



# **Introduction to Engineering Design - Research Methods and Theory of Science**

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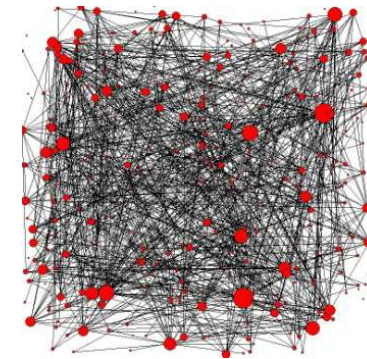
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# Research areas – Product Innovation

- **Networked Innovation**
  - Managing innovation- and idea networks
  - Co-opetition and competition in ideation
  - Knowledge-sharing in engineering
  - Open innovation
  - User- and customer involvement in innovation
  - Innovation eco-systems for Cyber-Physical Systems
- **Improving Innovation Engineering Performance**
  - Lean and agile approaches to R&D
  - Economics of innovation and portfolio management
  - Goal-setting for innovation
  - Measurement of innovation and innovation capabilities
  - Modularization and product platform management



# Researching innovation – some challenges

- Science of the artificial
  - Not only a study of how things are, but also of how they could/should be.
- Social science
  - Study of systems made up by human beings - difficulties to predict.
  - Interpretive and self-reflecting systems that are inherently complex – need to use a suitable combination of theory, phenomena, and methods.
- Continuous change
  - Of subjects. Organizations today are different from the ones yesterday.
  - Of the object of study. The nature of innovations changes over time, e.g. products, services, business models.
- Not only regularities, but also idiosyncracies are interesting.
- Gives rise to ontological and epistemological issues
  - Objectivity/subjectivity.
  - Should researchers be neutral observers or be involved in intervention and change.
  - What is the basis for validation of knowledge?

# Research methods used

- Case studies
- Collaborative research
- Experiments
- Surveys
- Social Network Analysis
- Econometrics



# Recent studies



## A selection of recently published articles

Helander, M., Bergqvist, R., Stetler, K. L. and Magnusson, M. (2015). Applying Lean in Product Development – Enabler or Disabler For Creativity?, *International Journal of Technology Management*, Vol. 68(1/2), pp. 49-69.

Stetler, K. L. and Magnusson, M. (2015). Exploring the ambiguity-clarity tension in goal setting for innovation, *Creativity and Innovation Management*, Vol. 24(2), pp. 231-246.

Mascia, D., Björk, J. and Magnusson, M. (2015). The role of social networks in organizing ideation, creativity and innovation – an introduction, *Creativity and Innovation Management*, Vol. 24(1), pp. 102-108.

Bergendahl, M., and Magnusson, M. (2015). Creating ideas for innovation - effects of organizational distance on knowledge creation processes, *Creativity and Innovation Management*, Vol. 24(1), pp. 87-101.

Sandström, C., Berglund, H., Magnusson, M. (2014). Symmetric assumptions in the theory of disruptive innovation – Theoretical and Managerial implications, *Creativity and Innovation Management*, Vol. 23(4), pp. 472-483.

Wadell, C., Björk, J. and Magnusson, M. (2014). How do R&D employees use their social networks to acquire user information?, *Journal of Knowledge Management*, Vol. 18(5), pp. 919-936.

Bergendahl, M. and Magnusson, M. (2014). Combining collaboration and competition – a key to improved idea management?, *European Journal of International Management*, Vol.8, No.5, pp.528–547.

Björk, J., Karlsson, M. and Magnusson, M. (2014). Turning ideas into innovations – introducing demand-driven collaborative ideation, *International Journal of Innovation and Regional Development*, Vol. 5, No. 4/5, pp. 429-442.

Magnusson, M. and Pasche, M. (2014). A Contingency-Based Approach to the Use of Product Platforms and Modules in New Product Development, *Journal of Product Innovation Management*.

Wadell, C., Ölundh Sandström, G., Björk, J. and Magnusson, M. (2013). Exploring the incorporation of users in an innovating business unit, *International Journal of Technology Management*.

Gutiérrez, E. and Magnusson, M. (2013). Dealing with legitimacy: A key challenge for Project Portfolio Management decision makers, *International Journal of Project Management*.

Martini, A., Gastaldi, L., Corso, M., Magnusson, M. and Timenes Laugen, B. (2012). Continuously innovating the study of continuous innovation: from actionable knowledge to universal theory in continuous innovation research, *International Journal of Technology Management*, Vol. 60, No. 3-4, pp. 157-178.

Björkdahl, J. and Magnusson, M. (2012). Managerial challenges when integrating ICTS in established products, *International Journal of Learning and Intellectual Capital*, Vol 9, No. 3, pp. 307-320.

Di Vincenzo, F., Hemphälä, J., Magnusson, M. and Mascia, D. (2012). Exploring the role of structural holes in learning – an empirical study of Swedish pharmacies, *Journal of Knowledge Management*, Vol. 16, No. 4, pp. 576-591.

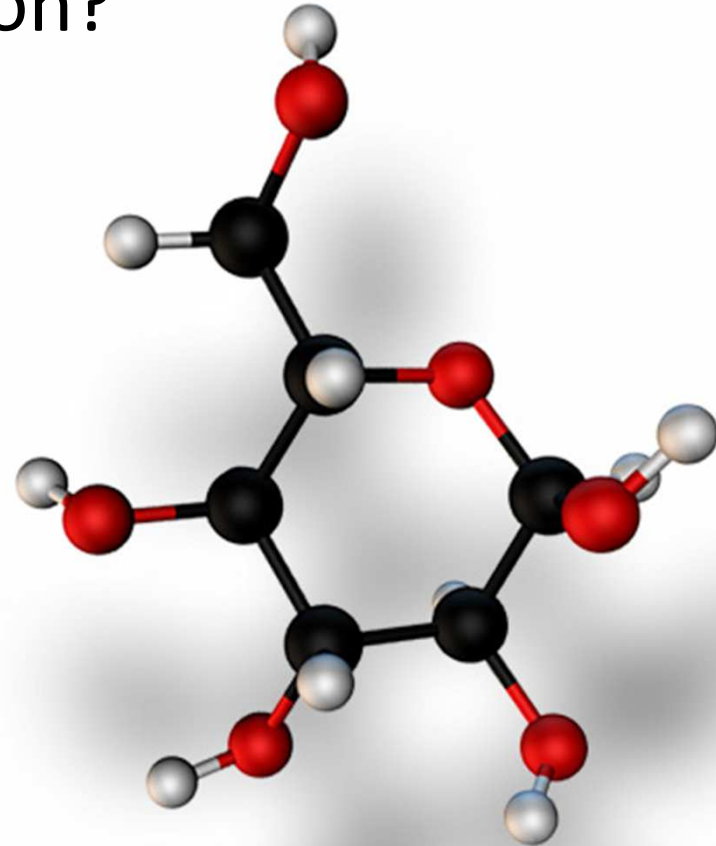
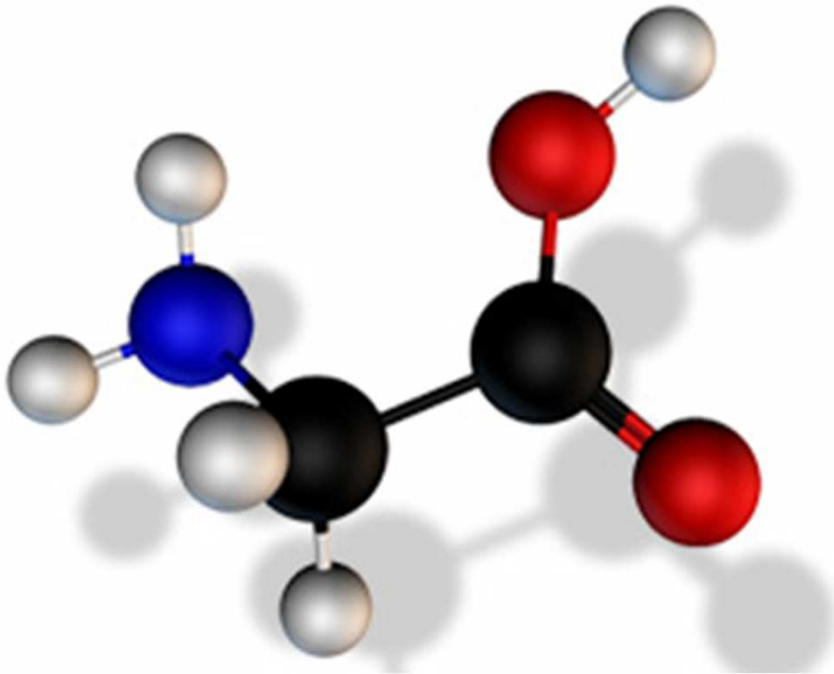
Bourellos, E., Magnusson, M. and McKelvey, M. (2012). Investigating the complexity facing academic entrepreneurs in science and engineering: the complementarities of research performance, networks and support structures in commercialization, *Cambridge Journal of Economics*, Vol. 36, No. 3, pp. 751-780.

Colombo, M. C., Laursen, K., Magnusson, M. and Rossi-Lamastra, C. (2012). Introduction: Small business and networked innovation: organizational and managerial challenges, *Journal of Small Business Management*, Vol. 50, No. 2, pp. 181-190.

Hemphälä, J. and Magnusson M. (2012). Networks for Innovation – But What Networks and What Innovation?, *Creativity and Innovation Management*, Vol. 21, No. 1, pp. 3-16.

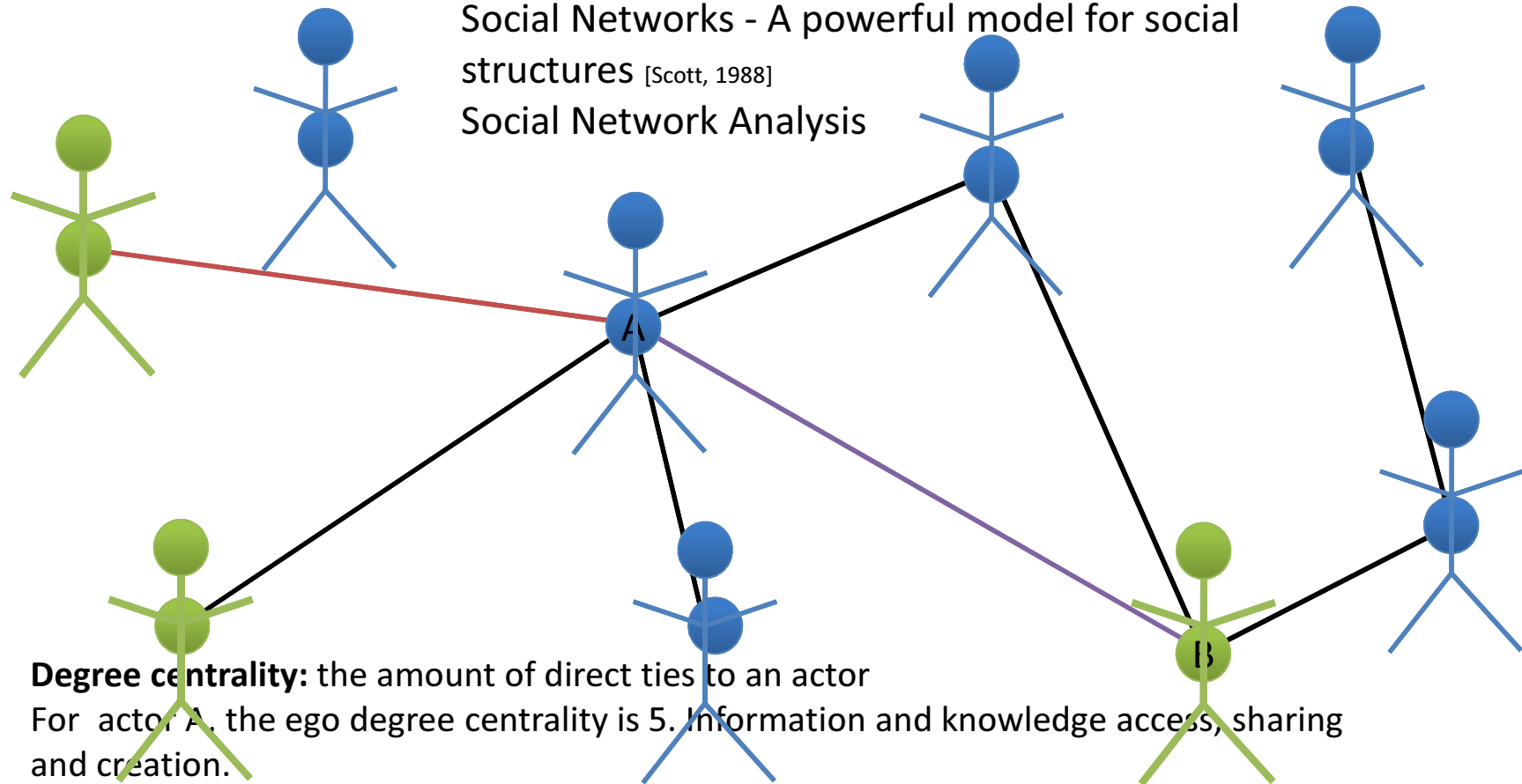
## Collaborative ideation networks

- How do different network structures influence ideation?



# Mapping and analyzing structural properties

Social Networks - A powerful model for social structures [Scott, 1988]  
Social Network Analysis



**Degree centrality:** the amount of direct ties to an actor

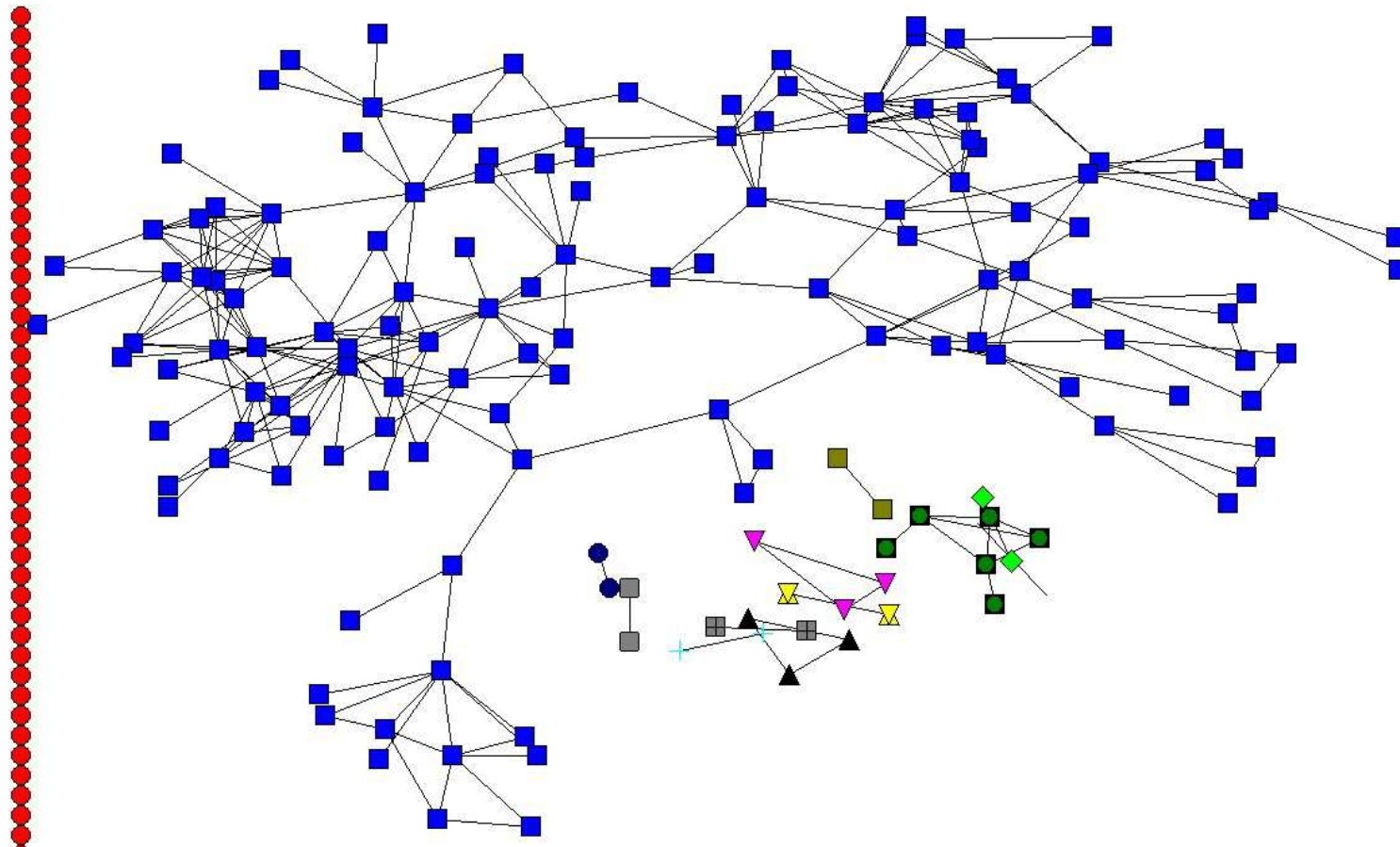
For actor A, the ego degree centrality is 5. Information and knowledge access, sharing and creation.

**Structural holes** access to unconnected alters

For actor B = 2. Information dissimilarities, power

# Mapping and analyzing innovation networks

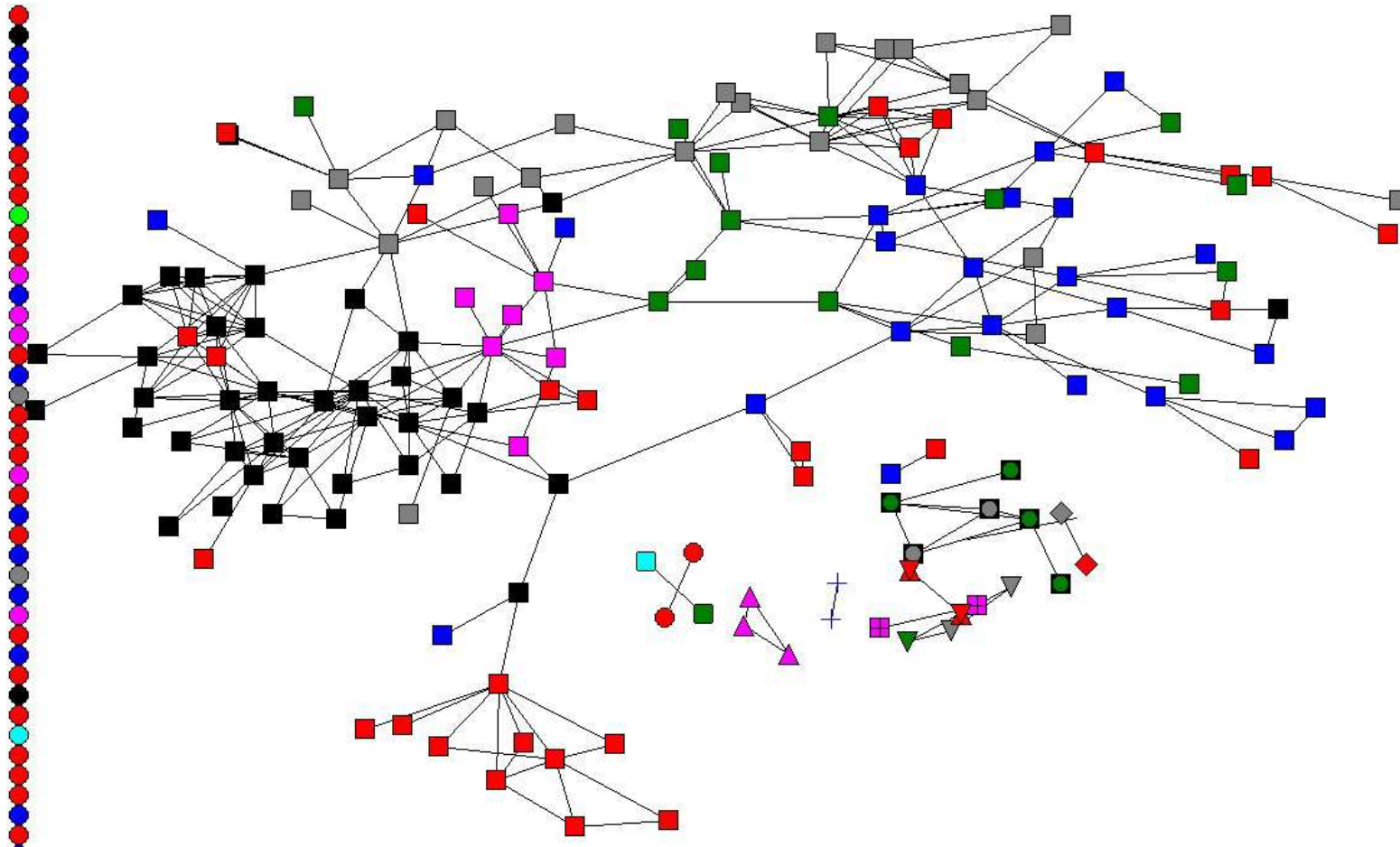
Components in an ideation network within one organisation





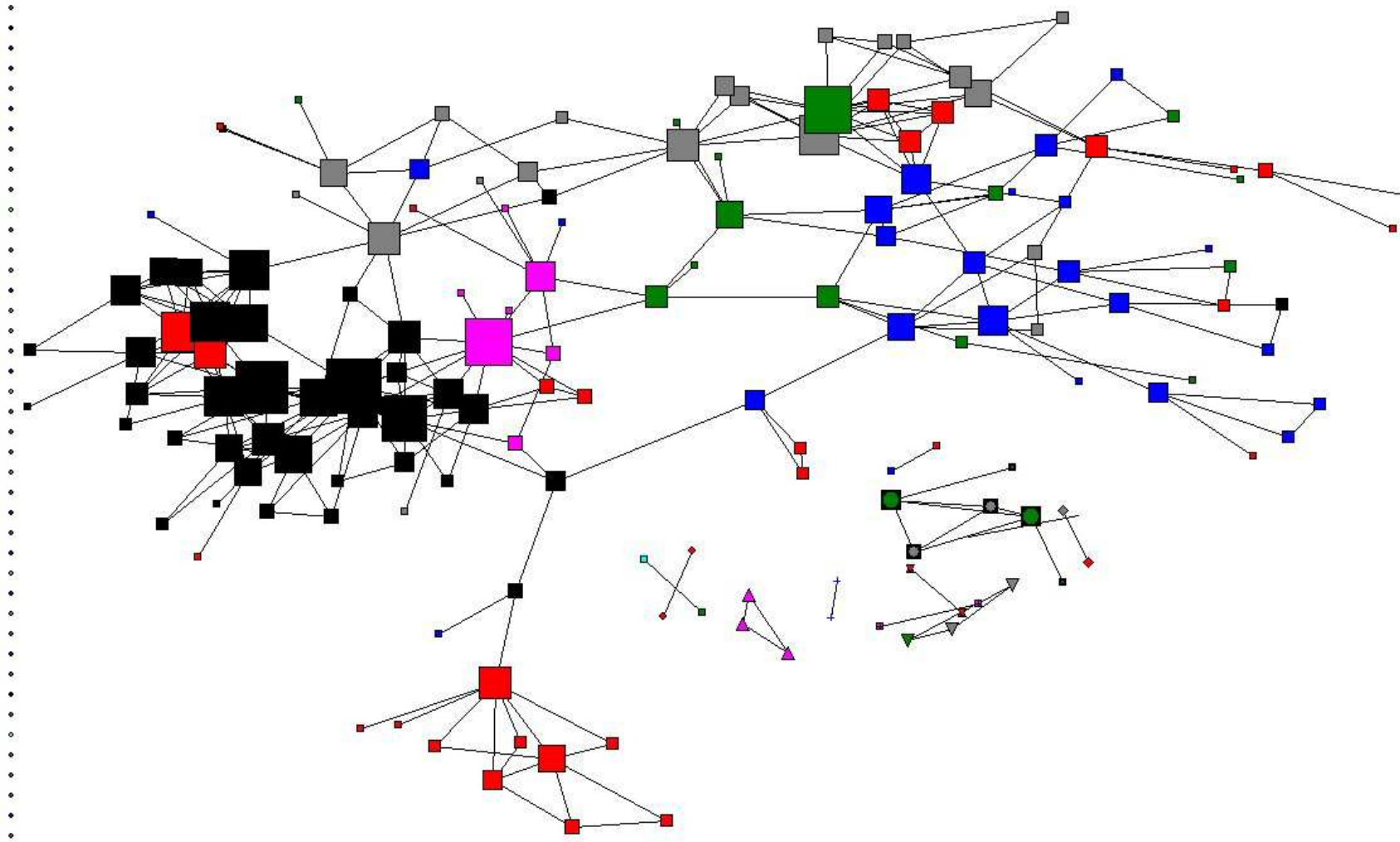
# Mapping and analyzing innovation networks

Identifying collaboration - formal organisational belonging



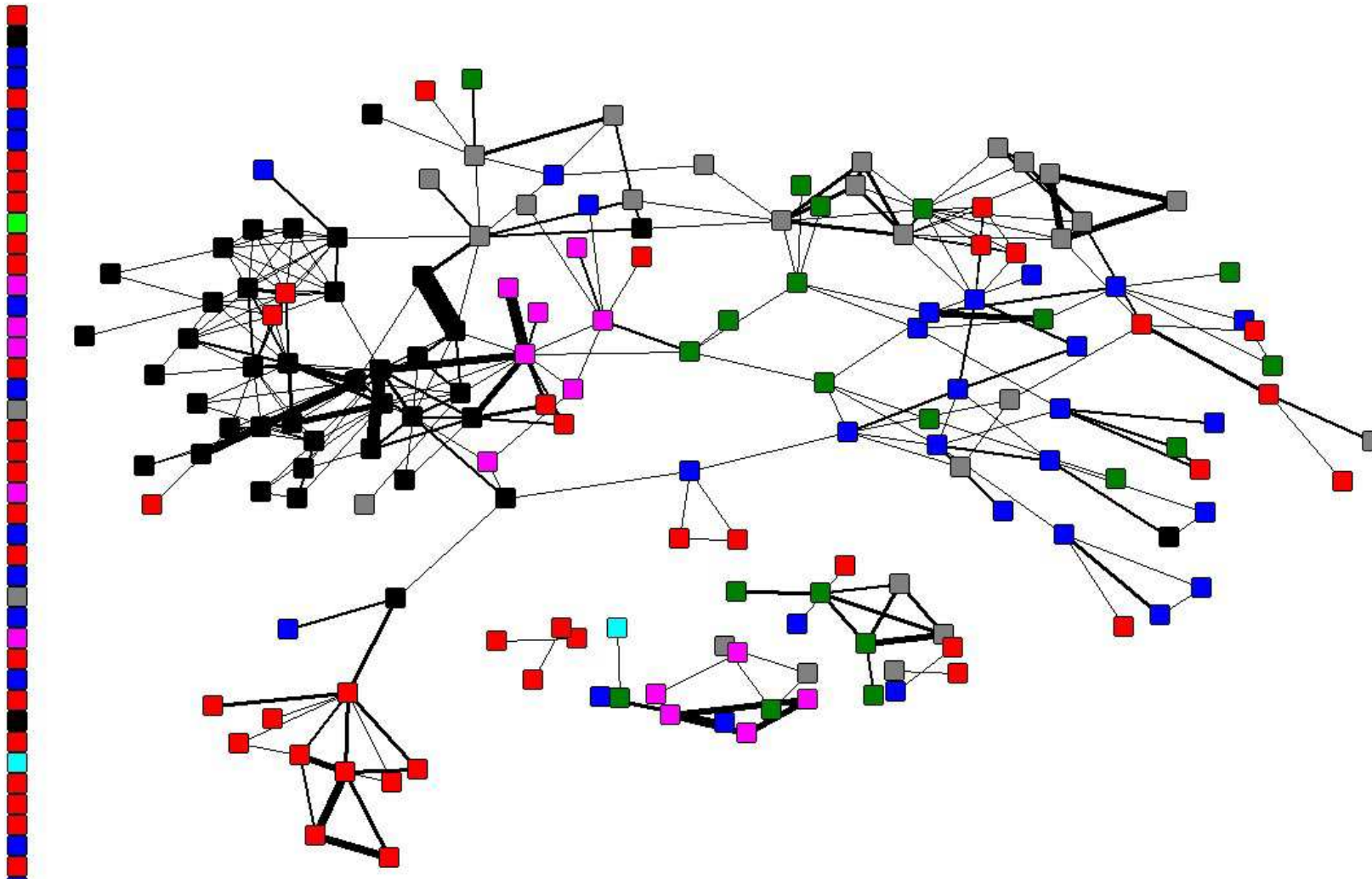
# Mapping and analyzing innovation networks

Number of direct ties to an actor (degree centrality)



# Mapping and analyzing innovation networks

Tie strength - collaboration frequency

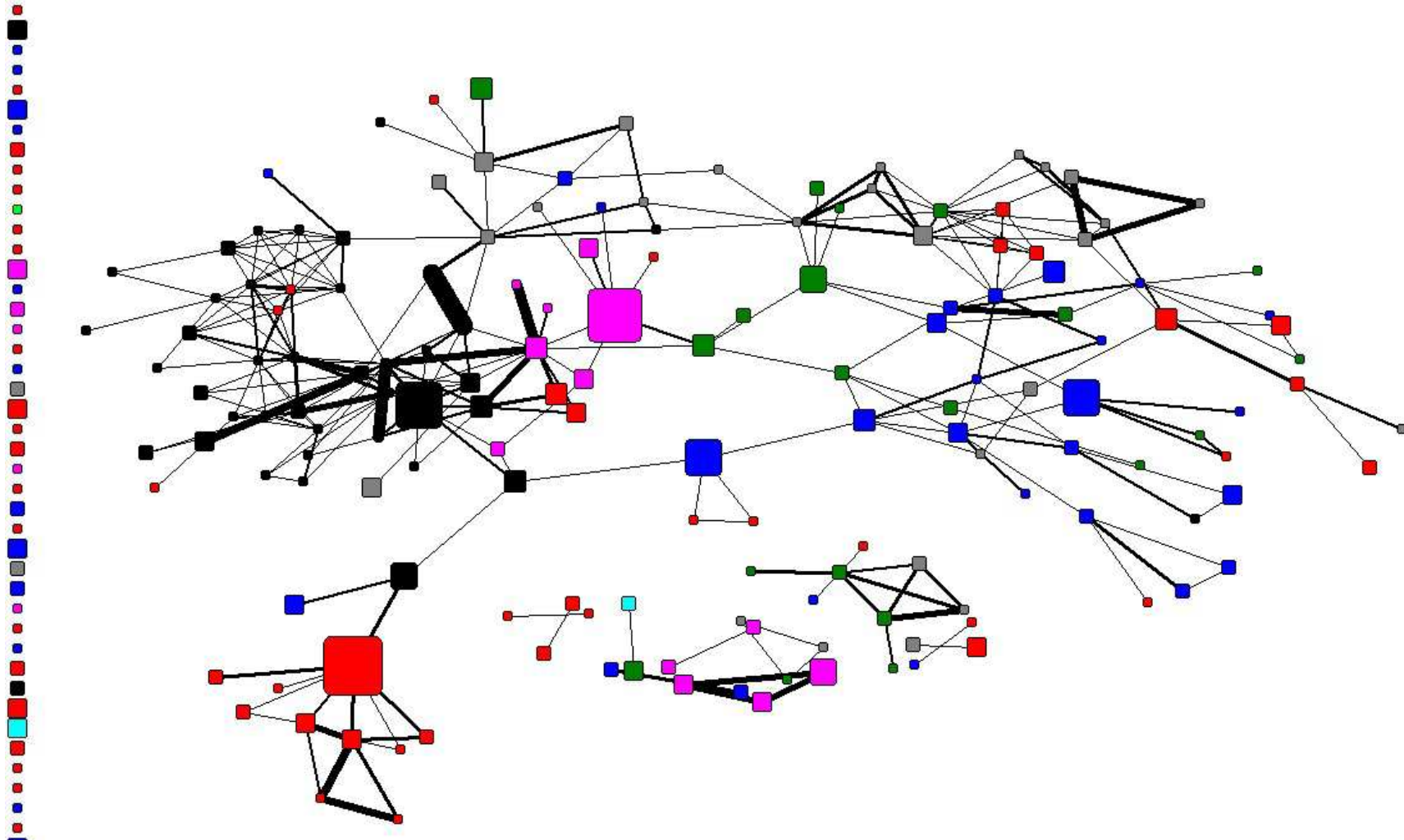


The image displays a large, interconnected network graph. The nodes are represented by squares of different colors and sizes, indicating different categories or weights. The colors include black, grey, blue, green, red, pink, and cyan. The edges are thin black lines connecting the nodes, forming a complex web of relationships. A vertical legend on the left side of the image shows a sequence of colored dots corresponding to the node colors, likely representing a specific attribute or classification for each node. The network is highly clustered, with many nodes having multiple connections, suggesting a dense and interconnected system.

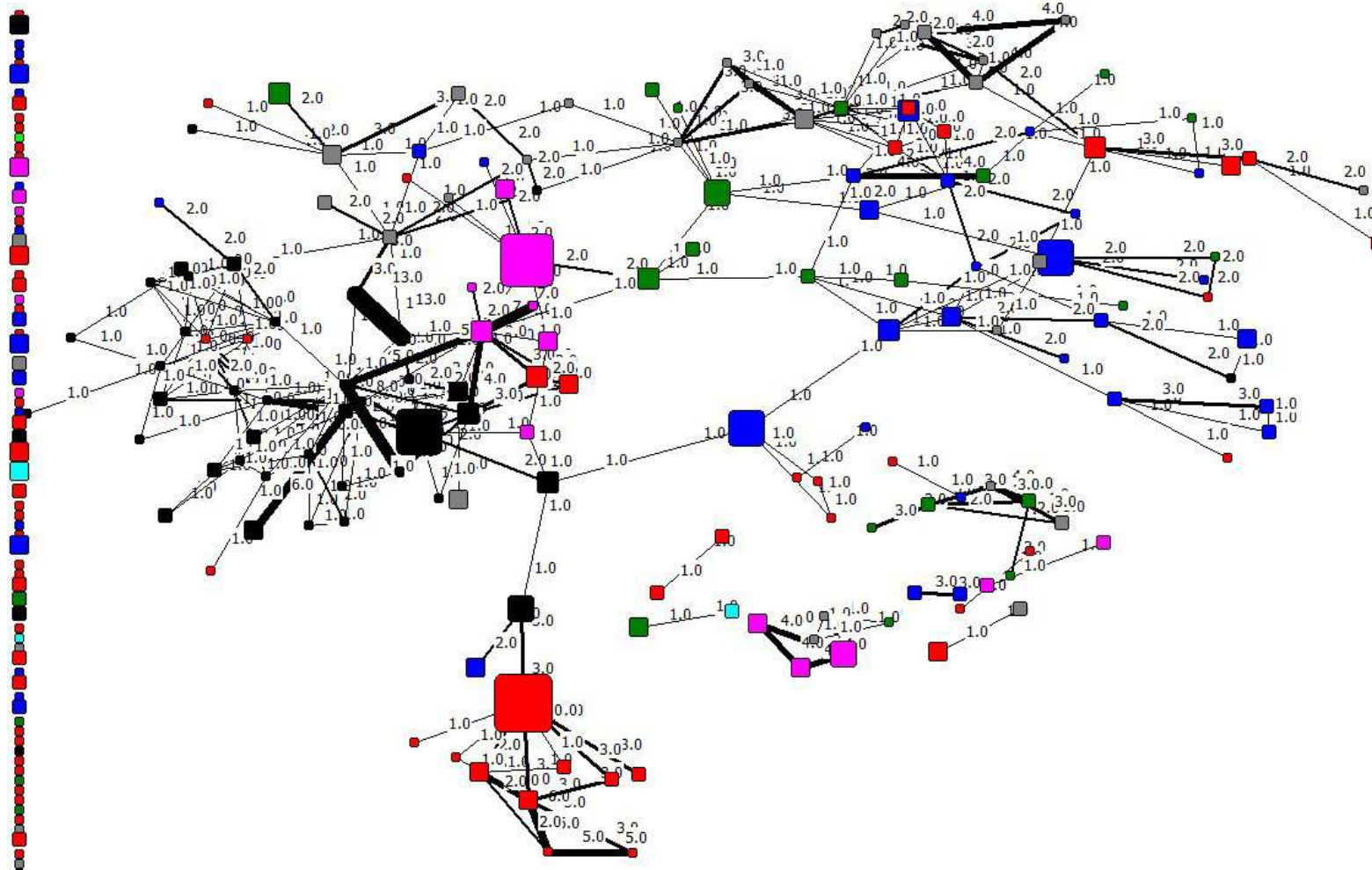


# Mapping and analyzing innovation networks

Number of "high quality" ideas each single actor has been involved in



# Mapping and analyzing innovation networks



Visual analysis not possible when the complexity increases -> statistical analyses