# TECHNICAL REVIEW REPORT

## *Information and Communication Technologies*
## *ICT*

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|---|---|
| *Project acronym:* | NADINE |
| *Project title:* | New tools and Algorithms for Directed NEtwork Analysis |
| *Grant agreement number:* | 288956 |
| *Funding scheme:* | ICT FP7 — FP7-ICT-2011-C (CP) |
| *Project starting date:* | 01/05/2012 |
| *Project duration:* | 36 months |
| *Coordinator:* | Dima Shepelyansky |
| *Project web site:* | http://www.quantware.ups-tlse.fr/FETNADINE/ |

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| *Period covered by the report:* | Period No. 1, from 01/05/2012 to 31/10/2013 |
| *Place of review meeting:* | Toulouse, FR |
| *Date of review meeting:* | 14/11/2013 |
| *Experts:* | Ciro Cattuto |
| | Juan Pavón |
| | Piet Van Mieghem |
| *Project officer:* | Andrea Feltrin |

Individual report ☐
Consolidated report ☒

SEVENTH FRAMEWORK
PROGRAMME

# 1.  OVERALL ASSESSMENT

a.  Executive summary

*Please give your overall assessment of the project, commenting on the following:*
- *main scientific/technological achievements of the project*
- *quality of the results*
- *attainment of the objectives and milestones for the period*
- *adherence to the workplan, any deviations (whether justified) and remedies (whether acceptable)*
- *take-up of the recommendations from the previous review (if applicable)*
- *contribution to the state of the art*
- *use of resources*
- *impact*

The project is progressing adequately towards the achievement of the main scientific goals that were stated in the Description of Work (Annex I to the grant agreement). In concrete, the project has generated and evaluated new algorithms to facilitate classification and information retrieval from large directed networks, based on PageRank and CheiRank with two-dimensional ranking. The Google matrix formed by the links of the network has been analyzed by analytical tools of Stochastic Processes, Random Matrix Theory and quantum chaos and by efficient numerical methods for large matrix diagonalization including the Arnoldi method.

The project has produced a large number of publications in conferences/workshops as well as in relevant peer-reviewed international journals. Peer review for such publications also demonstrates the soundness of the results.

The attainment of the objectives and milestones for the period is therefore highly satisfactory.

The workplan has been followed as expected. Only the work on WP3 on the applications to voting systems is delayed as the work effort has been dedicated to the development of the crawler described in WP5. This has been properly justified by the Consortium, because the availability for the crawler has a positive impact on database collection for other early tasks of the Project, especially those of WP4.

The contribution to the state of the art of the relevant disciplinary domains is convincingly demonstrated by the numerous publications in peer-reviewed journals. However, the relationship with the state of the art should be better clarified in order to highlight the specific advantages and disadvantages of the proposed methods, in particular with respect to those dealing with the spectrum of large directed networks. While the theory is pushed further by the NADINE work, the huge computational resources required by the proposed approaches for directed graphs has to be assessed.

The use of resources is in line with the description of work and satisfies the principles of economy, efficiency and effectiveness.

The impact could be measured via the citations to the publications. The crawler is already being used by third parties.

b.  Recommendations concerning the period under review

*Please give your recommendations on the acceptance or rejection of resources, work done and required corrective actions – e.g., resubmission of reports or deliverables, further justifications, etc.*

Deliverable D3.1 is provisionally accepted but should be resubmitted to include the voting application as specified in the description of work.

The submitted version of Deliverable D7.2 was rejected because it was not consistent with its description according to the Description of Work. In particular, it was lacking any information on the dissemination plan for the Project. The resubmitted version of D7.2 satisfactorily addressed these issues and is approved.

c.  Recommendations concerning future work

*Please give your recommendations – e.g., overall modifications, corrective actions at WP level, re-tuning of the objectives to optimise the impact or to keep up with the state of the art, better use of resources, re-focusing, etc. Where appropriate, indicate the timescale for implementation.*

While the quality of individual work is high and some collaboration between partners is noticed, we recommend a further integration during the second reporting period, in order to exploit the multidisciplinary (Physics, Mathematics and Computer Science) of the Consortium. We encourage as well more effort towards joint publications between different partners of the Consortium.

We also recommend bridging the gap between the theoretical work and its applications, conveying the envisioned path that leads from scientific insight to actionable insight in the specific knowledge domains of the project. For example, how can the insight on the spectral analysis of the directed Google matrices be translated into new capabilities for network-based applications (e.g., social network analytics, recommendation systems, or others)? How can the concept of "Anderson-localization" be applied to communications, social and web networks, and what can we learn from it, in operational terms?

We also recommend the Consortium to explore the possibility of leveraging the collaboration with the Nomao SME in order to demonstrate some specific advances enabled by the work of the Consortium.

To increase NADINE's visibility, we recommend to improve the website and facilitate access to the project's most relevant contributions and software packages. The visibility of the NADINE project may benefit from a consistent presentation of its results (the use of a logo, consistent presentation style, etc.). Finally, we also encourage more interaction between the Consortium and other related Framework Programme projects and other national/international R&D initiatives.

d.  Assessment

☐  Excellent progress (the project has fully achieved its objectives and technical goals for the period and has even exceeded expectations).

X  Good progress (the project has achieved most of its objectives and technical goals for the period with relatively minor deviations).

☐  Acceptable progress (the project has achieved some of its objectives; however, corrective action will be required).

☐       Unsatisfactory progress (the project has failed to achieve key objectives and/or is not at all on schedule).

## 2.    OBJECTIVES and WORKPLAN

a. Progress towards project objectives

*Assess to what extent the objectives of the project for the period have been achieved. In particular, please indicate if the project as a whole has been making satisfactory progress in relation to the Description of Work (Annex I to the grant agreement) and comment on the interaction between the work packages and the level of integration demonstrated.*

The objectives of the project for the reporting period have been achieved at the general level. The main scientific goals stated in the Description of Work (Annex I to the grant agreement) have been achieved with minor deviations. The integration of the work carried out in the different work packages is consistent with the Description of Work.

b. Progress in individual work packages

*For each work package (WP), assess the progress in relation to the Description of Work (Annex I of the grant agreement). Please also report and comment on any delays, reasons for them and any remedial action taken. Specify the work packages concerned.*

- WP1 (CheiRank versus PageRank, centrality measures and network structure). The progress is in line with the Description of Work.
- WP2 (Network analysis through Google matrix eigenspectrum and eigenstates). The progress is in line with the Description of Work.
- WP3 (Applications to voting systems in social networks). The progress is mostly in line with the Description of Work, with the exception of the voting application that has been delayed because the corresponding effort has been devoted to anticipating the work on Milestone M9 (web crawler). The delay is not detrimental to the general project plan and the anticipation of M9 is beneficial to the execution of the work plan and has had impact in terms of engaging third parties.
- WP4 (Applications of new tools and algorithms to real-world network structures). The progress is in line with the Description of Work.
- WP5 (Database development of real-world networks). The progress is in line with the Description of Work.
- WP6 (Management). The progress is in line with the Description of Work.
- WP7 (Dissemination). The progress is mostly in line with the Description of Work. More effort is needed to increase the visibility of the project web site and better convey the project outcomes.

c. Milestones and deliverables

*Indicate whether the planned milestones and deliverables have been achieved for the reporting period (please give more detailed comments first and then fill in the summary table below).*

Deliverables and milestones for the reporting period overall show a lot of good solid work, with a fair equilibrium of theoretical and practical achievements.

- Milestones M1 (Correlation properties of directed networks), M2 (Statistical characterization of 2DRanking), M3 (Eigenstate community detection), M4 (Spam filter protocols) have been achieved as described in the Description of Work and are approved.
- Milestone M5 (Network-specific centrality measures) is provisionally approved but it needs to be resubmitted in the second period. Some effort associated with M5 has been dedicated to the subsequent milestone M9, with demonstrated results.
- Deliverables D1.1, D2.1, D4.1, D5.1, D6.1, D6.2, D7.2 have been achieved as described in the Description of Work and are approved.
- The completion of Deliverable D3.1 (Period 1 scientific report on WP3) requires the achievement of Milestone M5: D3.1 is thus provisionally approved and needs to be resubmitted in the second reporting period.
- Deliverable D7.1 is provisionally approved. Some work is needed to increase the visibility and consistency of the project outcomes. D7.1 needs to be resubmitted in the second reporting period.

Some advancement on the work of the next reporting period has also been shown:
- M9 (Webcrawler development and database collection): work towards this milestone has been anticipated with demonstrated achievements and impact.

| STATUS OF DELIVERABLES | | | |
|---|---|---|---|
| **No.** | **Title** | **Status** *(Approved/Rejected)* | **Remarks** |
| D1.1 | Period 1 scientific report on WP1 | Approved | |
| D2.1 | Period 1 scientific report on WP2 | Approved | |
| D3.1 | Period 1 scientific report on WP3 | Provisionally approved | Resubmit at 2$^{nd}$ review meeting |
| D4.1 | Period 1 scientific report on WP4 | Approved | |
| D5.1 | Period 1 scientific report on WP5 | Approved | |
| D6.1 | Period 1 Scientific Report | Approved | |
| D6.2 | Period 1 Periodic Report | Approved | |
| D7.1 | Project Website | Provisionally approved | Increase visibility |
| D7.2 | Initial plan for the use and dissemination of foreground | Approved | Approved after review meeting following resubmission |

| STATUS OF MILESTONES | | | |
|---|---|---|---|
| **No.** | **Title** | **Status** *(Approved/Rejected)* | **Remarks** |
| M1 | Correlation properties of directed networks | Approved | |
| M2 | Statistical characterization of 2D ranking | Approved | |
| M3 | Eigenstate community detection | Approved | |
| M4 | Spam filter protocols | Approved | |
| M5 | Network specific centrality measures | Provisionally approved | Resubmit at 2$^{nd}$ review meeting |

d. Relevance of objectives

*Indicate whether the objectives for the coming periods are (i) still relevant and (ii) still achievable within the time and resources available to the project. Assess also whether the approach and methodology continue to be relevant.*

The objectives for the coming period are still relevant, although more emphasis should be given to provide an integrated view of the results of the project.
The objectives are still achievable within the time and resources available to the project.
The general approach and methodology is sound and broad enough to achieve new and solid results during the next period.

e.  For Networks of Excellence (NoEs) only

*Assess how the Joint Programme of Activities has been realised for the period and whether all the planned activities have been satisfactorily completed.*

N/A.

## 3.   RESOURCES

a.   Assessment of the use of resources

*Comment on the use of resources, i.e. personnel resources and other major cost items. In particular, indicate whether the resources have been utilised (i) to achieve the progress and (ii) in a manner consistent with the principle of economy, efficiency and effectiveness[1]. Note that both aspects (i) and (ii) have to be covered in your answer. The assessment should cover the deployment of resources overall and by each participant. Are the resources used appropriate and necessary for the work performed and commensurate with the results achieved? Are the major cost items appropriate? In your assessment, consider the person months, equipment, subcontracting, consumables and travel.*

The resources have been utilised to achieve the progress and in a manner consistent with the principles of economy, efficiency and effectiveness.
The deployment of resources overall and by each participant is consistent with the approved work plan. The resources have been properly used, in a consistent way, and following the needs for the work performed and commensurate with the results achieved.
The major cost items are appropriate.

b.   Deviations

*If applicable, please comment on major deviations with respect to the planned resources.*

No significant deviations have been identified. The effort corresponding to M5 has been dedicated to the successive milestone M9, thus anticipating the achievement of M9 and delaying that of M5. The shift is not detrimental to the execution of the work plan and does not impact the allocation of resources because the same partner is responsible for M5 and M9.

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[1] "The principle of economy, efficiency and effectiveness refers to the standard of "good housekeeping" in spending public money effectively. Economy can be understood as minimising the costs of resources used for an activity (input), having regard to the appropriate quality and can be linked to efficiency, which is the relationship between the outputs and the resources used to produce them. Effectiveness is concerned with measuring the extent to which the objectives have been achieved and the relationship between the intended impact and the actual impact of an activity. Cost effectiveness means the relationship between project costs and outcomes, expressed as costs per unit of outcome achieved." Guide to Financial Issues, Version 02/04/2009, p.33.

# 4.  MANAGEMENT, COLLABORATION AND BENEFICIARIES' ROLES

a.  Technical, administrative and financial management of the project

*Assess the quality and effectiveness of the project management, including the management of individual work packages, the handling of any problems and the implementation of previous review recommendations. Comment also on the quality and completeness of information and documentation.*

Project management has been effective, providing a high degree of autonomy to each partner. As all of them have successfully developed their assignments, there have not been any significant management issues to deal with.

The quality and completeness of information and documentation that has been presented at the review meeting is satisfactory for this kind of project. The Periodic Report is quite extensive in the description of the work that has been done so far.

b.  Collaboration and communication

*Comment on the quality and effectiveness of the collaboration and communication between the beneficiaries.*

The authors of the NADINE papers mostly belong to individual partners of the Consortium. More cooperation (e.g., joint publications) and inter-relationship among the partners is expected at the 2nd and final review meeting.

c.  Beneficiaries' roles

*Give an assessment of the role and contribution of each individual beneficiary and indicate if there is any evidence of underperformance, lack of commitment or change of interest.*

Each of the partners has successfully achieved their respective assignments.

# 5. USE AND DISSEMINATION OF FOREGROUND

a. Impact

*Is there evidence that the project has so far had, and is it likely to have, significant scientific, technical, commercial, social or environmental impact (where applicable)?*

The project has achieved several scientific insights, but their impact on the community at large still has to be assessed. Technical, commercial, and social impacts are not clearly demonstrated.

b. Use of results

*Comment on whether the plan for the use of foreground, including any updates, is still appropriate. Comment also on the plan for the exploitation and use of foreground for the consortium as a whole, or for individual beneficiaries or groups of beneficiaries, and its progress to date.*

The research plan is mostly appropriate. More emphasis should be placed on the translation of research advances into actionable knowledge for the relevant beneficiaries or stakeholders.

c. Dissemination

*Assess whether the dissemination of project results and information (via the project website, publications, conferences, etc.) has been adequate and appropriate.*

Dissemination activities are well achieved from an academic viewpoint (i.e., publications in peer-reviewed scientific journals and conferences).

d. Involvement of potential users and stakeholders

*Indicate whether potential users and other stakeholders (outside the consortium) are suitably involved (if applicable).*

One European SME, called Nomao (www.nomao.com), is collaborating with the project partners.

e. Links with other projects and programmes

*Comment on the consortium's interaction with other related Framework Programme projects and other national/international R&D programmes and standardisation bodies (if relevant).*

The Consortium's interaction with other related Framework Programme projects and other national/international R&D programmes is not sufficiently developed yet.

# 6. OTHER ISSUES

*If applicable, comment on whether other relevant issues (e.g. ethical issues, policy/regulatory issues, safety issues) have been handled appropriately.*

None.

Name(s) of expert(s):
Ciro Cattuto
Juan Pavón
Piet Van Mieghem

Date:
 28 November 2013

Signature(s):