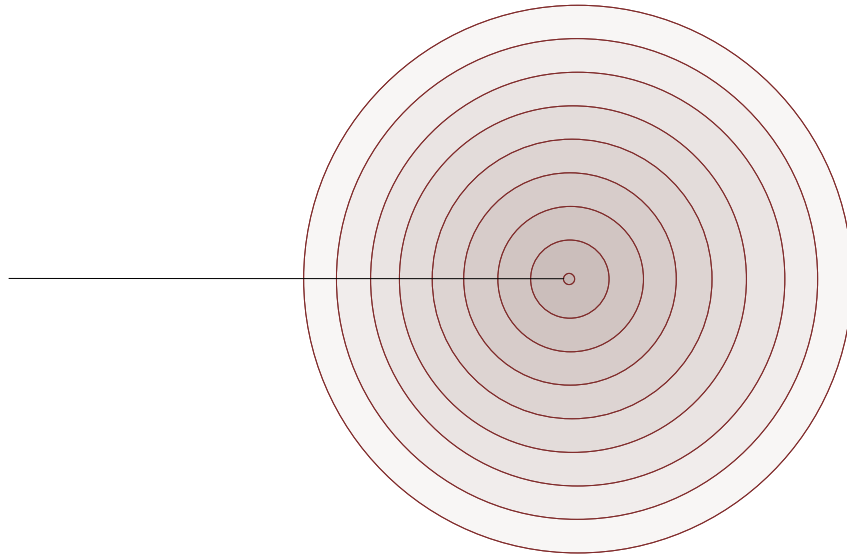# Healthy open collaboration
in and beyond the software domain
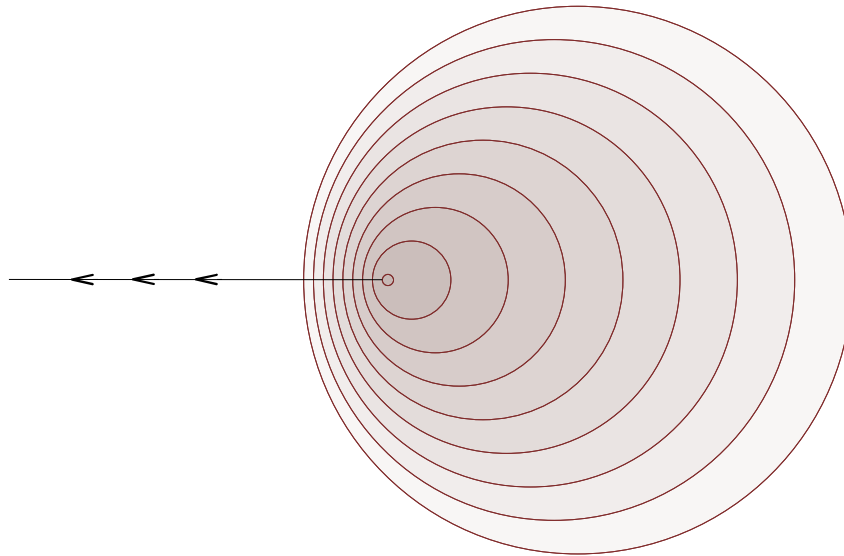
Allison Randal
University of Cambridge

Beyond Open Source

- What makes open source successful?
- Apply the principles to other "opens"
- Existing relevant research
    - on open source
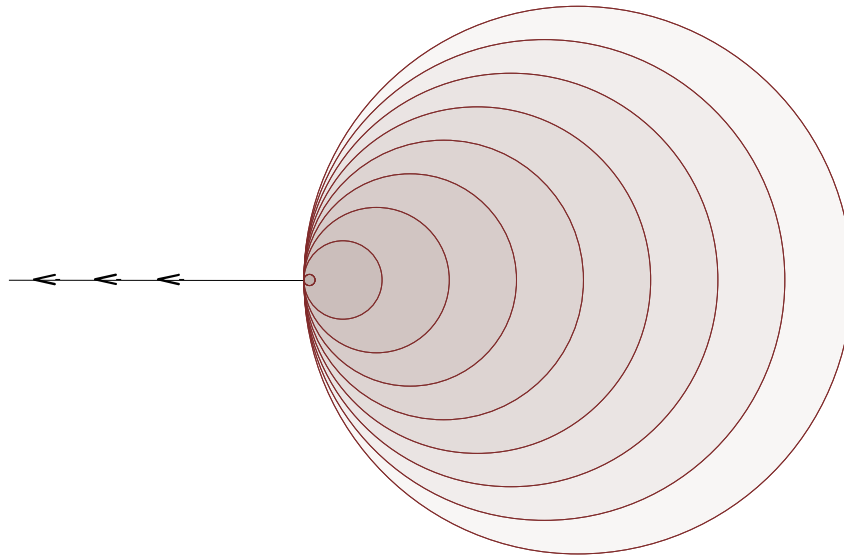   - on innovation
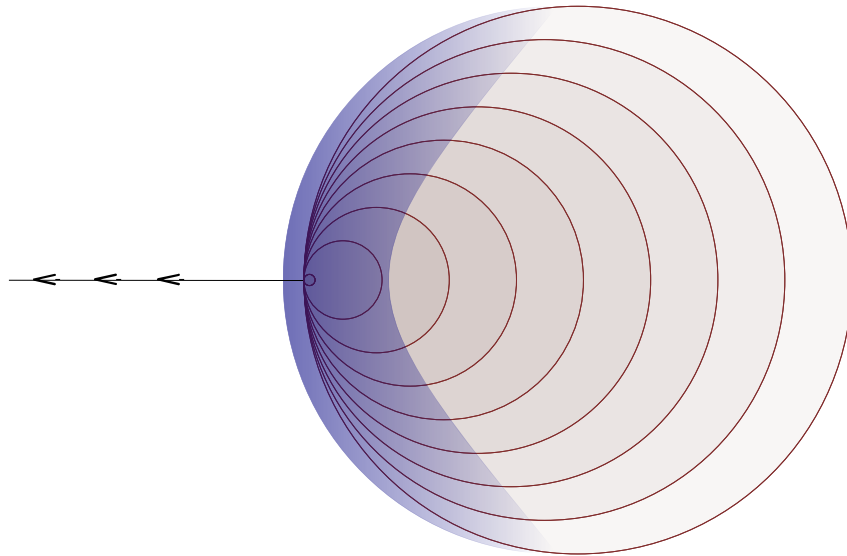- The two have a lot in common

Speed of Sound

Subsonic Speeds

Sonic Speeds

Sound Barrier

Supersonic Speeds
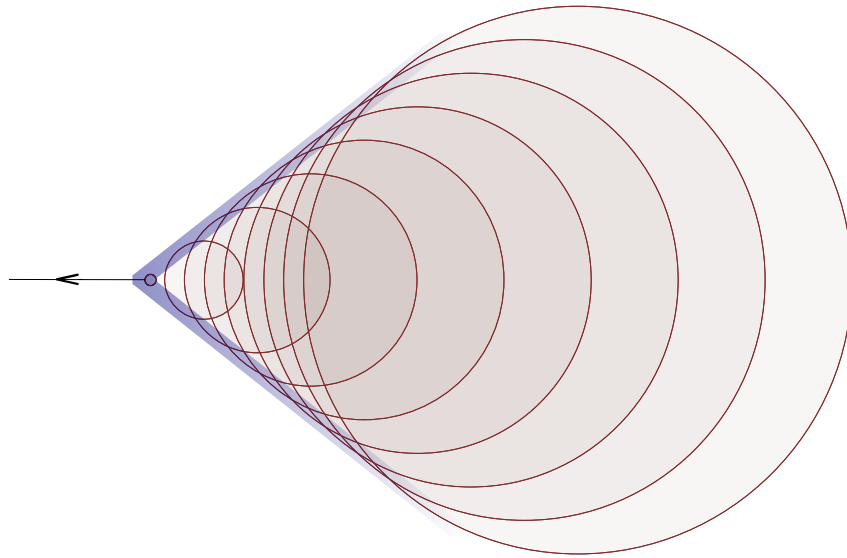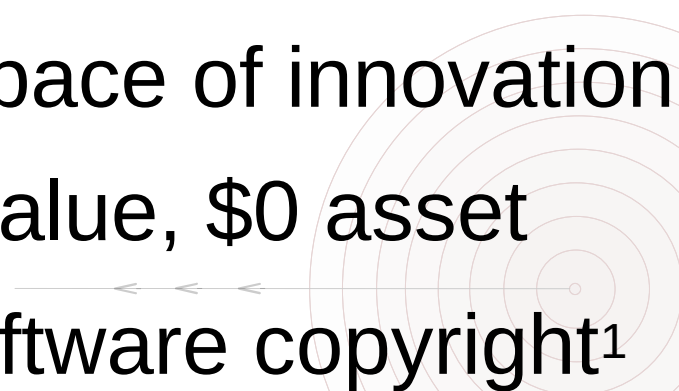
Supersonic Speeds

First Age of Software

leading edge

subsonic
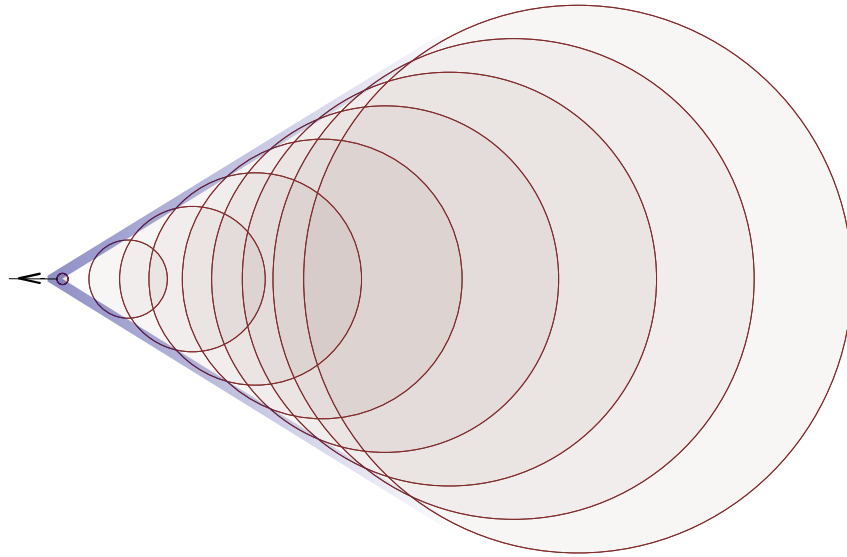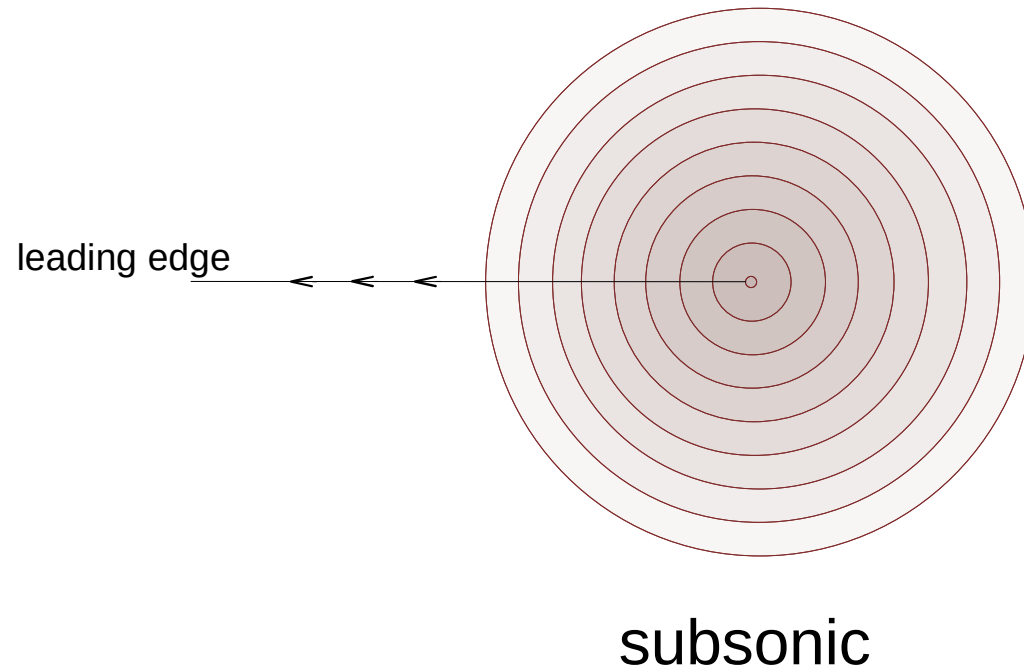
First Age of Software

- 1940s-1970s
- Slow pace of innovation
- Low value, $0 asset
- No software copyright[1]

[1]Lemley, M., Menell, P., Merges, R., Samuelson, P. and Carver, B. (2011) *Software and Internet Law*, 4th edition, Wolters Kluwer. (pp. 31-32)

First Age of Software

leading edge

subsonic
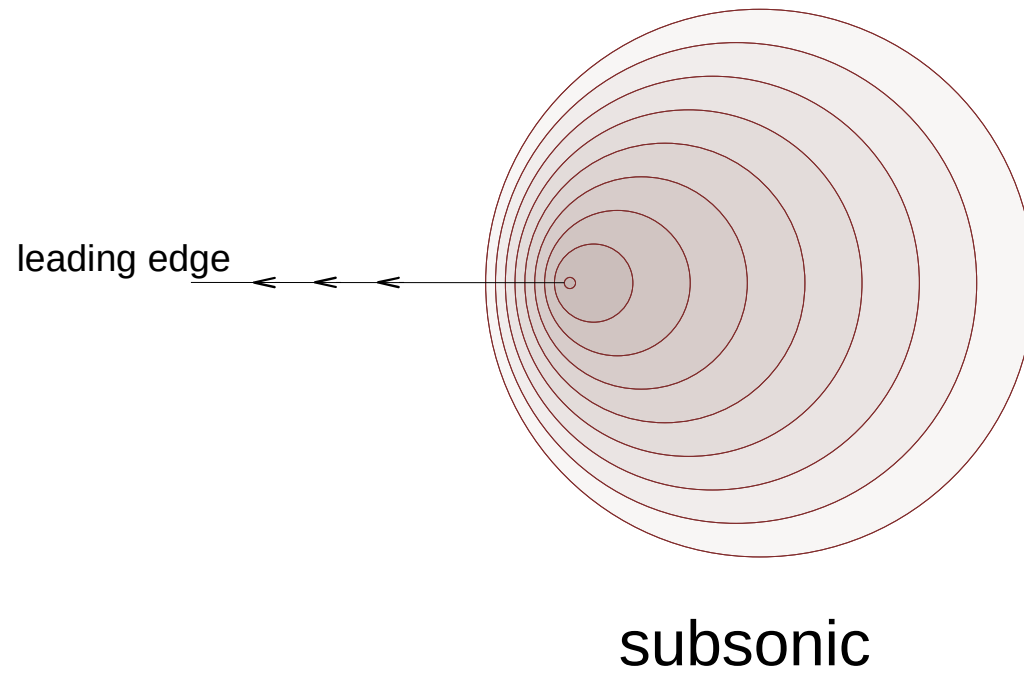
First Age of Software

- 1970s

- Signs of things to come

- Commission on New Technological Uses of Copyrighted Works[1]

- Berkeley Software Distribution (BSD)

- Stallman's printer[2]

[1]Lemley, M., Menell, P., Merges, R., Samuelson, P. and Carver, B. (2011) *Software and Internet Law*, 4th edition, Wolters Kluwer. (p. 32)

[2]Richard Stallman (2010) *Free as in Freedom (2.0)*, Free Software Foundation. (p. 4)

Middle Age of Software

leading edge

sonic
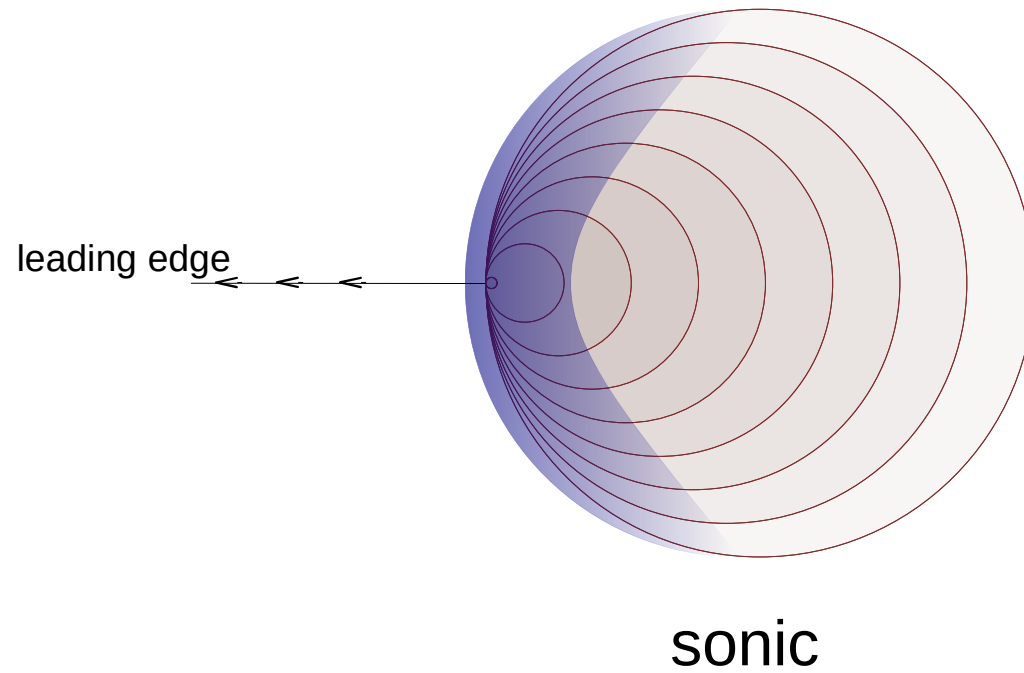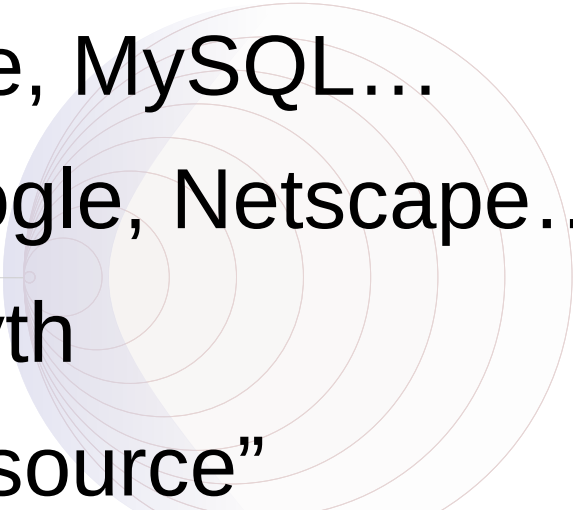
Middle Age of Software

- 1980s

- Software subject to copyright law[1]

- Apple, Microsoft, Oracle...

- Free Software Foundation[2]

- Equal & opposite reaction

- Myth of proprietary innovation

[1]Merges, R., Menell, P. and Lemley, M. (2012) *Intellectual property in the new technological age*, Wolters Kluwer. (p. 433)

[2]Richard Stallman (2010) *Free as in Freedom (2.0)*, Free Software Foundation. (p. 9)

Middle Age of Software

- 1990s
- Linux, Apache, MySQL…
- Amazon, Google, Netscape…
- Persistent myth
- Name "open source"

Modern Age of Software

leading edge

supersonic
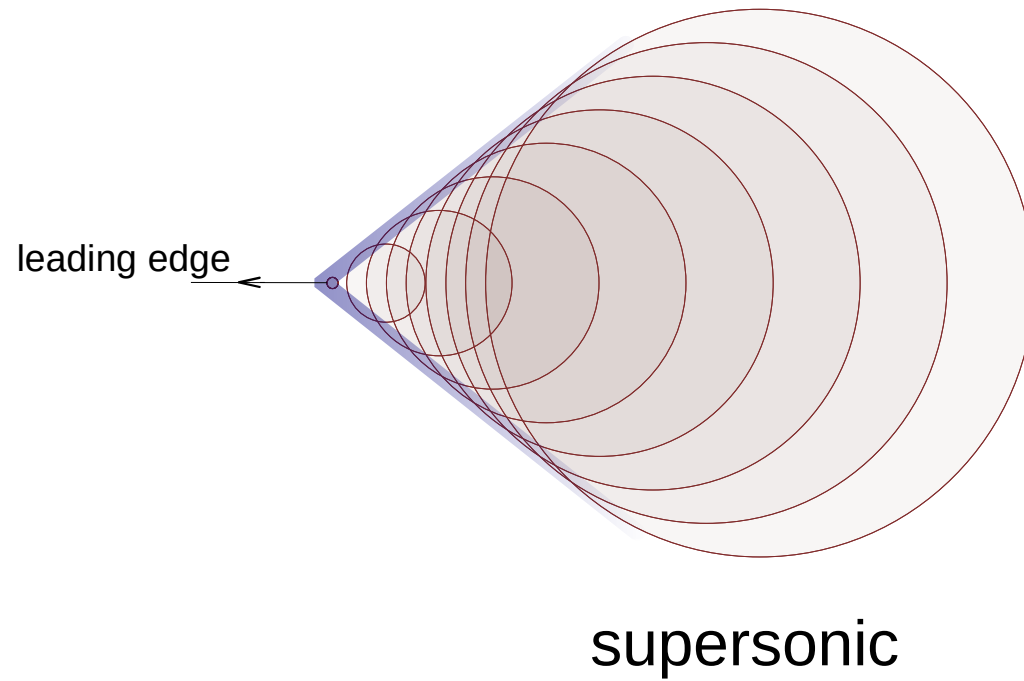
Modern Age of Software

- 2000s
- Corporate adoption of open source
- Economic necessity (dot-com bubble)
- Leading innovation (Web 2.0)
- Growing body of open source
- Proprietary hinders innovation
- We won?

Modern Age of Software

leading edge

supersonic

Modern Age of Software

leading edge

supersonic
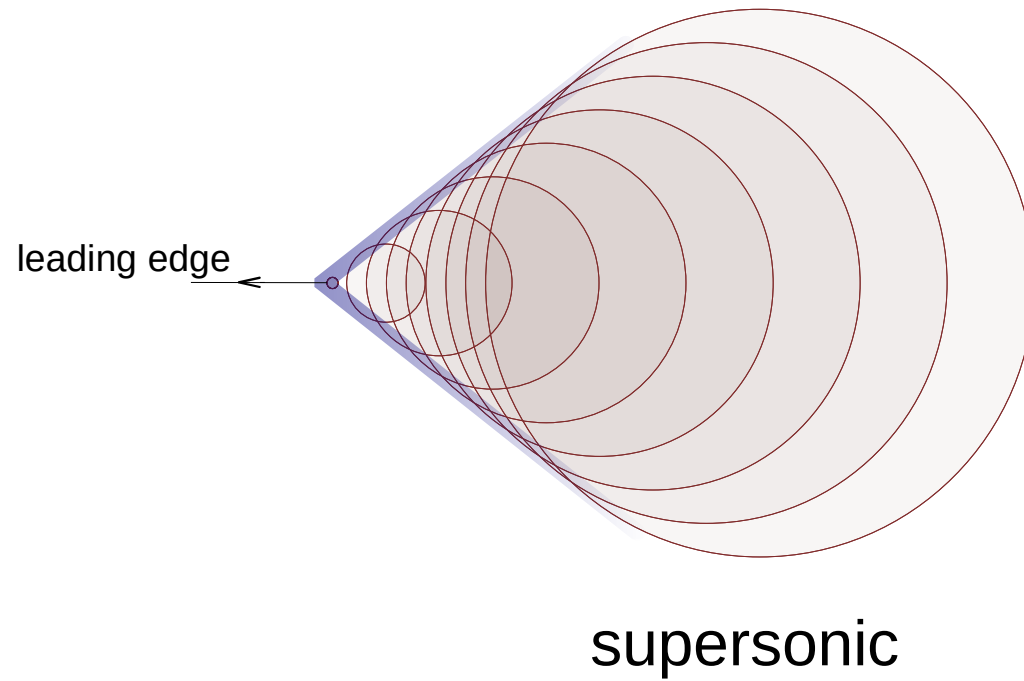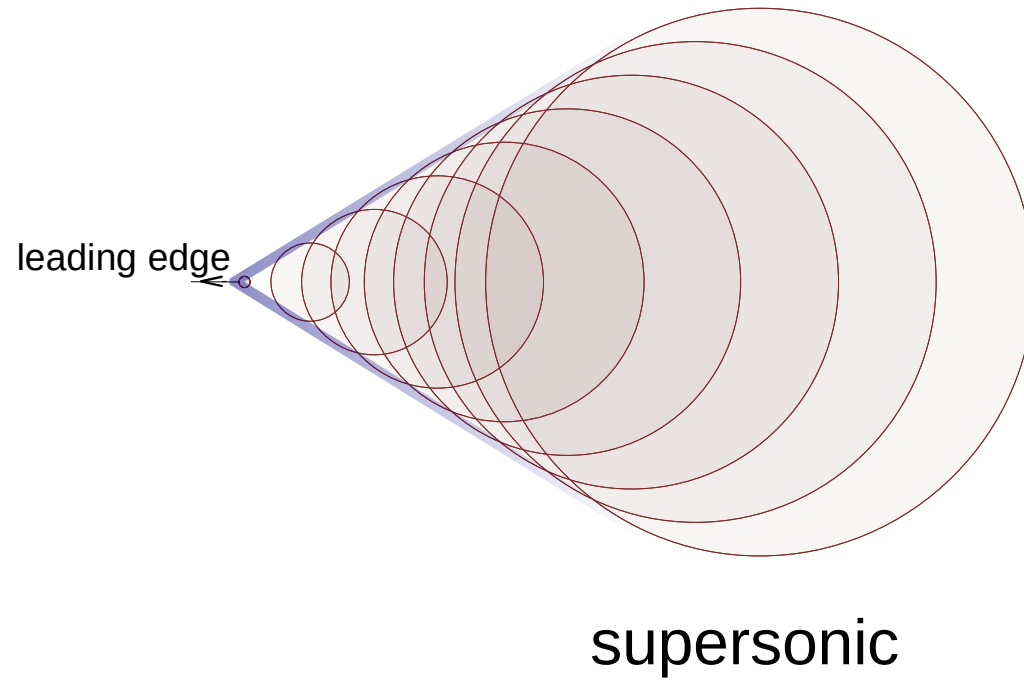
Modern Age of Software

- 2010s
- Use is merely table stakes
- Participation is competitive advantage
  - Needs understood (bugs & features)
  - Reduced cost of maintenance
- Snowball effect
- Combined efforts accelerate innovation

Open Source & Innovation

- Organizational capabilities[1]
  - knowledge of individuals
  - business process and model
  - can be learned, over time
  - impacts likelihood of success

[1]Löfsten, H. (2016) 'Organisational capabilities and the long-term survival of new technology-based firms', *European Business Review*, vol. 28, no. 3, pp. 312-332.

Open Source & Innovation

- Open Innovation[1]
  - share ideas externally
  - assimilate external ideas inward
  - (open source: share and assimilate code)
  - create and capture value for customers
  - co-develop across company boundaries

[1]Chesbrough, H. (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press.

Open Source & Innovation

- Levels of Engagement[1] [2]
    1. InnerSource
    2. Use
    3. Product integration
    4. Single company project
    5. Participate in external project
    6. Co-lead external project
- More investment, more effective, more value

[1]Westenholz, A. (Ed.) (2012) *The Janus Face of Commercial Software Communities — An Investigation into Institutional (Non) Work by Interacting Institutional Actors*, Copenhagen Business School Press, Frederiksberg.

[2]Ciesielska, M. & Westenholz, A. (2016) 'Dilemmas within commercial involvement in open source software', *Journal of Organizational Change Management*. vol. 29, no. 3, pp. 344-360.

Open Source & Innovation

- Across company boundaries
  - strategic alliances
  - standards bodies with patent pools
  - internal and outsourced R&D
  - licensing as acquisition

Open Source & Innovation

- Economics/business of software

- Customer value

- Proprietary model
  - Depends on scarcity
  - Fails on commodity

- Open source model
  - Freely available resource
  - forest → firewood → lumber → house → furniture

Software Business Models

- Hardware
- Software integration
- Software as a Service
- Support/Services
- Content
- ~~Software license~~

Shared Characteristics

Characteristic	Technology Innovation	Open Source
collaboration in external communities (knowledge and resources)	2, 3, 17, 26, 27, 30	8, 11, 14, 16, 19, 21, 28
access to external innovation (source code)	3, 5, 17, 29	8, 16, 19, 24
share ideas outward	3, 4, 26, 27	8, 11, 19
organizational learning, assimilate ideas inward	3, 5, 6, 7, 17, 23, 27, 29, 30	8, 10, 19
efficiency of reuse/modification	3, 5, 17, 27, 30	8, 9, 16, 18, 19, 21
strategic approach to customer value	3, 25, 26, 27	1, 12, 13, 19, 22, 24
low barrier to entry	20	16, 19, 24

[1]Asundi et al. (2012)
[2]Bigliardi & Galati (2016)
[3]Biloslavo (2005)
[4]Chesbrough (2003)
[5]Chiesa et al. (1996)
[6]Chiu et al. (2016)
[7]Christensen (2000)
[8]Ciesielska & Westenholz (2016)
[9]Dahlander & Gann (2010)
[10]Harison & Koski (2010)

[11]Henkel et al. (2014)
[12]Kort & Zaccour (2011)
[13]Krishnamurty (2005)
[14]Lerner & Tirole (2002)
[15]Löfsten (2016)
[16]Lundell et al. (2010, 2011)
[17]Martínez-Román & Romero (2016)
[18]Mattmann et al. (2012)
[19]Morgan & Finnegan (2014)
[20]Pisano (2016)

[21]Rajala et al. (2012)
[22]Riehle (2012)
[23]Rubera et al. (2015)
[24]Shanker (2012)
[25]Sullivan (2000)
[26]Teece (2000)
[27]Vakili (2016)
[28]Westenholz (2012)
[29]Yam et al. (2004)
[30]Zhao et al. (2016)

2010, 2015, 2018 Surveys

- Use: 42% → 78%[1] → 92%[2]

- Participation: 64%[1]

- Expect to contribute more: 88%[1]

[1]Black Duck Software (2015) *Future of Open Source Survey Results*, https://www.slideshare.net/blackducksoftware/2015-future-of-open-source-survey-results

[2]Tidelift (2018) *Professional Open Source Survey Results*, https://blog.tidelift.com/our-2018-professional-open-source-survey-report-is-now-available

2017 Survey

- Successful open source collaboration

- Companies involved in OpenStack

- Range: small startups to Fortune 50 (>300k employees)

- Active investment in open source

Styles of Engagement

Randal, A. (2017) *Capabilities for open source technology innovation: a study of collaboration characteristics across OpenStack project participants*, Master's Thesis.
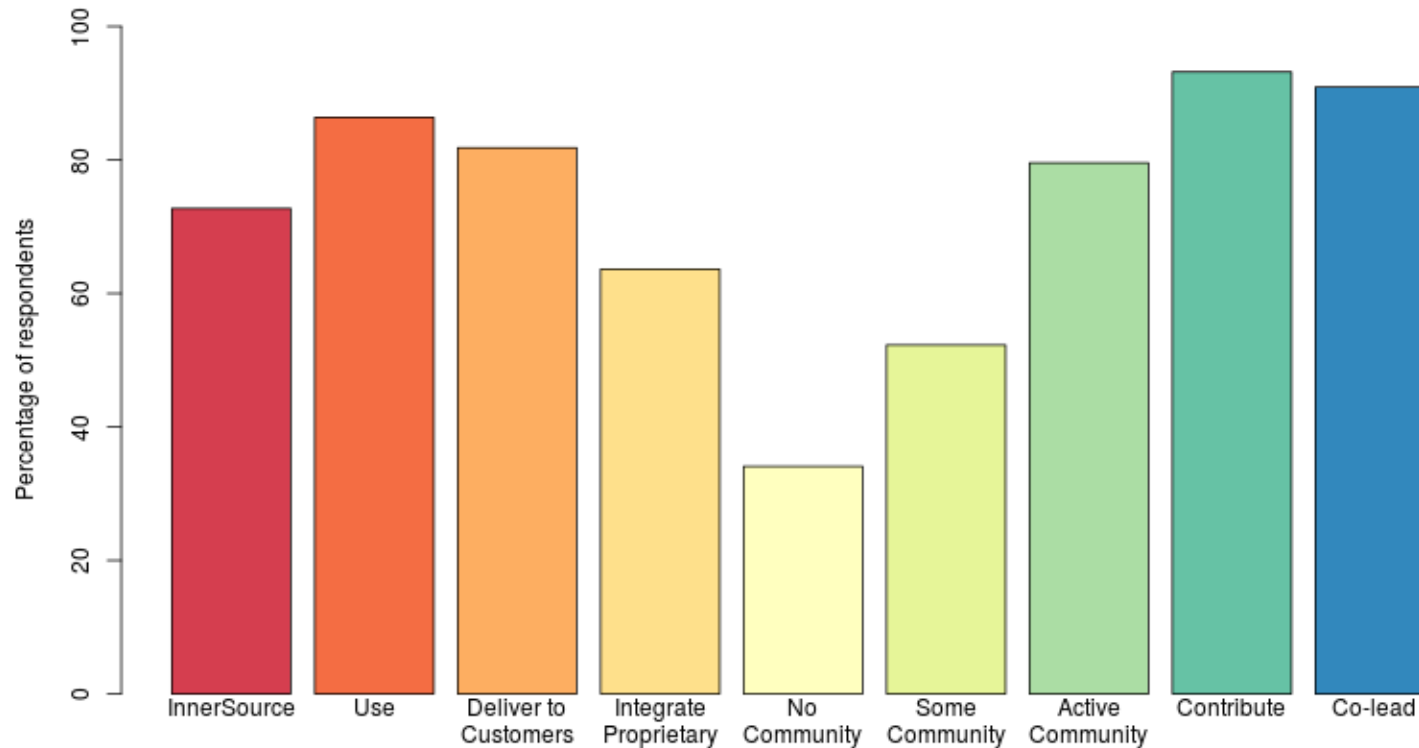
Styles of Engagement

- Most common:
  - contribute to community, 93%
  - participate as co-leaders, 91%
  - research predicts these would be less common
- Least common: open source with no community, 34%
- Integrating open source, 82%, more common than proprietary, 64%

Areas of Business Value

Randal, A. (2017) *Capabilities for open source technology innovation: a study of collaboration characteristics across OpenStack project participants*, Master's Thesis.
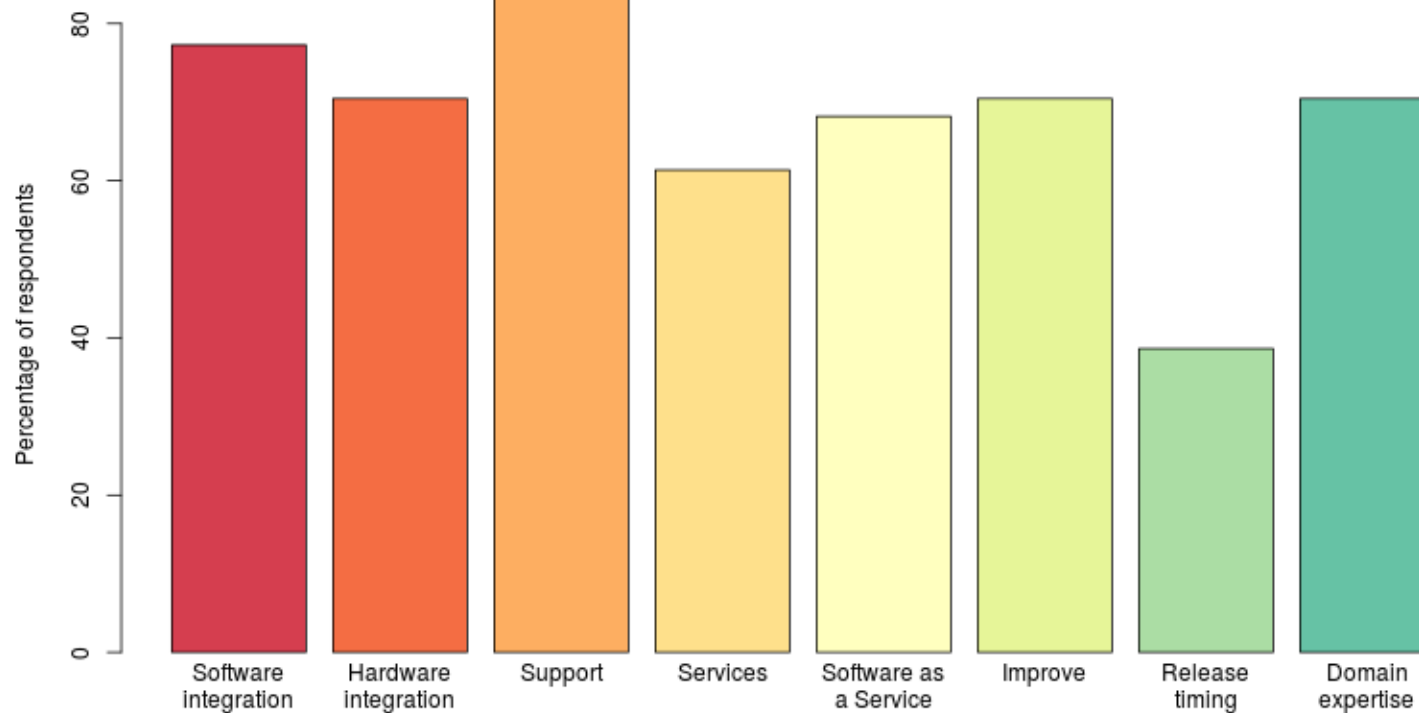
Areas of Business Value

- Most common:
  - support, 86%
  - software integration, 79%
- Correlations:
  - integration with distribution
  - contributing with support
  - active community with domain expertise
  - no community with SaaS

Participation Practices

Randal, A. (2017) *Capabilities for open source technology innovation: a study of collaboration characteristics across OpenStack project participants*, Master's Thesis.
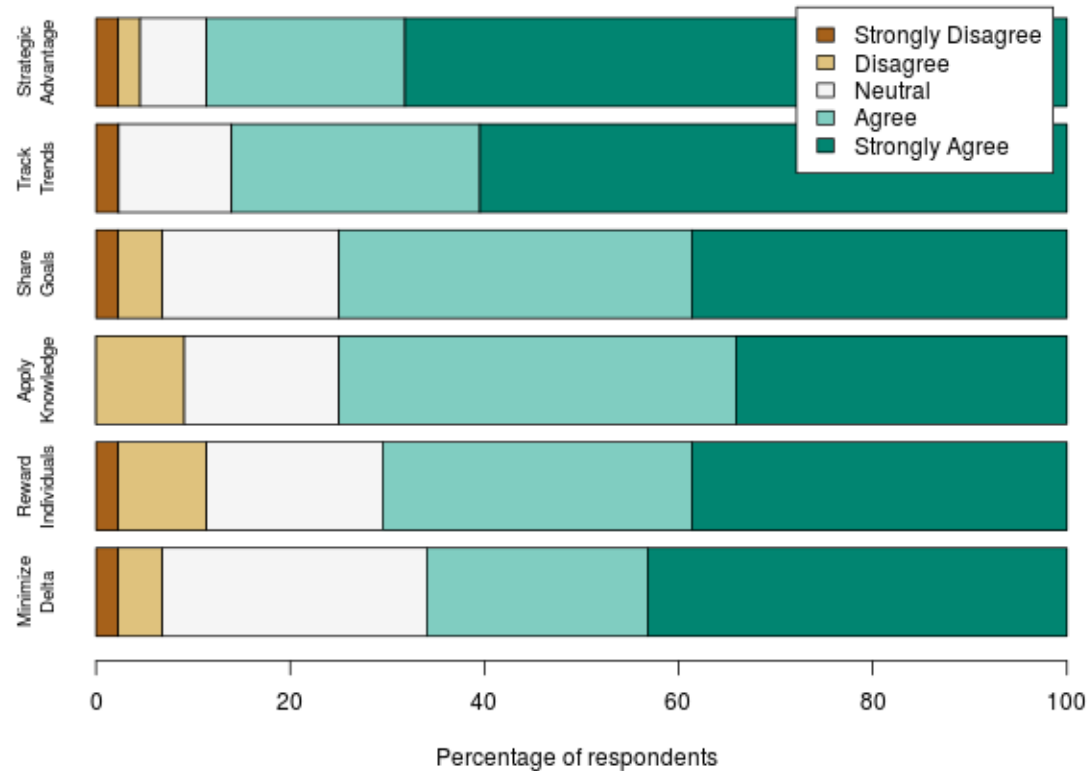
Participation Practices

- Most common:
  - regard open source as strategic component of competitive advantage, 90%
  - track open source trends for impact on business strategy, 86%
  - sharing and assimilating knowledge, 75%

What Works (and What Doesn't)

- More than a name

- More than a license

- Avoid "faux-pen" source
  - Open Core[1]
  - Commons Clause[2] license condition
  - New Year's resolution?

- No guarantee

- Best practices

[1]Phipps, S. (2010) 'Open Core is Bad For You', *ComputerworldUK*, https://webmink.com/essays/open-core/

[2]Vaughan-Nichols, S.J. (2018) 'Open-source licensing war: Commons Clause', *ZDNet*, https://www.zdnet.com/article/open-source-licensing-war-commons-clause/

Open Collaboration

- Open source
- Open development
- Open design
- Open community

Open Collaboration

- Co-leadership (strongest)
- Contribution
- Active community
- Some community
- No community (weakest)

Open Governance

- Developers and users have a voice

- Adapt over time

- Respond to opportunities and problems

Open Integration

- Internally
    - Strong integration points
    - Well tested, work well together
- Cross-project
    - Independently consumable
    - Users combine technologies
    - >50k projects in Debian
    - Opportunities for collaboration

Technical Best Practices

- Documentation
- Code review
- CI/CD
- Bug handling
- Security

~~Technical~~ Best Practices

- Documentation → Easy to get started
- Code review → Engage with new volunteers
- CI/CD → Deliver quality, consistently
- Bug handling → Solve problems as they arise
- Security → Respect and protect

What's Next?

- Open… (hardware, data, knowledge, science, pharma, agriculture, music, publishing, etc.)
- Lessons learned, reapplied
- Not just pragmatic, also philosophical
- Increasing participation, sustainability
- Proprietary niches of scarcity

Further Reading

- Pollock, R. (2018) 'The Open Revolution: Rewriting the rules of the information age'

- Ciesielska, M. and Westenholz, A. (2016) 'Dilemmas within commercial involvement in open source software', *Journal of Organizational Change Management,* vol. 29, no. 3, pp. 344-360.

- Morgan, L. and Finnegan, P. (2014) 'Beyond free software: An exploration of the business value of strategic open source', *The Journal of Strategic Information Systems*, vol. 23, no. 3, pp. 226-238.

- Pisano, G. (2016) 'Towards a Prescriptive Theory of Dynamic Capabilities: Connecting Strategic Choice, Learning, and Competition', *Harvard Business School Technology and Operations Management Unit Working Paper*, no. 16-146.

- Asundi, J., Carare, O. & Dogan, K. (2012) 'Competitive implications of software open-sourcing', *Decision Support Systems*, vol. 54, no. 1, pp. 153-163.
- Bigliardi, B. & Galati, F. (2016) 'Which factors hinder the adoption of open innovation in SMEs?', T*echnology Analysis & Strategic Management,* vol. 28, no. 8, pp. 869-885.
- Biloslavo, R. (2005) 'Use of the knowledge management framework as a tool for innovation capability audit', *International Journal of Innovation and Learning*, vol. 2, no. 4, pp. 402–24.
- Chesbrough, H. (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press, Boston, MA.
- Chiesa, V., Coughlan, P. and Voss, C. A. (1996) 'Development of a Technical Innovation Audit', *Journal of Product Innovation Management*, vol. 13, no. 2, pp. 105–36.
- Chiu, W., Chi, H., Chang, Y. & Chen, M. (2016) 'Dynamic capabilities and radical innovation performance in established firms: a structural model', *Technology Analysis & Strategic Management*, vol. 28, no. 8, pp. 965-978.
- Christensen, C. (2000) *The innovator's dilemma: when new technologies cause great firms to fail*, Harvard Business Review Press.
- Ciesielska, M. and Westenholz, A. (2016) 'Dilemmas within commercial involvement in open source software', *Journal of Organizational Change Management*. vol. 29, no. 3, pp. 344-360.
- Dahlander, L. and Gann, D.M. (2010) 'How open is innovation?' *Research Policy*, vol. 39, no. 6, pp. 699-709.
- Harison, E. & Koski, H. (2010) 'Applying open innovation in business strategies: Evidence from Finnish software firms', *Research Policy*, vol. 39. no. 3, pp. 351-359.
- Henkel, J., Schöberl, S. & Alexy, O. (2014) 'The emergence of openness: How and why firms adopt selective revealing in open innovation', *Research Policy*, vol. 43, no. 5, pp. 879-890.

- Kort, P. M. & Zaccour, G. (2011) 'When Should a Firm Open its Source Code: A Strategic Analysis', *Production and Operations Management*, vol. 20, pp. 877–888.

- Krishnamurty, S. (2005) 'An analysis of open source business models', *Perspectives on Free and Open Source Software*, The MIT Press, Cambridge, MA.

- Lerner, J. & Tirole, J. (2002) 'Some simple economics of open source', *The Journal of Industrial Economics*, vol. 50, no. 2, pp. 197-234.

- Löfsten, H. (2016) 'Organisational capabilities and the long-term survival of new technology-based firms', *European Business Review*, vol. 28, no. 3, pp.312-332

- Lundell, B., Lings, B. & Lindqvist, E. (2010) 'Open source in Swedish companies: where are we?', *Information Systems Journal*, vol. 20, no. 6, pp. 519–535.

- Lundell, B., Lings, B. & Syberfeldt, A. (2011) 'Practitioner perceptions of Open Source software in the embedded systems area', *Journal of Systems and Software*, vol. 84, no. 9, pp. 1540-1549.

- Martínez-Román, J. and Romero, I. (2016) 'Determinants of innovativeness in SMEs: disentangling core innovation and technology adoption capabilities', Review of Managerial Science, Springer.

- Mattmann, C.A., Downs, R.R., Ramirez, P.M., Goodale, C. & Hart, A.F. (2012) 'Developing an open source strategy for NASA earth science data systems', *2012 IEEE 13th International Conference on Information Reuse & Integration (IRI)*, pp. 687-693.

- Morgan, L. and Finnegan, P. (2014) 'Beyond free software: An exploration of the business value of strategic open source', *The Journal of Strategic Information Systems*, vol. 23, no. 3, pp. 226-238.

- Pisano, G. (2016) 'Towards a Prescriptive Theory of Dynamic Capabilities: Connecting Strategic Choice, Learning, and Competition', *Harvard Business School Technology and Operations Management Unit Working Paper*, no. 16-146.

- Rajala, R., Westerlund, M. & Möller, K. (2012) 'Strategic flexibility in open innovation – designing business models for open source software', *European Journal of Marketing*, vol. 46, no. 10, pp. 1368-1388.
- Riehle, D. (2012) 'The single-vendor commercial open source business model', *Information Systems and e-Business Management*, vol. 10, no. 3, pp. 5-17.
- Rubera, G., Chandrasekaran, D. & Ordanini, A. (2015) 'Open innovation, product portfolio innovativeness and firm performance: the dual role of new product development capabilities', *Journal of the Academy of Marketing Science*, vol. 44, no. 2, pp. 166-184.
- Shanker, A. (2012) 'An Enterprise Perspective on Customer Value Propositions for Open Source Software', *Technology Innovation Management Review*, vol. 2, no. 12, pp. 28-36.
- Sullivan, P.H. (2000) *Value-driven Intellectual Capital*, New York, Chichester Wiley/Arthur Andersen.
- Teece, D.J. (2000) *Managing Intellectual Capital: Organizational, Strategic, and Policy Dimensions*, Oxford, Oxford University Press.
- Vakili, K. (2016) 'Collaborative Promotion of Technology Standards and the Impact on Innovation, Industry Structure, and Organizational Capabilities: Evidence from Modern Patent Pools', *Organization Science*, vol. 27, no. 6, pp. 1504-1524.
- Westenholz, A. (Ed.) (2012) *The Janus Face of Commercial Software Communities — An Investigation into Institutional (Non) Work by Interacting Institutional Actors*, Copenhagen Business School Press, Frederiksberg.
- Yam, R. C. M., Guan, J. C., Pun, K F. and Tang, E. P. Y. (2004) 'An audit of technological innovation capabilities in Chinese firms: some empirical findings in Beijing, China', *Research Policy*, vol. 33, no. 8, pp. 1123–40.
- Zhao, S., Sun, Y. & Xu, X. (2016) 'Research on open innovation performance: a review', *Information Technology and Management*, vol. 17, no. 3, pp. 279-287.