AGILE DEVELOPMENT METHODS THROUGH THE EYES OF ORGANIZATIONAL NETWORK ANALYSIS

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WIMS'14

Problem definition

- Agile development makers argue that their methods bring noticeable improvements in delivering products and satisfying clients' needs.

- But skepticism arises among organizations' stakeholders, as it is difficult to explain the mechanism by which the development process is enhanced.

Solution

Use Organizational Network Analysis to quantify the benefits of Agile Development Methods compared to the classical development methods.

Organizational Network Analysis

Is the science that studies the formal and/or informal networks that appear within an organization.

Establishes the manner by which particular network properties influence the organization's well being.

Example of networks

Each people in an organization is represented by a node. Establish links between nodes based on the following:

- Who stays with whom during lunch.
- Who ask who when a difficulty arises
- Direct subordination

Questions that can be answered by using ONA

- Which are the most important people.
- Does the network support the exchange of information/goods between individuals.
- Which individuals are overwhelmed by the amount of “work”.
- Compare networks and determine which one is better.

Agile Development Methods

Methods of commercial product development created in order to adapt to "fast-paced" fiercely competitive world, where speed and flexibility are essential.

SCRUM

- A framework for developing products in a time boxed cycles, called Sprints.
- SCRUM embraces the concept of self-organized development teams
- In SCRUM there are just 4 roles:
  - Product Owner
  - Developing Team
  - Scrum Master
  - Stakeholders

Product Owner

Is responsible for identifying product features and prioritizing them into a list, called Product Backlog.

The list is continuously refined and adapted to match the pace of the development.

Developing team

The individuals that actually participate in the creation of the product from design to testing.

Multiple teams can be created, but a team size is restricted to a maximum of 9 individuals.

SCRUM Master

Person that enforces and makes sure that the rules of SCRUM are respected.

Stakeholders

Are all the persons interested in the development of the product: future owners, end users, financial consultants, etc.

Communication in SCRUM

- Scheduled meetings are enforced between all SCRUM participants
- Teams have a meeting every day
- All participant meet at the beginning and the end of every time box (Sprint)
- A Sprint has a duration between 2 to 4 weeks

What did we do?

1. Created networks of individuals that simulate the use of SCRUM in an organization.
2. Created networks of individuals that resemble a classical development method with a tree like hierarchy.
3. Compared the networks by using ONA.

Network creation

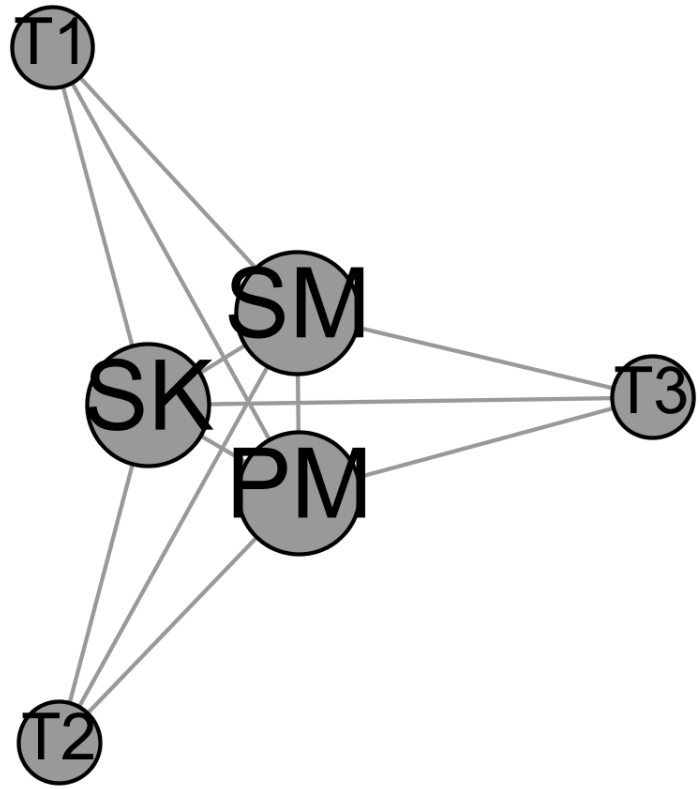
- For each development method type we created 2 networks. One for each perspective:
  - The diffusion of knowledge from the stakeholders to all the individuals in the network.
  - The exchange of skill between the organization's members.

- We took as inspiration companies that develop software.

SCRUM's network

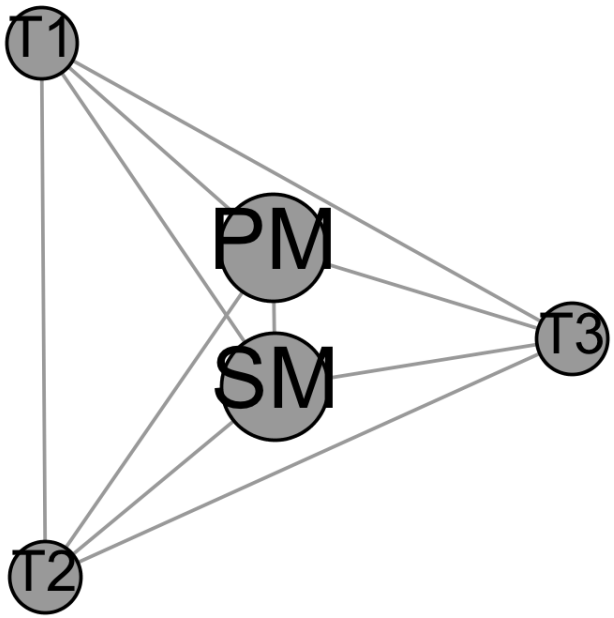
- 3 developing teams, each team having 9 members.
- 1 project manager.
- 1 node representing all the stakeholders.

- Links between the nodes were created based on the opportunity of communication defined by SCRUM



Network of knowledge dissipation from the stakeholders

Due to the fact that Stakeholders meet on a regular basis with all the the members, everyone is just one step away from communicating with them.



Network of skill exchange between individuals

In this case we have a complete graph, as everyone can talk directly to everyone else in the organization.

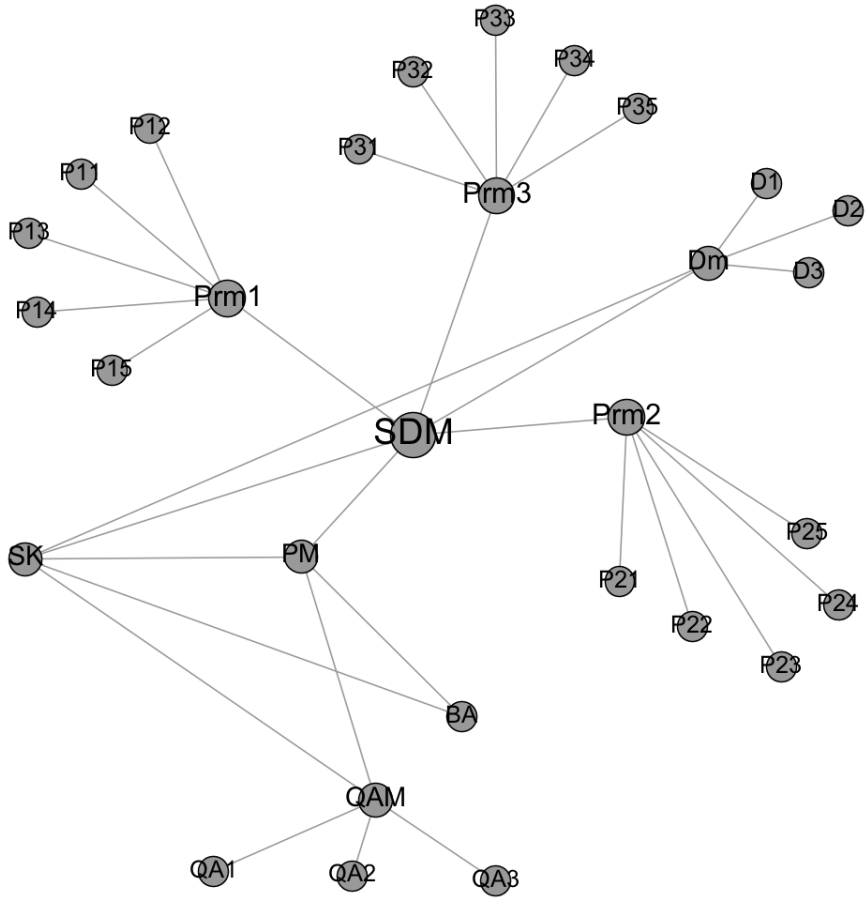
Hierarchical network (organization's chart)

A hierarchical structure follows the layout of a pyramid. Every employee in the organization, except one, is subordinated to someone else in the organization. Members communicate with their subordinates and with their respective superior.

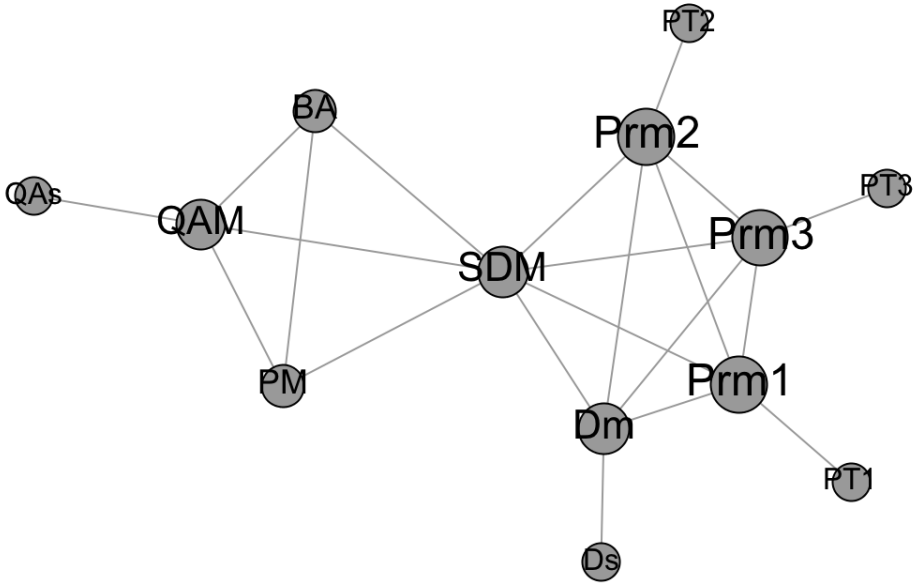
Hierarchical roles and nodes

- 1 Project Manager
- 1 Business Analyst
- 1 Software Developer Manager
  - 3 Programming Managers
    - Each Programming Manager has 5 Programmers
  - 1 Design Manager
    - 3 Designers
- 1 Quality Assurance Manager
  - 3 Quality Assurance individuals
- 1 node representing all Stakeholders

Knowledge dissipation from Stakeholders



The Design Manager is considered to be in direct contact with the Stakeholders as his work is heavily by stakeholders requests.



Knowledge exchange

Here each Team of Programmers is represented by a node, as we are more interested in cross-team exchange of skills. We suppose that inside a Team of Programmers each one can directly talk with each other.

ONA general metrics

- Erdos number:
  - the shortest path length between two nodes
- Average Erdos number:
  - the average shortest path from a specific node to the rest of the network
- Clustering coefficient:
  - measures the amount of triadic closure in the graph.

ONA node metrics

- Closeness centrality:
  - it can interpreted as a measure of how many steps are needed for information that raises in the suburbs of the network to get to a certain node
- Betweenness:
  - a node with high betweenness appears more often in paths between nodes in the network
- PageRank:
  - algorithm to determine a node's importance.

Result of the comparisons

Knowledge dissipation

- General graph metrics

Metric	SCRUM value	Hierarchical Value
Average path length	1.8	3.2
Diameter	2	5
Average Erdos number for stakeholders	1	2.34

Knowledge dissipation

- Node properties
  - Stakeholders

	Closenness	Degree	Betweenness
Hierarchical	2.34	5	71.5
Scrum	1	29	117

Knowledge dissipation

- Node properties with SCRUM network

	PageRank	Edos Number
SK	0.16	0
PM	0.16	1
PM	0.16	1
Team member	0.01	1

Knowledge dissipation

- Node properties with hierarchical network

	PageRank	Erdos Number
SK	0.04	0
PM	0.04	1
BA	0.04	1
QAM	0.07	1
SDM	0.08	1
QA	0.01	2
PRM	0.1	2
DM	0.08	2
Designer	0.01	2
Programmer	0.01	3

Skill exchange

- General graph description of skill transfer between teams

	SCRUM	Hierarhical
Diameter	1	4
Average path length	1	2.11
Clustering Coefficient	1	0.41

Skill exchange

- Node properties in SCRUM network

	PageRank	Closeness	Betweenness
PM	0.2	1	0
SM	0.2	1	0
Team	0.2	1	0

	QA	Designer
Path lengh from Team	4	3

Skill exchange

- Node properties in the Hierarchical network

	PageRank	Closeness	Betweenness
PM	0.07	2.08	0
SDM	0.15	1.41	32
BA	0.07	2.08	0
QAM	0.09	2	11
QA	0.03	2.91	0
PRM	0.11	1.66	11
DM	0.11	1.66	11
Designer	0.03	2.53	0
Team	0.03	2.58	0

Conclusions

By the means of ONA metrics we quantified the difference between SCRUM and a classical development method based on a tree like hierarchy

SCRUM offers better results in every case that we took in consideration. An organization that implements SCRUM supports better the exchange of skill between teams. Also the products developed have a higher chance to comply with the stakeholders requests.

Future work

- Explore an agent based approach
- Use other organizational development methods


Questions?

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