“Evaluating the impact of a service-oriented framework for healthcare interoperability”

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A service-oriented architectural (SOA) framework was implemented at the Health Informatics Laboratory, Faculty of Nursing, University of Athens, Greece [1]

The SOA prototype framework:

✓ **Aims to investigate the adaptation** of service oriented architectures (SOA) for achieving healthcare interoperability [2-4]

✓ **Attempts to formulate** a virtual patient record (VPR) paradigm, operating over a service-oriented framework

✓ **Exploits the use of the business process execution language (BPEL) standard** for the design and implementation of business and technical processes that coordinate software services in order to achieve interoperability amongst a diversity of applications [2,5]
A subsequent step is conducting an evaluation

Investigation of strategies for evaluation

- With respect to interoperability, a variety of aspects need to be considered, either technical or non-technical
- Associated with a variety of concerns, perceptions and approaches whereas also involves several standards, methods, stakeholders and roles [1].

Decided not to concentrate on pure technical characteristics, aiming to assess perceptions and the trend towards the proposed technology

Conducted an empirical assessment based on a hypothetical adoption of the prototype
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The study **attempts to utilize** the initial proposition of the DeLone and McLean model of Information Systems Success [11], **as modeled** by Iivari[12].

DeLone and McLean define **six dimensions** namely system quality, information quality, use, user satisfaction, individual impact and organisational impact [11].

By definition, the dimensions of system and information quality both affect the dimensions of use and user satisfaction respectively. Furthermore, use and user satisfaction affect each other while both also affect the dimension of individual impact. Finally, individual impact affects organisational impact [11-14].

The study **attempts to empirically encapsulate** SOA and VPR characteristics within the six dimensions of the DeLone and McLean model.

The study refers to a **hypothetical adoption**, due to the prototype nature of the SOA framework.

The aim of the study is to observe and discuss on the **trend** and the **perception** that such a prototype might create amongst participants with clinical and/or informatics background.

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Research method and data modeling approach were adopted from Livari [12]:

- **Questionnaire** along with number of measures per dimension and scaling, where applicable
- **Extended** to include the dimension of organisational impact of IS Success model
- **Second order model**, regarding the dimensions of system and information quality
- Relevant **Hypotheses** were formulated
- **Two scenarios**, in order to reflect the **bi-directional relation** between the dimensions of use and user satisfaction
Standarised characteristics per dimension adopted from previous studies [12,15], combined with empirical propositions:

- System Quality (24 measures)
  - Flexibility, Usefulness, Interoperability, Maintainability, Scalability and Reusability
  - Attempt to reflect possible SOA characteristics and architectural advantages [1,2,5]

- Information Quality (24 measures)
  - Completeness, Relevancy, Consistency, Data Unification, Semantically mapping capabilities and Data Standardization
  - Attempt to reflect possible VPR characteristics related with the prototype [1]

- Rest of dimensions include: Use (2 measures), User Satisfaction (6 measures), Individual impact (6 measures) and Organisational impact (6 measures)
Study Sample

- Sample size: 62 participants
- Total sample relevant with healthcare domain / diverse professions
- Overall, 35.5% of the sample employed at healthcare organisations
- Diverse backgrounds:
  - Mainly past and present postgraduate students at the Faculty of Nursing (Health informatics and Healthcare services management)
  - Minor set: either from nursing departments of healthcare organisations or the healthcare IT industry, who agreed to participate in the study on an individual basis

Actual evaluation

- A short introduction on design issues and a live demonstration of the prototype were presented to the evaluators
- Afterwards, participants were asked to complete an anonymous questionnaire
- Evaluation was based on ‘hypothetical adoption’ due to the prototype nature of the framework
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The data gathered was analyzed using partial least squares (PLS)

Emphasis on:

- Measurement model
  - Item loadings
  - Construct reliability
  - Convergent validity
  - Discriminant validity

- Structural model
  [12,13,17-20]

The software package smartPLS version 2.0 M3 beta was used [16]
Hypotheses were formulated, according to the theoretical basis of DeLone and McLean

- **H1**: System Quality positively affects User Satisfaction
- **H2**: Information Quality positively affects User Satisfaction
- **H3**: System Quality positively affects Use
- **H4**: Information Quality positively affects Use
- **H5**: Use positively affects User Satisfaction
- **H6**: User Satisfaction positively affects Use
- **H7**: User Satisfaction positively affects Individual Impact
- **H8**: Use positively affects Individual Impact
- **H9**: Individual Impact positively affects Organisational Impact
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Results

Measurement model

✓ Item loadings
  ▪ All values considered reliable, since they satisfied the relative threshold values

✓ Construct reliability – Internal consistency
  ▪ Cronbach’s alpha: All values were considered reliable, except the value of Use
  ▪ Composite Reliability: All values were considered reliable

✓ Convergent Validity
  ▪ All constructs generated a satisfactory value
  ▪ Exceptions were system and information quality

✓ Discriminant Validity
  ▪ Inadequacies observed

Structural Model

✓ Bootstrapping (500 resamples) [12,13,17,18,20]

✓ The examination of the t-values was based on a two-tail test with 3 statistically significant levels - p<0.05 (*), p<0.01 (**) and p<0.001 (***)

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Results

Results of the Structural Model (Source: Adopted from Daskalakis [22], p. 140)

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Discussion

- The significant relationships may emphasize that participants focused more on the quality of information provided.

- Potentially, the dimension of information quality was more appreciated because the majority of the sample did not have strong IT background.
  - Sample synthesis appeared comfortable with high-level concepts related with information quality.
  - The live demonstration of the VPR capabilities assisted the participants to comprehend the characteristics of information quality due to interaction via a homogeneous Web-based environment.

- Adequate comprehension of information quality consequently leads to User Satisfaction.

- Continuously, perceived User Satisfaction positively affects Individual Impact which in turn affects Organisational Impact.
Discussion

➢ System quality appeared with a minor contribution in terms of significance of the paths in the structural model

  ✓ Attributes were mainly related with back-end functionality and concepts
  ✓ Such concepts seemed more advanced to be appreciated by non-technical people through a high-level overview

➢ Overall the hypothetical conditions of the SOA framework prototype demonstration and the lack of real applications consequently produce hypothetical opinions and perceptions from the participants side

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Limitations of the study

- Hypothetical nature of the prototype under evaluation, thus not realistic conditions
- Empirical encapsulation of SOA and VPR attributes within the dimensions of the DeLone and McLean model
- Sample synthesis originates from a variety of healthcare professionals
- The perception of each distinct stakeholder group is not clearly depicted

Further work

- Future adoption of the prototype in real healthcare settings, in order to investigate its impact in pragmatic conditions
- Further empirical evaluation of alternative and/or additional attributes on possible SOA and VPR characteristics
- Thorough empirical assessments on several distinct stakeholder groups, in order to capture specific perceptions and beliefs

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A service-oriented interoperability prototype with VPR capabilities has been developed and empirically evaluated, based on a hypothetical adoption.

The evaluation strategy was based on the DeLone and McLean model of information systems success, as modeled by Iivari[12], by encapsulating specific service-oriented and VPR characteristics in a subjectivist manner.

An empirical study was conducted amongst sixty two participants in order to observe their perceptions regarding the prototype framework.

The current work aims to move towards an evaluation strategy for SOA implementations with VPR functionality in the healthcare domain.
References


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Thank you!