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Determining Critical Success Factors for realizing innovative IT solutions in Higher Education

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ABSTRACT

There is much research on Critical Success Factors when implementing novel IT solutions in different industries and contexts. However, for the domain of higher education the amount of studies is limited. This is partially due to the fact that what is considered higher education is different across countries. Universities, Universities of Applied Science, Vocational Universities, Polytechnics and related (research) institutes both have similarities and differences. However, one commonality is that institutions in higher education are not sufficiently capable of supporting the development(s) and requirements of educational processes with adequate (innovative) IT. Therefore the purpose of this study is to determine the CSFs that contribute to the implementation and adoption of (innovative) IT in higher education in an international context. First a literature study was conducted on critical success factors which provided the foundation to a conceptual research model. Using a Delphi study the model was elaborated upon by 32 international experts from the field of higher education. The experts determined the relevance and applicability of the CSFs which then resulted in a final model consisting of 31 CSFs across 7 different subject areas. We also found that "organisation culture" is mentioned as an aspect in relation to many CSFs. It seems that attention to cultural aspects of the organisation is so important that without this the realisation of (IT) innovations will likely not succeed. The final version of the model enables higher educational institutions to organise innovative IT projects, although they still need to adopt it to their specific context.

Keywords: Higher Education, Innovation, IT, Delphi Study, Critical Success Factors

INTRODUCTION

Many researchers have focused on the CSFs for realising (innovative) IT in all kind of environments and situations. Not much research has been done on the success factors for the realisation of innovative IT in higher education¹ in an international environment. The area of higher education is another kind of “business” that does not need to act like a commercial company. As Zijdeveld (2000) states: “Institutions as universal behaviour patterns cannot disappear since they are the very foundations of the human species. (..) Moreover, even historically and culturally specific institutes will rarely come to their end. Rather they will change their structure, their meaning and maybe even their composition but continue to be fed by their institutional roots.” This makes it more defiant to research than what might really be contributing to the realisation of (innovative) IT in higher education.

Globalisation is speeding up in the world of education. Wit (2011) says “Over the last two decades, the concept of the internationalization of higher education is moved from the fringe of institutional interest to the very core.” Knight (2011) says the following about globalisation and higher education:

“Internationalisation of higher education is one of the ways a country responds to the impact of globalisation yet, at the same time, respects the individuality of the nation.” Also, within the Netherlands, there are many discussions about the internationalisation and the used language. Higher education has given priority to education programmes in English, more students from abroad and internationalisation plans (Dutch Council of Education, 2018).

The position of higher education in this changing focus to internationalisation and a minimal focus on innovative IT leads to a situation where the education process is less supported by IT than a modern information-driven institute of higher education should do. Developments such as Artificial Intelligence (AI), Internet of Things (IOT) and Security are very important themes according to Gartner (Gartner, 2017). This is also confirmed by experts in the field of education, such as the Council of Education (Council of Education (Netherlands), 2017) and SURF² (SURF 2015, 2016, 2017).

PROBLEM STATEMENT

Challenges in the area of didactic enrichment, organising flexibility, taking away physical and logical borders and the use of adaptive learning can only be realised by implementing, organising and deploying the right (innovative) IT. But the realisation of these changes within the IT infrastructure and application landscape isn’t as adequate as needed to keep up with the required changes in educational needs.

¹ *The level of education in international context is not the same. Universities of Applied Science, Universities and related research institutes are therefore mentioned as Higher Education in the rest of this document.*

² *SURF is an organisation in which universities of applied science, universities and research institutes in the Netherlands bundle their knowledge and developments.*

SURF thus claims that all investments of time, effort and money spent in the last couple of years have not led to changes in IT that support the primary process as they should. These changes that the digitalisation of education needs to bring along are fundamental changes and require more than organic change. It needs bigger steps and investments (SURF, 2017). The Council of Education in the Netherlands supports these conclusions. They say: “Education is looking for a way to organise itself within the digital era but seems to stay behind.” This means that although a lot of effort has been spent, education is still not enough connected to the developments in IT, (Council of Education, 2017). SURF (2017) acknowledges the same issue in saying that IT is not on a level that offers the best support for educational processes and innovations are often too late because of the time it takes to implement them.

Considering the situation, the problem statement is: Higher education is not sufficiently capable of supporting the development(s) and requirements of education with adequate (innovative) IT.

RESEARCH OBJECTIVE, QUESTION(S) AND APPROACH

The research objective of this study was to determine which factors contribute the most to the struggle to realize innovative IT in higher education in an international context. The objective was to gather these factors into a list of CSFs which also indicates the area in which they are most effective (their Subject³). These factors are relevant for the realisation of innovative IT to be more efficient, take less effort, give more pleasure and have a higher success rate.

Derived from this, the main research question is:

What Critical Success Factors are needed to realise innovative IT in higher education in an international context?

To ensure the outcome, the main research question was subdivided in the following sub questions:

1A *What Critical Success Factors are needed to realize innovative IT?*

This research question was focussed on the realisation of innovative IT in general, not specifically on the factors related to internationalisation.

1B *What Critical Success Factors are needed for realising innovative IT in an international context?*

Internationalisation has been chosen as a separate research area because this area was expected to be a much smaller but quite specific area.

2 *How does the concept list of Critical Success Factors apply within international higher education?*

The particular positioning of education in our societies (Zijderveld, 2000) may require a different set of CSFs than might be suitable in (for example) a commercial company.

This sub-question concerned itself with the question of whether or not the literature research had provided the right CSFs we needed to realize innovative IT.

The list would be adjusted according to expert opinion as needed. The outcome of this step was the final list of CSFs. This final list was validated in Sub-Question 3.

³ *Subjects are areas in which the Critical Success Factors are related to according to the literature*

3 *Will the application of the Critical Success Factors lead to better realisation of innovative IT?*

This question concerned itself with the question of whether or not the final list of CSFs defined by the literature research and expert opinion (Sub-Question 2) would be applicable and effective in a real-life case. This last sub-question was used as a validation step to support the triangulation.

Research approach

In Figure 1, the research approach, consisting of a literature research (Phase 1), a Delphi study (Phase 2) and the validation (Phase 3), is shown.

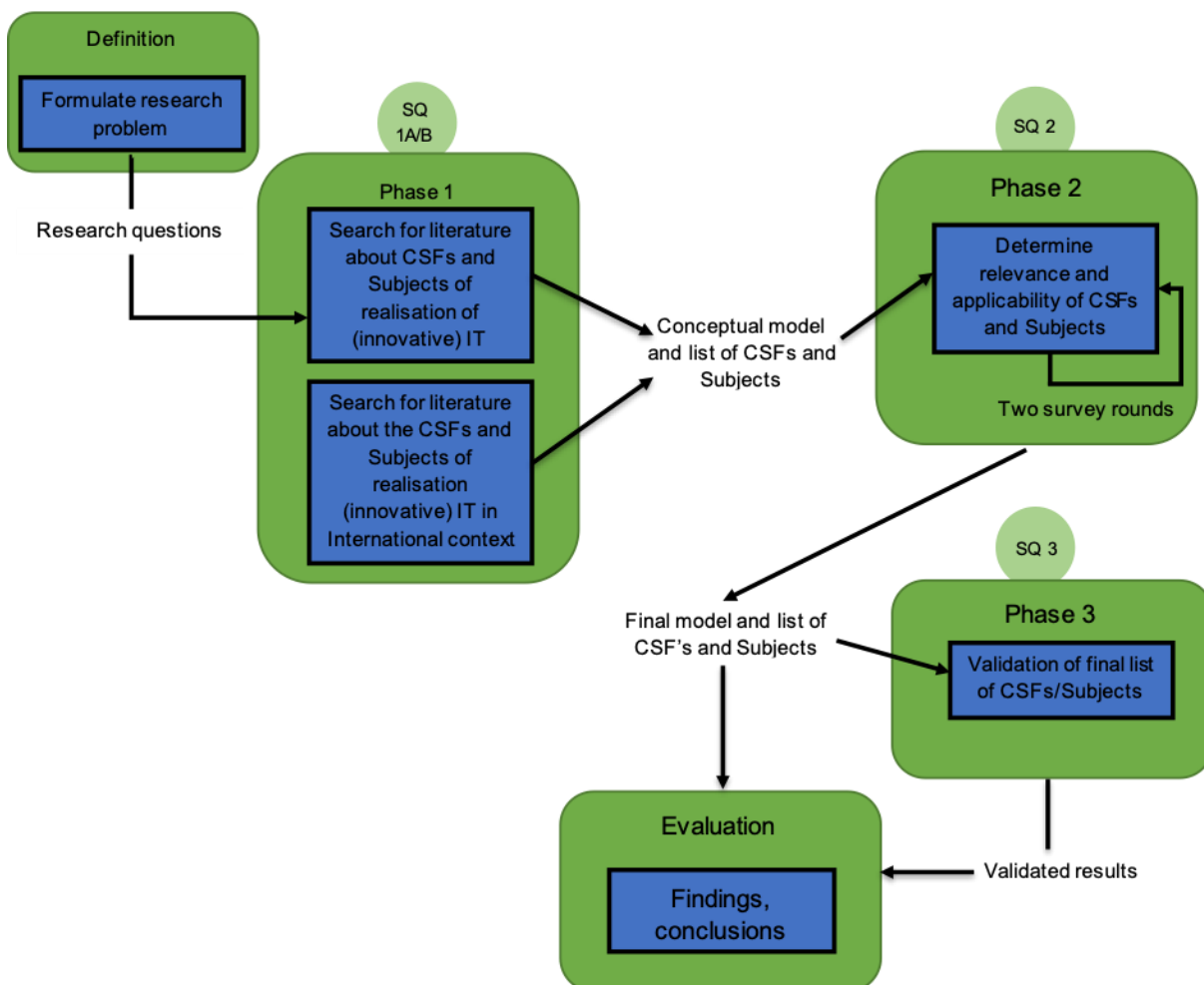


Figure 1. Research approach

LITERATURE REVIEW

The literature review was done to explore the literature on CSFs and their related subjects for the realisation of innovative IT in an international context. The CSFs and subjects that were found during the reading of all the literature were aggregated and displayed in a matrix (Tables 1 and 2).

The following keywords were used to find the right literature: *innovation, university of applied science, higher education, IT, Critical Success Factors, CSFs, success factors, global, roll out, implementation, ownership, stakeholder management, product development, learning, project management.*

The most important definitions/descriptions found in the literature for the terms used in this research and terminology that might be interpreted differently are described here.

Critical Success Factors and Subjects

From the literature of project management, Kerzner (2000), defines CSFs as “those measurable factors that, when present in the project’s environment, are most conducive to the achievement of a successful project.” Bullon and Rockart (1981) propose the following definition: “Critical Success Factors – CSFs are the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department or organization. CSFs are the few key areas where ‘things must go right’ for the business to flourish and for the manager's goals to be attained,” (Bullen & Rockart, 1981). Morrison (2015) defines CSFs as “any of the aspects of a business that are identified as vital for successful targets to be reached and maintained. Critical Success Factors are normally identified in such areas as production processes, employee and organization skills, functions, techniques, and technologies. The identification and strengthening of such factors may be similar.” The last definition of the CSF (Morrison, 2015) was used.

The CSFs we investigated in this research are not always measurable, but depend on the opinion/feeling of the experts working with them. The subjects are areas that the CSFs relate to. These relations were noted during the reading of the literature. The Subjects Morrison (2015) is referring to as “Critical Success Factors are normally identified in such areas as,” (Morrison, 2015) were used as an example to determine the Subjects. The grouping of the CSFs in Subjects was not the goal, but the relation between them was. The literature was leading in building the relations, not the organisational structure of an organisation.

If the literature research was incomplete in the determination of the Subjects, this would be corrected by the experts in the survey.

International Context

Knight (2011) says the following about internationalisation: “Internationalisation of higher education is one of the ways a country responds to the impact of globalisation yet, at the same time, respects the individuality of the nation.” Within the Netherlands, there are many discussions about the internationalisation and the used language. Higher education has given priority to English education, more students from abroad and internationalisation plans (Dutch Council of Education, 2018). Wit (2011) says “Over the last two decades, the concept of the internationalization of higher education is moved from the fringe of institutional interest to the

very core.” Therefore, the international context of the study was the field of higher education in locations all over the world. This scope has been derived from the developments within the education sector where internationalisation is a necessity to prepare students for the globalizing society (Dutch Council of Education, 2016).

Innovative IT

Koeldiep (2014) defines innovative IT as: “An innovative IT solution could be defined as a new (the creative destruction of old tools), original and/or improved (disruptive innovation) technological solution that creates value for the students and teachers within Dutch universities.”

Importance of innovation has been defined by Tucker (2001): “Innovation is the only sustainable source of growth, competitive advantage and new wealth.” To make this more concrete, he defined four basic principles (Tucker, 2001):

- A company’s approach to innovation must be comprehensive.
- Innovation must include an organized systematic and continual search for new opportunities.
- Organizations must involve everyone in the innovation process.
- A company must work constantly on improving its climate for innovation.

By defining these principles, Tucker makes it clear that innovation is an organisation issue and not an individual issue.

Another definition has been made by Siquaw (et al.,2006), and they conclude that the importance of innovation has been defined as: “The growth and long-range success of an organization is reliant on an overall orientation to innovation that enables capabilities and produces new value.”

There is much diversity in the definition of innovation. Baregheh, Rowley and Sambrook (2009) have defined a multidisciplinary definition of innovation: “*Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace.*” We chose to use this definition while it is applicable to what the higher education needs (Surf, 2017).

Positioning of innovation

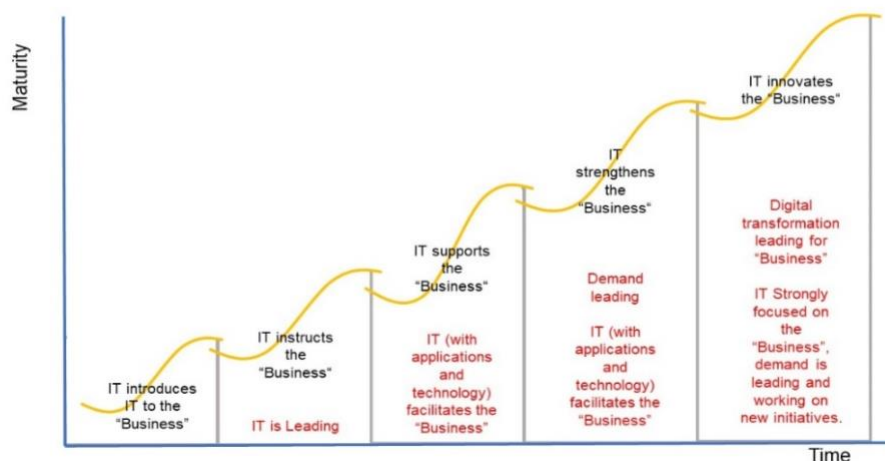


Figure 2. IT stages derived from Nolan stages (Koot et al., 2015)

The necessity for innovation has been explained in the Introduction. Koot, Mutsaers and Veen (2015) positioned innovation in the organisation and coupled the innovation to a derivative from the Nolan stage model (Figure 2). By doing this, Koot et al. (2015) made it clear that the traditional demand-supply model is no longer effective and that therefore, “innovating the business” is the stage in which IT and business ended up. Work as partners in a symbiotic relation and the use of the possibilities in digital transformation is leading to support the “business”, which was education in our case (Koot et al., 2015).

Exploring literature

During the reading of the literature, 58 sources, consisting of 52 papers, three books, and three master theses, were selected to answer sub-questions 1A and 1B. After reading this literature, no new CSFs or subjects had been found, so the decision was made to stop further reading.

Figure 3 shows how the list of CSFs and subjects was composed. This includes the relationship between the CSFs and the subjects. This list of CSFs was used as the input for the Delphi rounds.

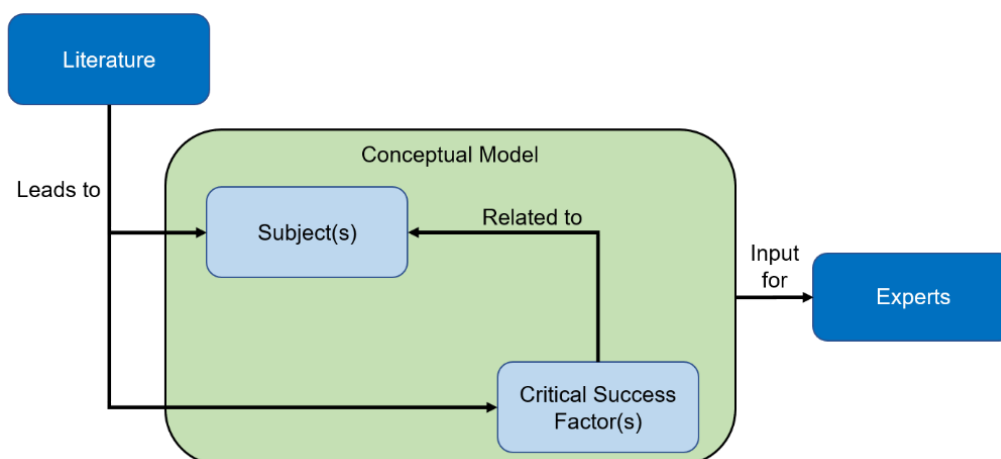


Figure 3. From literature to CSFs

Determining subjects and CSFs

Quite a large group of CSFs and Subjects came out of the literature research. With 64 CSFs and 12 subjects, this resulted in a theoretical number of 768 combinations that might have to be investigated. There is no standard in statistics for how to reduce this amount. However, there was consensus between the researchers and experts on statistics and methodologies that leaving out everything that contributes less than 1 % to the whole list of CSFs and subjects was the correct way. The shared opinion was that, if the decision to reduce the number of CSFs and subjects like this were not correct, this would be determined by the experts in the survey round. By reducing both CSFs and subjects by leaving out those which contribute less than 1%, the number of mentioned CSFs was reduced to 31 and the number of subjects was reduced to eight.

Distinction between the two sub-questions

Culture is a factor that should be taken into consideration in the literature as very important in relation to internationalisation. The cooperation of organisations in different countries depends on how well their cultures work together and whether or not there is enough openness and trust to allow for innovation. Because culture is the one true key to critical success in internationalisation, no distinction was made between the two sub-questions (1A/1B) in the conceptual model.

Overview literature, subjects and CSFs

The relation between subjects and literature is shown in Table 1. The relation between CSFs and literature is shown in Table 2.

Subject Literature	Subject							
	Business IT Alignment	Business Strategy	Domain Knowledge	Human factors	IT Strategy	Organisation Culture	Project Manager Skills	Top Management Involvement
(Abdoel, 2010)		X		X		X		
(Akbar, 2013)				X				
(Alenezi, 2016)			X	X		X		
(Alias et. al., 2014)				X			X	
(Anantatmula & Thomas, 2010)		X				X	X	X
(Arts, 2011)				X		X	X	X
(Avidov-Ungar & Eshet-Alkabay, 2011)				X		X		
(Barczak et al., 2006)							X	
(Ben-Zvi et al., 2010)		X	X					
(Bessant et al., 2005)		X			X	X	X	
(Bingimlas, 2015)				X		X	X	X
(Brentani de & Kleinschmidt, 2004)		X		X		X	X	X
(Burkett & Meehan, 2017)		X	X	X		X	X	X
(Cameron & Quinn, 2011)		X			X			
(Cooke-Davies, 2002)		X		X		X	X	X
(Cooper, 1999)		X				X	X	X
(Cumps et al., 2006)					X			
(Damanpour & Schneider, 2006)				X				X
(Davis et al. 1989)				X				
(Davis, 1993)				X				
(De Haes & Van Grembergen, 2015)		X	X		X	X	X	
(Dwivedi et al., 2017)				X				
(Fortune & White, 2006)				X		X	X	X
(Fu, 2013)		X		X		X		
(Gacel-Ávila, 2005)		X						
(Gemünden, 2015)							X	X
(Gundry et al., 2016)		X		X		X		
(Henderson & Venkatraman, 1993)		X			X			
(Hofstede, 1983)		X		X		X		
Subject Literature	Subject							
	Business IT Alignment	Business Strategy	Domain Knowledge	Human factors	IT Strategy	Organisation Culture	Project Manager Skills	Top Management Involvement
(Hyväri, 2006)				X		X	X	X
(John, 2015)						X		X
(Keil, Lee, & Deng, 2013)		X	X				X	
(Khang & Moe, 2008)		X		X		X	X	X
(Klein & Knight, 2005)		X		X		X		
(Klein & Sorra, 1996)						X		
(Koeldiep, 2014)		X			X	X		X
(Koning et al., 2016)		X			X	X		
(Koot et al., 2015)		X		X	X	X		
(Luftman, 2003)		X				X		
(Manohar & Pandit, 2014)				X		X		
(Martins & Terblanche, 2003)		X				X	X	X
(Müller & Jugdev, 2012)		X				X	X	
(Naranjo-Valencia et al., 2011)						X		
(Ozguler, 2016)		X					X	
(Özsomer et al., 1997)		X						
(Pankratz & Basten, 2017)							X	
(Pinto & Slevin, 1989)		X		X			X	X
(Ramos & Mota, 2014)		X		X			X	
(Saadé et al., 2015)				X		X	X	X
(Sennara & Hartman, 2002)		X				X	X	
(Sharma & Yetton, 2003)								X
(Siguaw et al., 2006)		X		X		X		X
(Subramaniam & Youndt, 2005)				X		X		
(Taherdoost & Keshavarzsaleh, 2016)		X				X	X	X
(Tucker, 2001)		X					X	
(Tucker, 2001)		X						
(Weill & Ross, 2009)					X	X		
(Westerveld, 2003)		X					X	X

Table 1. Relation between subject and used literature

Literature	CSF																														
	Business agility	Clear and realistic objectives	Culture of openness and trust	Customer Satisfaction	Financial commitment	Globalization commitment	Innovation commitment	Innovative IT Strategy	IT Savviness within the management/board	Leadership of a project manager and/or management	Learning orientation	Motivation to contribute to (implement) innovation(s)	Open and clear communication	Organising skills	Perceived Usefulness	Planning	Portfolio- and Programme Management	Positive attitude	Process	Project involvement	Resource commitment	Shared perception of the why	Skills required	Stakeholder Satisfaction	Strong cooperation	Sufficiently professional	Training	Trust	Well managed expectations	Well organised Governance	
(Abdoel, 2010)							X																								
(Akbar, 2013)																															
(Alenezi, 2016)																															
(Alias et. al., 2014)																															
(Anantamula & Thomas, 2010)			X	X					X																						
(Arts, 2011)				X						X																					
(Avidov-Ungar & Eshet-Alkabay, 2011)							X																								
(Barczak et al., 2006)									X																						
(Ben-Zvi et al., 2010)																															
(Bessant et al., 2005)								X																							
(Bingimlas, 2015)								X																							
(Brentani de & Kleinschmidt, 2004)						X	X			X																					
(Burkett & Meehan, 2017)	X								X	X																					
(Cameron & Quinn, 2011)		X						X	X																						
(Cooke-Davies, 2002)											X																				
(Cooper, 1999)		X		X																											
(Cumps et al., 2006)								X																							
(Damanpour & Schneider, 2006)						X		X																							
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(Davis, 1993)																															
(De Haes & Van Grembergen, 2015)			X						X																						
(Dwivedi et al., 2017)																															
(Fortune & White, 2006)		X			X		X	X		X																					
(Fu, 2013)							X																								
(Gacel-Ávila, 2005)						X																									
(Gemünden, 2015)																															
(Gundry et al., 2016)		X					X																								
(Henderson & Venkatraman, 1993)								X		X																					
(Hofstede, 1983)			X						X																						
(Hyväri, 2006)		X			X				X	X	X																				
(John, 2015)					X		X																								
(Keil, Lee, & Deng, 2013)		X						X	X	X	X												X	X	X						
(Khang & Moe, 2008)		X				X	X	X			X												X	X	X	X					
(Klein & Knight, 2005)							X		X	X																					
(Klein & Sorra, 1996)							X																								
(Koeldiep, 2014)					X		X	X																							
(Koning et al., 2016)		X																													
(Koot et al., 2015)		X					X	X	X																						
(Luftman, 2003)																															
(Manohar & Pandit, 2014)					X		X			X																					
(Martins & Terblanche, 2003)							X																								
(Müller & Jugdev, 2012)		X		X																											
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(Özsomer et al., 1997)							X																								
(Pankratz & Basten, 2017)					X	X																									
(Pinto & Slevin, 1989)					X	X			X	X	X	X																			
(Ramos & Mota, 2014)					X																										
(Saadé et al., 2015)		X			X		X		X	X																					
(Sennara & Hartman, 2002)			X						X																						
(Sharma & Yetton, 2003)							X																								
(Siguaw et al., 2006)					X		X				X											X	X	X							
(Subramaniam & Youndt, 2005)							X																								
(Taherdoost & Keshavarzsaleh, 2016)		X						X	X													X	X	X							
(Tucker, 2001)							X																								
(Tucker, 2001)							X															X									
(Weill & Ross, 2009)								X																							
(Westerveld, 2003)		X			X				X																						

Table 2. Relation between CSF and used literature

The combination of the literature, the relationship between the CSFs and subjects, and the choice to release some of the CSFs and subjects as described resulted in the conceptual model (Figure 4). The conceptual model was the outcome of sub-questions 1A and 1B, and was the starting point for the Delphi study.

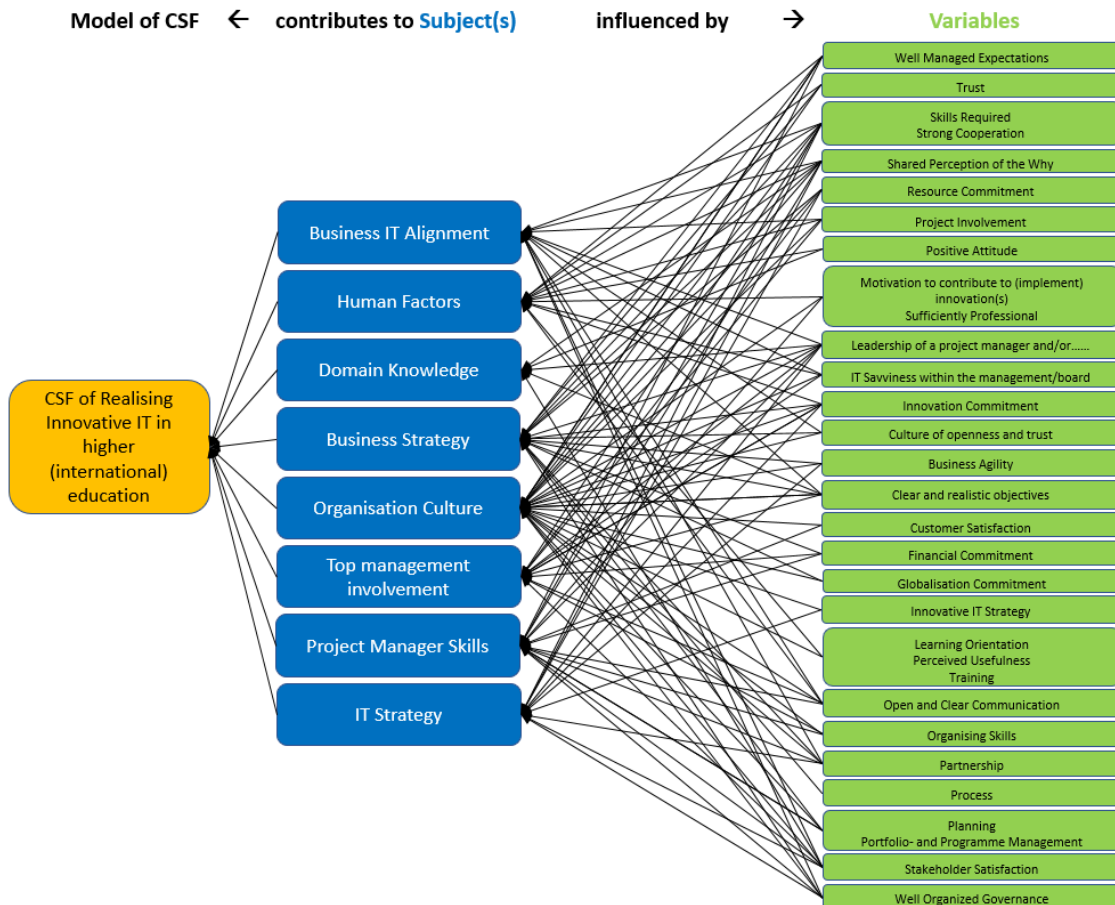


Figure 4. Conceptual model

DELPHI STUDY

The Delphi method emphasizes structured anonymous communication between individuals who hold expertise on a certain topic, with a goal of arriving at a consensus in the areas of policy, practice, or organizational decision making (Birdsall, 2004; Dalkey & Helmer, 1963). Linstone and Turoff (1975) recommend the Delphi method when the problem being researched benefits from subjective statements made on a collective basis. In this research method, where the focus is on the area of higher education, experts can contribute to the solution of a problem by using their experience, opinions and expertise.

This makes the Delphi method the right method. What makes the Delphi method so valuable is that the aims of the Delphi study must have a direct bearing in the area of the research (Alder & Ziglio, 1996; Dietz, 1987). The aim for this research is to have a direct positive impact on how the higher education can implement innovative IT. So Delphi is probably the right method to gather the information and get consensus about the CSFs that do contribute to this purpose. The Delphi method/approach does avoid the possible domination/hierarchical issues that may appear within groups. This method gives experts the opportunity to provide their opinions anonymously.

This is supported by the facts that (Skulmoski et al., 2007; Dalkey & Helmer, 1963):

- Contributors are spread out across the world (face to face would be impossible, due to time and money).
- Contributors are all professionals who are all quite busy, and this approach makes it possible to contribute to the survey whenever they like (within a certain timeframe).
- Information of highly experienced experts can be gathered in the least amount of time.
- It can be used for quantitative and qualitative research.

Brady (2015) concludes that Delphi studies typically have three rounds: one of them is the literature research, followed by two rounds of feedback and a final consensus concluded from all the feedback.

Considering all experts' arguments as described above and the pragmatism of the method, we chose to make the Delphi method, with two feedback rounds, the method we used during this study.

Contributors

The Delphi method is based on the feedback of experts who might look at the same issue from different angles. Therefore, expertise from CIOs to educational/IT experts were needed for the study. The European e-Competence Framework 3.0 was used to define the needed roles, including their specific competences. The Delphi group size does not depend on statistical power, but rather on group dynamics for arriving at a consensus among experts (Okoli and Pawlowski, 2004). Thus, the literature recommends 10 to 18 experts on a Delphi panel (Okoli and Pawlowski, 2004). Therefore, in order to be above the recommended number of experts and to make it less important if some of the attendees were not able to join for some reason, 32 experts were selected. The larger the group of contributors, the higher the reliability.

The distribution of the experts over the described roles and types of institutes can be found in Tables 3 and 4. The experts were situated in 10 different countries in the world.

Institutes	Distribution in percentage
University of Applied Science	28%
University	47%
External education (IT) expert/consultant	25%

Table 3. Distribution of expert roles amongst the type of institutes

Roles	Expert roles in percentage
IT Director/CIO/IT Manager	18%
Teamleader ICT	16%
Information Manager	14%
Project/Program manager	18%
Enterprise Architect	10%
Education (IT) expert/consultant	25%

Table 4. Distribution of expert roles amongst the contributors

Result of the feedback rounds

To be sure that the questions had a high degree of reliability (internal consistency), a Cronbach's alpha was applied. The first round scored .826 and the second round .859. Because the questions were about opinions, expertise and experience, the Cronbach's alpha had to be more than .6. Thus, in this case, there was a high degree of reliability between the questions (Baarda, Dijkum, and Goede, 2014).

The response in the first round was 91% and 84% in the second round. This was more than the 70 % required by the theory (Sumsion, 1998). No anomalies were found in the data, so no input from any of the contributors had to be removed.

Organisation Culture as a common subject

Organisation culture was mentioned in relation with about 90 % of all the CSFs. This means that organisational culture is a shared subject in implementing innovative IT and does not need to be mentioned per CSF. Therefore, it can be concluded that organisational culture is a key factor in the implementation of innovative IT. Although it is hard to measure and not a CSF, it should be asked whether or not the organisation's culture is convenient for implementing innovative IT.

New added CSF

One of the contributors in Round 1 said the following: "Extend to which technology contributes to better learning outcomes (perceived or proven)," as a CSF that has to be added. A couple of contributors confirmed the need for this CSF. Therefore, the relation to the primary process and the combination of innovation and education makes it valuable to add this to the final list of CSFs.

The new CSF is "Relation between IT innovations and learning outcomes".

Whereas the relation between the innovative IT and education was the primary goal for this

CSF, it was connected to the subject “business IT alignment” and put in Group 1. The expert that did the validation was asked to give their opinion about the positioning of the CSF.

The new CSF was not in the 1 % that did not make the conceptual list/model. It can be concluded that the method used has proven its value by using the contributors’ expertise and experience.

This new CSF fully supports Arts (2011) when he says: “Successfully integrating IT and education is a true innovation which transforms the educational practice effecting our society for the better.”

FINAL LIST AND MODEL

The study resulted in a model with the CSFs and related subjects that offers the contribution to the realisation of innovative IT.

The scores and feedback of the experts put the CSFs in two groups. The scores of the CSFs determined their positioning. Group 1 consists of 18 CSFs and was defined as “CSF must be taken into consideration” in every attempt to realise innovative IT. Group 2 consists of 13 CSFs and was defined as the group whereby: “the position of the CSF is such that the expertise/experience of the project manager and/or steering committee must be used to decide whether to act or not.” When the CSFs are in Group 2, it must be checked whether or not it is applicable in the situation of the innovation.

During the research, it was noted that “organisation culture” was mentioned in relation to (almost) all the CSFs, and it is concluded that culture is an underpinning condition. This underpinning condition was taken into the model as a separate consideration for every attempt to realise innovative IT (Figure 7). The outcome of these two feedback rounds showed as a list of CSFs and their corresponding subjects (Figures 5 and 6,) complemented with an adjusted final model (Figure 7).

Although the experts were located in locations all over the world, all with their own culture, they all agreed on the CSFs that are really important for the realisation of innovative IT. The search for a relevant list of CSFs and subjects that is applicable has been answered by the experts. Their opinion did result in this model, which is applicable in the realisation of innovative IT within (international) higher education.

CSF (Group 1)	Subject
Clear and Realistic Objectives	Top Management Involvement
Customer Satisfaction	Project Manager Skills
Financial Commitment	Top Management Involvement
Innovation Commitment	Business Strategy
Innovative IT Strategy	IT Strategy
Leadership of a project manager and/or management	Project Manager Skills
Open and Clear Communication	Top Management Involvement
Organising skills	Project Manager Skills
Perceived Usefulness	Human Factors
Planning	Project Manager Skills
Portfolio- and Programme Management	Business Strategy
Process	Project Manager Skills
Project Involvement	Human Factors
Shared perception of the why	Human Factors
Strong Cooperation	Human Factors
Training	Human Factors
Well Managed Expectations	Project Manager Skills
CSF (Added)	Subject
Relation between IT innovation(s) and learning outcome(s)	Business IT Alignment

Figure 5. Final list of (Group 1) CSFs and their corresponding subjects

CSF (Group 2)	Subject
Business Agility	Business Strategy
Culture of openness and trust	Organisation Culture
IT Saviness within the management/board	Top Management Involvement
Learning Orientation	Organisation Culture
Motivation to contribute to (implement) innovation(s)	Human Factors
Partnership	Business IT Alignment
Positive Attitude	Human Factors
Resource commitment	Top Management Involvement
Skills required	Project Manager Skills
Stakeholder Satisfaction	Top Management Involvement
Sufficiently professional	Human Factors
Trust	Human Factors
Well Organised Governance	Business IT Alignment

Figure 6. Final list of (Group 2) CSFs and their corresponding subjects

In the final model (Figure 7), culture is displayed as underpinning for the CSFs and the subjects.

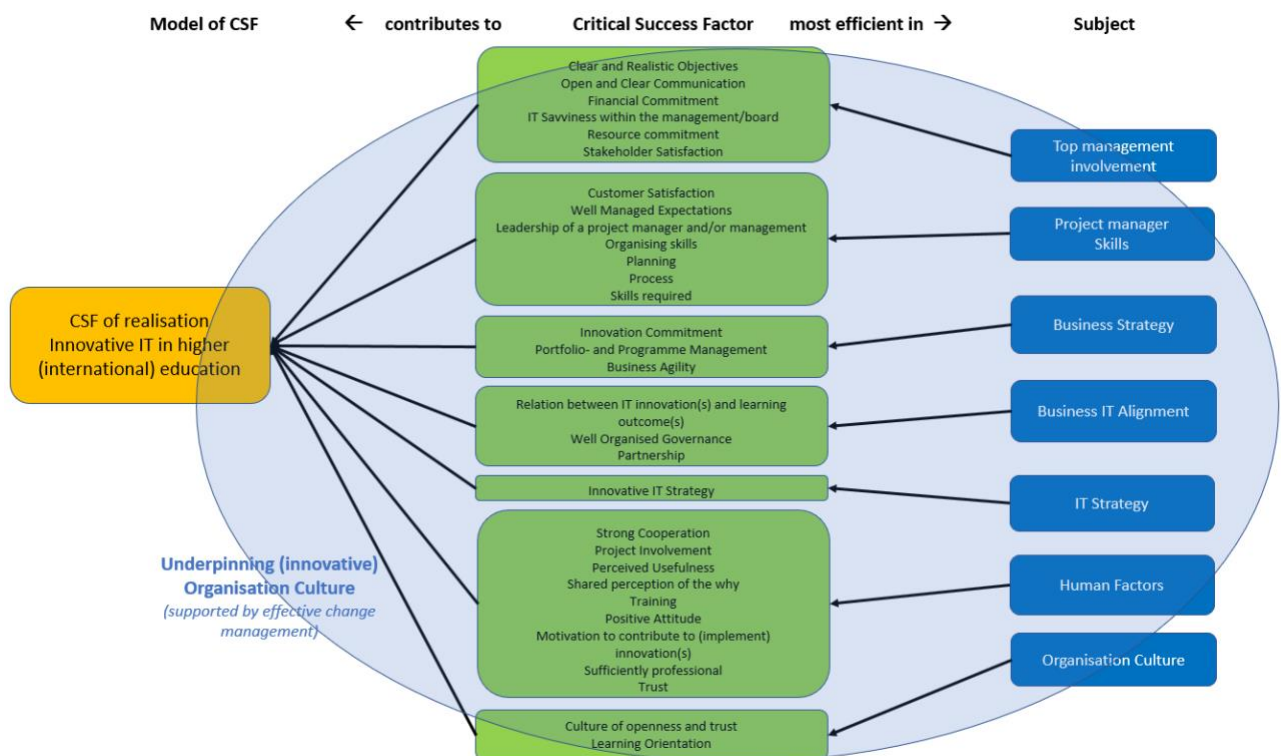


Figure 7. Final model of CSFs and related subjects

VALIDATION

Triangulation via different research approaches provides a way to make the results of the research more rigorous (Skulmoski, Hartman, and Kran, 2007); therefore, triangulation was done in this study. The triangulation was done by combining the literature research, the two Delphi rounds and the expert validation. The final model was presented to an expert for validation. The autonomous expert had not contributed to the study, either in the survey rounds or in the literature research. The validation was done by looking at real-life application of the CSFs within the area of IT in higher education. All CSFs and the model as a whole were validated with respect to positioning and whether it is relevant, useful and contributing to the implementation of innovative IT.

The validation of the model was positive. The expert confirmed that these CSFs—including the recently added one (Figure 5)—are the ones which are required to organise innovative IT and would have contributed to better outcomes. This validation also confirms that culture is so important and underpinning that, without the right culture, realising innovation (IT) would not happen successfully.

CONCLUSIONS

The study resulted in a relevant and applicable model, confirmed by the experts. However, the model must still prove its value in a new attempt to realise innovative IT.

The model with the CSFs offers the possibility to *organise* the realisation of innovative IT. The subject “organisation culture” is mentioned in relation to (almost) all the CSFs, and it might be concluded that culture is an underpinning condition. Culture is so important and underpinning that, without the right culture, realisation of innovations (IT) will not happen successfully. The culture is hard to influence, but capable change management can be effective in supporting the realisation of innovative IT. Culture is a hard thing to “control” during innovations and, in many cases, a withdrawal from this subject takes place and is the focus on the “organising” CSFs. Via the expert opinion, the validation and the change-management literature (Homan, 2013,2016;Witte and Jonker, 2013), we can conclude that the need to pay attention to culture is confirmed.

Innovation always has a factor of uncertainty. The culture to support and accept this is very important to realise innovation(s).

The missing link: The “relation between IT innovations and learning outcomes” (CSF) between the primary process and the organisation responsible for the realisation of innovative IT is added to the list of CSFs and is of great value for the alignment of students, teachers and IT.

Finally, it can be concluded that the realisation of (innovative) IT in higher education in an international context is supported by the outcome of this study. The combination of literature, experts’ opinions and validation have led to a relevant model. By adding this model to the field of knowledge, it will benefit the development of innovative IT in higher education.

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