An Approach for Improving Business Process Management in Agile Service Networks

Minor Research

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Detailed Outline

- **Background Information**
  - Agile Services Networks (ASNs)
  - Evaluating and Increasing Value in ASNs
  - Business as Ecosystems
  - Intangible Value and Social Interactions

- **Ideas for Improving Agility**
  - Existing Case Studies: Amazon and eBay
  - Methods for Involving the Final User in the Value Creation
  - Convergence of Social Network Analysis to Service Network Analysis

- **Improving BPM Lifecycle**

- **Case Study: A Car Sharing Company**
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- Ideas for Improving Agility
- Improving BPM Lifecycle
- Case Study: A Car Sharing Company
**Background: What is a Service Network?**

- System composed of several entities that may be either whole companies or different roles within the same company: these are the nodes of the network [12,16,17,22,24].

- All these entities are allowed to interact to each other by exchanging generic offerings and revenues: these interactions are the edges of the network.

- In literature Service Networks are also known as Service Value Networks since through the interactions it is possible to create some sort of *value* (Porter value chain generalization) [10,14,15].
An Agile Service Network (or ASN) is a Service Network with the following characteristics [12,13]:

- Each component of the network (firms and roles within a firm) does not have fixed business processes.
- Interactions may be dynamic (change over time), asynchronous, and involve more than a node at the same time.
- Interactions (and therefore Business Processes) may be adapted right-away depending on the needs and KPIs of each interacting partner [21].

A Service Network may have different levels of agility:

- More agile networks are able to react and modify their business processes in a seamless way to increase the created value.
- Less agile networks are instead characterized by limited capability to react to changes, and therefore, depending on the dynamism of the environment, they have a negative impact on the created value.
Background: Evaluating ASNs

- Qualitative and quantitative evaluation approaches have been proposed: [7,8,9,13,25]

- Qualitative approach (network effectiveness):
  - Capability of the network to actually produce value
  - Sharing responsibility among each node (to avoid hubs)
  - Ratio of tangible/intangible interactions (a tangible interaction may be trust, competence transfer, etc) [11,18,20]
  - Capability to transform value [4,6]
  - Existence of virtuous/vicious circles

- Quantitative approach (network efficiency):
  - Amount of value created (including revenue and satisfaction)
  - Agility (in terms of average distance between nodes)
  - Weak tie stability (resistance to loss of interconnections)
Background: Business as Ecosystems /1

- Bio-inspired Parallelism: each role (interacting entity) depends on other roles, competes with concurrent roles, provides dependencies for other roles [1,2,3].
Background: Business as Ecosystem /2

- Different coordination mechanisms: [3]
  - Rigid hierarchies.
  - Flexible markets.

- The environment is a key in choosing the best coordination mechanism.

- Behavior of a company [2]:
  - Aggressive (tries to “eat” other competitors).
  - Cooperative (acts as a “keystone” by cooperating with competitors).

- Created value is an emergent property of the ecosystem.

- The set of common cooperative/competitive behaviors that are required to achieve the emergent properties define the “ecology” of the network.
Intangible value is **knowledge**. [11,18,20]

It is usually a side effect of human interactions and may be perceived as either a positive or negative value.

**Typical positive intangibles:**

- Knowledge of individuals (increased social-networking).
- Knowledge of competences (increased know-how).
- Knowledge of internal/external structures (trust/reputation information).
Background: Modeling Intangible Value

- A typical business system has been formerly represented as a Value Chain and now as a more flexible Value Network. [10,14,15]

- Tangible Interactions $\rightarrow$ transfers of contractual goods.

- Intangible Interactions $\rightarrow$ transfer of goods (knowledge) that have not been contractually defined.

- The network may be modeled as three different graphs:
  - 1) Tangible graph
  - 2) Intangible graph
  - 3) Mixed graph
  - All three graphs may be analyzed individually to see if all participants in the network are able to gain value from both types of transactions.

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<thead>
<tr>
<th>Tangibles &gt; Intangibles</th>
<th>Intangibles &gt; Tangibles</th>
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<tbody>
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<td>+ High level of transparency</td>
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<td>+ Good formal structures</td>
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<td>- Lack of trust</td>
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<td>+ High flexibility</td>
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<td>- Broken formal processes</td>
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Background: The Role of Trust /1

- **Definition**: *an attitude of positive expectation that one’s vulnerabilities will not be exploited* [5]

![Diagram showing the process of trust]

- Initial knowledge (and possible warranty) is the only decision parameter for estimating the risk of the interaction.
Background: The Role of Trust /2

- Trust depends on the level of Uncertainty and on Extrinsic / Intrinsic Knowledge [5,23]
  - Extrinsic Knowledge:
    - What the trustor know before taking the risk the first time.
    - Additional knowledge that is not related to interactions.
    - Examples: Reputation of trustee, abilities, motivation, …
  - Intrinsic Knowledge:
    - What the trustor learns after other interactions.
    - Examples: fulfillment of previous trusting actions.

- Agile Service Network environment is dominated by uncertainty (many actors and processes, continuous change)
  - Trust solution is to increase the knowledge: increase the quantity of intangible value through social interactions.
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- Improving BPM Lifecycle
- Case Study: A Car Sharing Company
Agile Service Networks try to overcome the following issues in reorganizing Business Processes:

- Possible no a-priori knowledge of interacting partners.
- Multiple possible partners for each role of the network.
- Dynamic functional and non-functional requirements (KPI/SLA).

In other words:

- This is a decision problem.
- Need of a mathematical model for estimating the solution that maximizes the value of the network.
- Need of a mechanism for increasing the knowledge among the ASN participants.
Why the applicability of a mathematical model and a quantitative approach is limited if high agility is a requirement?

- In business ecosystems the coordination mechanism is a form of self-organization → indirect achievement of the final goal through virtuous loops.
- A figure of Service Network leader may either not exist or may not have enough power to reorganize the whole network.
- No interacting partners may have a comprehensive understanding of the whole network (such as what happens in the stocks exchange market).

We have Uncertainty

Environment is characterized by uncertainty and different objectives

Uncertainty needs Trust

Uncertainty requires trust for every interaction

Trust needs Knowledge

Trust may be increased by exchanging knowledge

Knowledge results from intangible interactions

Add intangibles in BPM lifecycle
Existing Case Studies

Amazon and eBay

Who is beyond that nickname?

Uncertainty: risk of frouds

Trade activities: need of trust

Unknown Service Providers

Unknown Service Users

Knowledge obtained using:
- Feedbacks
- Information about previous transactions
- Year of subscription
- Other insurances offered by the broker
Idea 1: integrate reputation mechanisms in Business Process Management

- Risk is lowered by increasing Knowledge.
- Eliminate “passive” interactions. Every interaction should generate some feedback (intangible transaction).
- In terms of Business Processes, every partner involved in a process should receive a feedback from any partner participating in the process.
  - Positive feedback → Lower risk.
  - Negative feedback → Higher risk.
- Similarly to what already happens in eBay.
- This value of risk may be used as a non-functional requirement in a SLA.
- The value of risk is extremely volatile (high standard deviation in a certain temporal horizon), therefore the Business Process should always be reorganized accordingly.
Idea 2: transparency and competence transfer

- Another method for increasing knowledge (and reducing risk) is to operate in the most transparent way and especially to cooperate.
  - Having the knowledge of all activities (and common goals) of interacting partners may lead to improved Business Processes.
  - This increases efficiency for both the partners and therefore having such common goal results in a stronger relationship (trust).

- Small Clarifying Example:
  - Company A and B are both online book shops (using for example Amazon brokering services).
  - Company A is specialized in academic books, while B is specialized in novels.
  - A buys the right to sell on its behalf some books of B.
  - Since B has enough knowledge about A, B proposes to do the same.
  - Through this cooperations both companies have more value and acquire the necessary skills to operate in both markets.
We need an active role for the final user in the business process

- Final user is able to convert the whole process in terms of:
  - Tangible value: (s)he pays.
  - Intangible value: (s)he shares her/his experience with the collectivity.

- Final user is not necessarily a simple customer:
  - Possibility to suggest process improvements based on her/his experience.
  - Possibility to have an active role in the process.

New Problem: How to evaluate user involvement?

- Possible solution:
  - Treat the ASN as a Social Network and apply Social Network analysis techniques. [19]
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BPM improvement in ASN: overview

- **Problem:**
  - Possibly no a-priori knowledge of interacting partners.
  - Multiple possible partners for each role of the network.
  - Dynamic functional and non-functional requirements (KPI/SLA).

- **Idea:**
  - Consider intangible interactions among the entities.
  - Intangible interactions are not defined by contracts, but they correspond to knowledge exchanges (e.g., reputation management).
  - Exploit intangible interactions and transform them into value.

- **Proposed Solution:**
  - Identify some patterns in the Agile Service Network.
  - Try to evaluate the impact on value of possible network transformations.
  - Apply the transformation: underlying business processes are transformed accordingly.
BPM improvement in ASN: transformation

- Add the concept of feedback to every interaction
- Reduce uncertainty, increase trust and chances of collaboration (value-creating activities)
Value comparison of the two Abstract Service Network Fragments

When do we expect to increase the overall value?

- More revenues under High risk: the lowest payment are compensated by intangible benefits like information, lower risk, predictable quality.

- Sellers transactions are memoryless: in the old fragment the sellers do not have incentives not to be selfish, therefore they require more offered payment from the customers for the same amount of quality (low reciprocity).

- Customer satisfaction/collaborations potentiality is dominant: customers perceive dominant value from benefits that are not contractually defined, such as the number of choices, personal service, reputation management, flexibility.
An Architecture for a Self-Organizing BPM

- Provide mechanisms for each participant of an ASN to reorganize her/his participation in Business Processes (or whole Business Processes) without having to impose some rules on other participants.

- Possible BPM lifecycle (SN4BPM):
Special KPIs

- **Trust** (risk reduction) and **Convenience** (intangible value such as chance of collaboration): both indicators are subjective.

**Indicator 1: Trust**
- Risk reduction that is perceived from the local participant considering environment and reputation history of interacting partners.

**Indicator 2: Convenience**
- Possibility to gain intangible value from the interaction.

- Trust may be treated as “value damping” parameter: all the calculated (positive) values are damped by it.

- Convenience contributes to the Satisfaction Index, that depends on the application domain. It represents the intangible value expectations.
In SN4BPM trust and convenience may be integrated the following way (part 1):

- **Extended Rationalization phase**, where existing patterns of the Service Network are analyzed for possible transformations (such the one we proposed).

- Network transformation decisions are taken not only on the pattern, but also on the evaluation of value, pointing out the two important KPIs we have defined: **trust** (risk) and **convenience** (potential intangibles).

- Since risk function depends on the participant, its definition $risk_{ij}(t)$ (the risk perceived by participant $i$ in her/his interactions with $j$ at time $t$) cannot be generalized.

- The function becomes a factor in the calculation of the expected value $v_{ij}(t)$ (the expected value estimated by participant $i$ in her/his interactions with $j$ at time $t$).
In SN4BPM trust and convenience may be integrated the following way (part 2):

- Identify and add all potential value given by new intangible interactions.
- Keep into account existing uncertainty and the possible reduction given from the reputation management mechanism.
- Measure in some way (problem dependant) the chances of interactions and the consequent “openness” of the network to new value-creating collaborations. Express the increase in freedom.

All the partners involved in the process may have a different $risk_{ij}(t)$ function, therefore it is not possible to accurately predict opportunistic behaviors. This means that such actions are discouraged (that avoids falling down from a virtual loop to a vicious loop after a business process reconfiguration).
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Case Study: A Car Sharing Company

Overview

- Model of an existing car sharing company as a Service Network.

- Analyze such network using a Value Network Analysis tool.

- Find out the weaknesses of such network:
  - everybody knows that car sharing services are still not taking over the private transportation market.

- Add intangible interactions and enough production/share of knowledge to increase trust, process flexibility, and reduce the total costs.
Case Study: A Car Sharing Company
Problem description

- **Goals:**
  - Reduce the number of cars in circulation.
  - Reduce costs for occasional drivers.
  - Remove the need for a second car.

- **Benefits:**
  - Less traffic, less pollution, more available parking slots.

- **How does it work? (at least in Milan)**
  - Customer pays to the company an annual subscription fee (**120 Eur**).
  - Customer may reserve a car with the desired characteristics for a specified amount of time (**cost is 2,2 Eur/hour plus 0.50 Eur/km**).
  - Kasko insurance, fuel, cleaning, assistance, and maintenance are included in the previous costs.
Milan’s Car Sharing Company as a Service Network /1

- Network participants:
  - (many) Customers: car sharing final users (payers)
  - (one) Administrative center: coordinates the car sharing company
  - (many) Maintenance centers: provide maintenance to car sharing vehicles
  - (many) Suppliers: provide the vehicles for the car sharing company
  - (many) Reservation centers: manage bookings (online and by phone)
  - (many) Garages: provide pick-up and drop-off locations
  - (many) Insurance Centers: provide insurances for car sharing vehicles
  - (one) Public Administration: provides eco-incentives
### Main Interactions:

<table>
<thead>
<tr>
<th>Sequence</th>
<th>From Role</th>
<th>To Role</th>
<th>Deliverable</th>
<th>Nature of Deliverable</th>
</tr>
</thead>
<tbody>
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<td>4</td>
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<td>Pickup/Dropdown</td>
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Milan’s Car Sharing Company as a Service Network /3

- Garage
- Reservation Center
- Customer
- Administrative Center
- Suppliers
- Billing Center
- Public Administration
- Insurance Center
- Maintenance Center

1 1 1 1 1 1
6 5 4 6 7 6
1 1 1 1 1 1
8 9 2 10 3 8
Analysis of Milan’s Car Sharing Company

- Since the Network models the whole process from subscription to unsubscription, the most important parameters are:
  - Ratio intangible/intangible interactions (0.19:1)
  - Number of transactions (19)
  - Weak tie stability (0.25)
  - Average degree of separation (all: 1.64, intangibles: 0.14, tangibles: 1.75)

- Comments on the results:
  - The service network is able to create value almost only from tangible well-defined interactions.
  - Symptom of lack of trust among participants (in particular from the customer, which is the one involved in most interactions).
How to Add Agility to this Case Study?

- Traditional Car Sharing Systems have fixed interacting partners.

- Customers do not have the feeling of being in their car:
  - Last minute reservations cannot be usually honored.
  - Garages may be far from home.
  - The proposed insurance may not be suitable with the customer needs.
  - Hourly cost and kilometer cost may not reflect the actual costs.

- Customers who already own a car (or a second car) are forced to sell their car to take advantage of car sharing benefits.

- The key for addressing the issues above is the following:
  - Increase flexibility (last minute reservation without a pre-determinate duration) and more realistic costs.
Agile Car Sharing: move competences and decisions around the network

- Administrative center becomes only a coordinator:
  - Provides subscriptions/unsubscribes/administrative support
  - Provides certifications and manages payments

- Customers (private/company) have now two options:
  - Share a car
  - Reserve a shared car

- Insurance, Maintenance, Garage are optionally provided directly by customers that are sharing their car at their preferred price.

- A new reputation center gathers feedback after every interaction to permit the knowledge transfer and an easier evaluation of risk.
Agile Car Sharing: possible benefits

- Offer will be more differentiated:
  - Final cost will be proportional to quality/risk ratio.
  - Final user may have some cash back by sharing her/his second car.
  - Private companies that have many unused vehicle may cooperate with other companies who need them.

- Last but not least:
  - The “coordinator” (Car Sharing company) may be easily replaced, for example when going to a foreign city/country.
  - Opportunity for more powerful roaming agreements.
  - Possibility to have car sharing in places that are not covered by local coordinators.
  - Flexibility in pick-up/drop-down time as soon as a critical mass of car sharing vehicles has been reached.
## Agile Car Sharing as an Agile Service Network

- **Network participants:**
  - (many) **Car Providers**: customers who share a car
  - (many) **Car Users**: customers who use a shared car
  - (many) **Garages**: provide parking slots to customers
  - (many) **Insurance Centers**: provide insurances
  - (many) **Maintenance Centers**: provide equipment and maintenance
  - (one) **Administrative Center**: broker between providers and users
  - (one) **Reputation Center**: manages feedbacks
  - (one) **Billing Center**: manages payments
  - (many) **Reservation Centers**: manages reservations
  - (one) **Public Administration**: provides eco-incentives
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<tr>
<td>17</td>
<td>Administration Center</td>
<td>Car Provider</td>
<td>Trust</td>
<td>Intangible</td>
</tr>
<tr>
<td>17</td>
<td>Billing Center</td>
<td>Administration Center</td>
<td>Billing Information</td>
<td>Tangible</td>
</tr>
<tr>
<td>17</td>
<td>Car Provider</td>
<td>Garage</td>
<td>Reputation</td>
<td>Intangible</td>
</tr>
<tr>
<td>17</td>
<td>Car Provider</td>
<td>Insurance Center</td>
<td>Reputation</td>
<td>Intangible</td>
</tr>
<tr>
<td>17</td>
<td>Car Provider</td>
<td>Maintenance Center</td>
<td>Reputation</td>
<td>Intangible</td>
</tr>
<tr>
<td>17</td>
<td>Reputation Center</td>
<td>Administration Center</td>
<td>Reputation Analysis</td>
<td>Intangible</td>
</tr>
<tr>
<td>18</td>
<td>Car Provider</td>
<td>Administration Center</td>
<td>Unsubscribe</td>
<td>Tangible</td>
</tr>
<tr>
<td>18</td>
<td>Car User</td>
<td>Administration Center</td>
<td>Unsubscribe</td>
<td>Tangible</td>
</tr>
</tbody>
</table>
Agile Car Sharing as an Agile Service Network /4

- Billing Center
- Administration Center
- Reservation Center
- Reputation Center
- Car User
- Car Provider
- Public Administration
- Insurance Center
- Garage
- Maintenance Center
- S-CUBE
Analysis of Agile Car Sharing System

- The most important parameters are:
  - Ratio intangible/tangible interactions (0.54:1)
  - Number of transactions (40)
  - Weak tie stability (0.62)
  - Average degree of separation (all: 1.67, intangibles: 1.11, tangibles: 1.61)

- Comments on the results:
  - This service network has much more intangibles than the previous one.
  - A market based on trust and cooperation is the mechanism of coordination for the whole network.
  - Based on the reputation information and the provided flexibility each partner is able to select interacting partners and therefore adapt the whole business process according to their needs.
Case Study Discussion /1

- **Traditional Car Sharing**
  - Low flexibility ⇔ Fixed business processes
  - User is just a user (like the user of an electric company), user is not involved in the value creation process (it just pays for what he uses).
  - User satisfaction is not taken enough into consideration.

- **Agile Car Sharing**
  - Users may act as providers (similarly to users that act as sellers on eBay).
  - User satisfaction is fundamental and have most impact on the value created.
  - Network is able to self-organize to market conditions and to user requirements in a seamless way.
  - Need of trust among interacting partners (whose identities may be undisclosed) → obtained using a reputation system.
Case Study Discussion /2

### Traditional Car Sharing

- Central Control
- Fixed Offer
- High costs (due to high risks)
- Need to sell (or not to buy) an existing car

### Agile Car Sharing

- Customers may act as Providers
- Central Company is only a broker that manages intangible knowledge
- More cars, more sellers, more flexibility
- More chances to optimize customer satisfaction
Conclusions

- Trust and risk may be taken into account in the quantitative estimation of value of a Service Network:
  - This becomes part of the BPM lifecycle.

- Other forms of user satisfactions may emerge from interactions: they should be considered too.

- We have seen an example of a Service Network that is traditionally considered rigid and with almost no intangible interactions (Car Sharing)
  - We have analyzed it using ValueNetworks.com tool and extended it by allowing users to participate to the value creation process.
  - We have moved the coordination mechanism based on a rigid hierarchy without any shared knowledge to a flexible reputation-guided market system: in this situations Business Processes will spontaneously self-organize to maximize user satisfaction.
Future Work

- A stability study using Game Theory models for Agile Service Networks characterized by self-organizing Business Processes (such as the Agile Car Sharing example).

- Provide real studies of value in existing companies using the modified quantitative estimation of value that takes into account the perceived risk.

- Investigate on how the information of a trust/reputation system may be expressed in terms of KPIs/SLAs.

- Classify the types of Business Processes that may be eligible for the seamless reconfiguration approach we are proposing.
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