Collaboration behavior enhancement in co-development networks
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Organizations increasingly encounter change and challenging situations outside their control, and find themselves unable to individually gain business opportunities in the market. Traditional organization structures are therefore shifting to Collaborative Networks (CN) of organizations, one form of which is the Virtual Organization (VO), which is short-term and goal-oriented. VOs need to dynamically and fluently configure and establish, in order to address a market emerged opportunity, and compete with large organizations. The pre-existence of a strategic alliance among organizations in a sector to provide the necessary base conditions and mechanisms has proved to be required to facilitate dynamic creation and successful operation of the VOs. This long-term CN, called the Virtual organizations Breeding Environment (VBE), already manifests in many industry sectors.

The analyzed data gathered from collaborating organizations in VOs illustrate that most VO failures are caused by organizations’ behavior. Consequently, besides understanding and designing well-founded models for organizations’ behavior, some mechanisms are needed to monitor and control these behaviors. As a main contribution of the thesis, our VO Supervisory Assisting Tool (VOSAT) applies two specific measurements to each VO partner organization: the past collaborative behavior of each partner in the VBE, mostly calculated from its long term behavior monitoring during previous VOs, and current collaborative behavior of the VO partner, calculated through monitoring of each partner’s behavior against the defined norms in this VO.

For measuring past organization’s behavior in the VBE, four specific quality-behavioral dimensions are considered, including: the organization’s integrity, courage, agreeableness, and openness, each of which is modeled by a set of traits. A quantitative causal approach is then defined to inter-relate some known factors from the environment with the traits of these four behavior dimensions. Some formulas are derived from the causal relationships, computing the Individual Collaborative Behavior (ICB) degree for each organization. This measure constitutes
one criterion in our proposed approach for evaluating collaborative trustworthi-
ness of each partner organization, as needed to be known during the VO operation 
phase.

To address current partner’s behavior quality in the VO, we propose a new nor-
mative multi-agent model for VOs, within which four specific kinds of behavioral 
norms are distinguished: (i) Socio-regulatory norms, (ii) Co-working norms, (iii) 
Committing norms, and (iv) Controlling norms. Our proposed model is therefore 
called the S3C model to handle the norms. Our approach to committing norms 
and co-working norms introduces new formalization and mechanisms, based on 
individual- and joint-promises that are made between VO partners. Therefore, 
VO partners commit themselves in a bottom-up manner to perform tasks, as 
opposed to the VO coordinator who assigns tasks to partners in a top-down man-
ner. The bottom-up approach is much more fitting the collaboration nature in 
VOs, resembling federated partnership among organizations. Furthermore, based 
on the results of monitoring the socio-regulatory norms, co-working norms, and 
committing norms, as well as the partner’s ICB, the trust level of each partner 
is calculated. This is done by applying the AHP-fuzzy comprehensive evalua-
tion method. The controlling norms apply three specific measurements related to 
characterizing VO partners, i.e. their trust level, workload, and communication 
level. If any of the controlling norm is violated by a VO partner, then VOSAT 
identifies it and warns issues the VO coordinator. The violation of a controlling 
norm is a source of failure risk in fulfilling the VO goals. Considering these mea-
sures, a Bayesian network is created to measure the probability of failure in each 
of the planned sub-tasks, tasks, sub-goals, and the general goal of the VO.

Furthermore, VOSAT provides suggestions to support decision making on 
potential intervention in planned tasks to prevent VO failures to promote collabora-
tion in VOs; thus greatly enhancing the success rate of VOs. For instance, as 
one example, it can support the VO coordinator during its operation phase, with 
altering a risky sub-task, e.g. through suggesting alternative suitable partners 
among those that may volunteer to take over that sub-task. A second example 
of how VOSAT can assist the VO coordinator with enhancing the collaborative 
behavior and thus the success rate of VO, during its operation phase, is through 
recording and ranking the VO partners’ performance and collaborative behavior 
in order to apply it for some reward distribution at the VO. A third example of 
how VOSAT facilitates the tasks of the VO coordinator is for selection of most 
suitable partners during the formation/creation phase of the VO. This case is 
exemplified in the thesis for the VOs in service industry, demonstrating that for 
creation of a new integrated value-added services in the VO, how both the past 
and current behavior of candidate partners can influence their potential selection 
for involvement in the new VO. Consequently, the thesis designs and develops 
assisting mechanisms, tools, and systems to support VO coordinators with in-
creasing both the resilience and the success rate of the VOs.