37TH INTERNATIONAL CONFERENCE ON ORGANIZATIONAL SCIENCE DEVELOPMENT: ORGANIZATION AND UNCERTAINTY IN THE DIGITAL AGE
MARCH 21ST - 23RD, 2018, PORTOROŽ, SLOVENIA, CONFERENCE PROCEEDINGS
O. Arsenijević, I. Podbregar, P. Šprajc, D. Trivan & Y. Ziegler

University of Maribor Press

Measuring Digital Capabilities of the Higher Education Institution Using Digital Capability Maturity Model

MELITA KOZINA & VALENTINA KIRINIĆ

Abstract Digital business transformation is based on the application of digital technologies for the purpose of designing digital business models to create new value for customers. The paper describes the Digital Capability Maturity Model (DCMM) as one of the modern approaches to measuring the digital capabilities of any enterprise including also higher education institution. DCMM evaluates the digital business transformation management through five levels of maturity (initial, reactive, defined, managed and excellence). Furthermore, assessment of the digital business transformation management according to the DCMM can be conducted within six areas of digital capabilities: innovation capability; transformation capability; IT excellence; customer centricity; effective knowledge worker; operational excellence. As an example one of six areas of digital capabilities, the paper describes the results of the maturity assessment according to the innovation capability maturity model. The assessment results were collected within the higher education institution and refer to the innovations related to the implementation of educational technology and ICT suported business procesess related to the teaching, lerning and scientific resarch.

Keywords: • digital business transformation • digital capability maturity model • innovation capability • educational technology • assessment • higher education •

CORRESPONDENCE ADDRESS: Melita Kozina, Ph.D., Associate Professor, University of Zagreb, Faculty of organization and informatics, Pavlinska 2, 42000 Varaždin, Croatia, e-mail: melita.kozina@foi.hr; valentina.kirinic@foi.hr. Valentina Kirinić, Ph.D., Associate Professor, University of Zagreb, Faculty of organization and informatics, Pavlinska 2, 42000 Varaždin, Croatia, e-mail: valentina.kirinic@foi.hr.

DOI https://doi.org/10.18690/978-961-286-146-9.38 ISBN 978-961-286-146-9

Available at: http://press.um.si.

1 Introduction

Digital business transformation is based on the application of digital technologies for the purpose of designing digital business models to create new value for customers (Spremić, 2017). The role of new technology is not just automating the business process, but also creating new ways of doing business (Salle, 2004; Gartner, 2003). Digital business transformation is a very complex process that requires holistic analysis of internal and external strengths and weaknesses. Accordingly, new approaches are being developed that will help managers to successfully implement digital transformation.

The paper describes the Digital Capability Maturity Model (DCMM) as one of the modern approaches to measuring the digital capabilities of any enterprise including also higher education institution (Uhl et al., 2016). The purpose of this model is to evaluate the company's existing maturity in digital transformation processes in order to define improvements and achieve the desired level of digital transformation.

DCMM evaluates the digital business transformation management through five levels of maturity (initial, reactive, defined, managed and excellence). Digital business transformation management includes nine management disciplines such as: *strategy management; value management; risk management; program and project management; competence and training management; business process management; organizational change management; transformational IT management; meta management.*

Furthermore, assessment of the digital business transformation management according to the DCMM can be conducted within six areas of digital capabilities*: innovation capability; transformation capability; IT excellence; customer centricity; effective knowledge worker; operational excellence.*

Accordingly, there are six versions of DCMM. These are:

1. Innovation Capability Maturity Model;
2. Transformation Capability Maturity Model;
3. IT Excellence Maturity Model;
4. Customer Centricity Maturity Model;
5. Effective Knowledge Worker Maturity Model;
6. Operational Excellence Maturity Model.

Each of these maturity models aims to assess the ability to manage innovations or transformation or IT excellence or customer centricity or operational excellence or knowledge workers in order to achieve the effective digital business transformation.

As an example one of six areas of digital capabilities, the paper describes the results of the maturity assessment according to the innovation capability maturity model. The assessment results were collected within the higher education institution and mainly refer to those types of innovations that include *digitalization of higher education and the*

implementation of educational technology as well as the *digitalization of services to support the teaching, learning and evaluation processes*. In this way, the existing maturity of innovation management for digital transformation within the institution was determined as the basis for defining improvements.The structure of the DCMM as part of digital capability framework is described in Chapter 2. The results of the conducted research to assess the digital capability of the higher education institution in the field of innovation are described in Chapter 3.

2 Structure of digital capability framework

The structure of Digital Capability Framework is based on three dimensions: key areas of digital capabilities (one dimension), maturity levels (second dimension) and digital business transformation management (third dimension). It is shown in Fig.1.

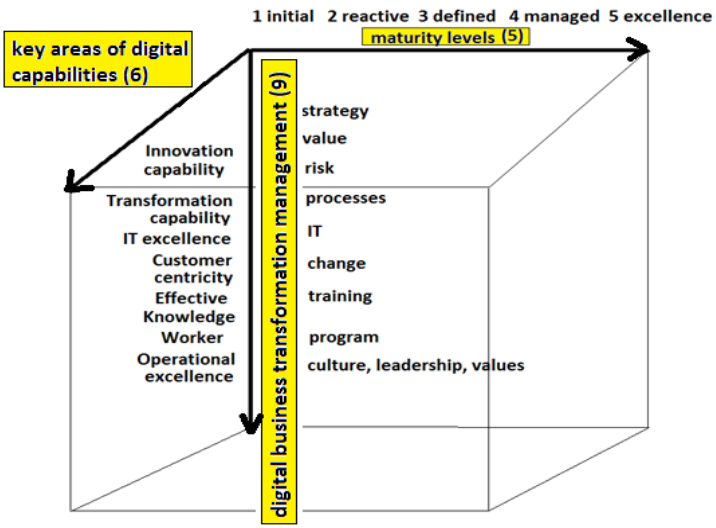

Figure 1: The structure of Digital Capability Framework (Source: Authors)

Digital Capability Maturity Model has a two-dimensional structure and is a part of Digital Capability Framework. The structure of DCMM is shown in Fig.2.

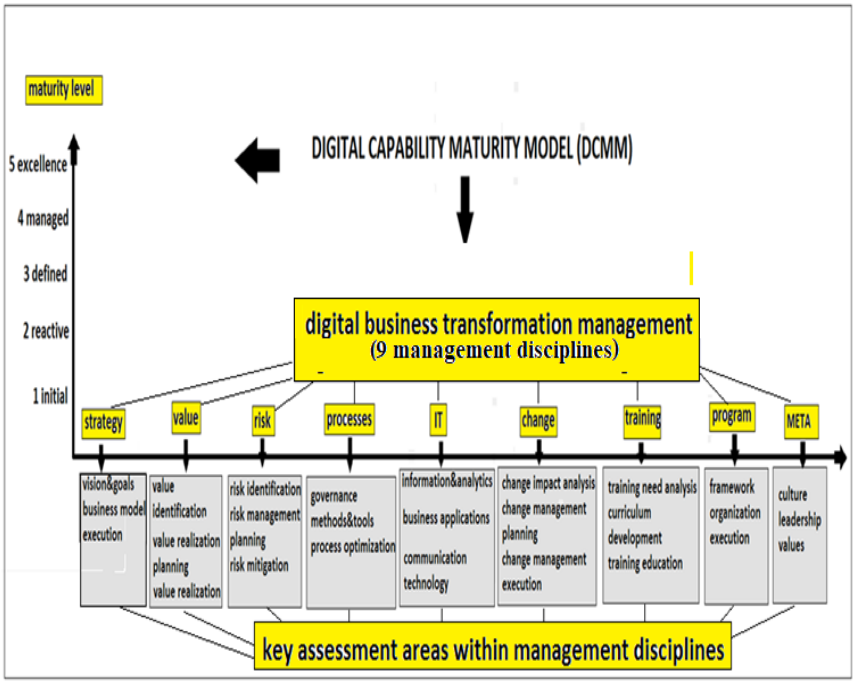

Figure 2: Generic concept of DCMM (Source: Authors)

Each of the above three dimensions will be described below.

2.1 Key areas of digital capabilities

2.1.1 Innovation capability

This area of digital capability allows the enterprise to focus on new business opportunities and to realize new products and services through digital technology (mobile, cloud, big data, Internet of Things, etc) (Safrudin et al., 2016). Innovation capability is the ability of enterprise to transform ideas into new and profitable products and services. Successful digital enterprises include innovations in their vision and strategic goals. In such enterprises, employees are continually thinking about new ideas that need to be analyzed and evaluate their benefits and potential risks. The results of the conducted research to assess innovation capability of the higher education institution are described in the Chapter 3.

2.1.2 Transformation capability

This area of digital capability allows the enterprise to manage complex changes that have a great impact on all parts of the enterprise. New and unpredictable impacts are constantly emerging and successful digital companies have to react to them continuously. The ability of transformation is key to digital businesses. Employee must have an understanding of such changes that are complex and may have a negative impact on all stakeholders. Leadership must continue to encourage and support such changes, communicate with employees. A digital enterprise must have a clear vision and business strategy and all employees must understand the impact of transformation on the business strategy. Transformation capability requires transformation experts to be able to apply the appropriate methodologies for transforming best practices. Furthermore, the transformation team manages all interests of different stakeholders and establishes open communication within the company (Labusch,Winter & Uhl, 2016a).

2.1.3 IT Excellence

IT Excellence is the third key area of digital capability and has its own maturity model - IT Excellence Capability Maturity Model. This ability determines whether enterprises are able to manage their technological potential and how they use this potential to create greater business value (Labusch,Winter & Uhl, 2016b). Any investment in new technologies should be evaluated both in terms of benefits and in terms of costs and risks. It is important that business management has a vision of how to utilize the potential of digital technology.

2.1.4 Customer Centricity

This capability enables a digital enterprise to focus on customers by using digital technologies. Most of the enterprises focus their strategy on achieving higher market shares based on the development of quality products. Digital technology provides new ways to collaborate with customers and the whole business focuses on their needs and expectations (MacGillavry & Uhl, 2016). Accordingly, new customer relationship management projects need to be designed and adapted to business processes and IT applications.

2.1.5 Effective Knowledge Worker

Digital enterprises require new competencies to use digital technology to enhance the satisfaction of their employees. Digital business jobs are designed to encourage creativity and collaboration among employees. Setting up a collaborative and creative working environment enables employees to become more loyal, independent, and self-confident (Safrudin & Uhl, 2016). Leadership and its support are very important during the digital transformation.

2.1.6 Operational Excellence

Operational Excellence as a key area of digital capabilities is ability of the effective business process management within the enterprise to achieve their excellence through continuous improvement and innovation (Schmiedel, Brocke & Uhl, 2016). For a digital enterprise, it is important to realize fully integrated processes and data as the basis for operational performance. Business processes must be effective in order to achieve the business goals. Second, business processes must be effective so that organizations perform their business with the lowest cost and error.

2.2 Maturity levels

Below is a short summary of the importance for each level of maturity (in the text below referenced as: ML) (CMMI, 2006; ISO/IEC 15504-5, 2012).

INITIAL ML1 (first maturity level): digital capability is not recognized. There is no idea about digital transformation or any initiative. Not carried out an evaluation of digital capabilities.

REACTIVE ML2 (second maturity level): there are not all aspects of digital ability recognized. The goals of digital transformation are partially integrated in the vision of the company. There are no risk assessments that are associated with digital transformation. Digital transformation projects take place in an intuitive, ad hoc way. There are no defined responsibilities for the needs of digital transformation. Business integration is very low. Evaluation of certain aspects of digital capability is carried out reactive.

DEFINED ML3 (third maturity level): digital capability is recognized. The digital transformation strategy is defined and the values and risks of digital transformation are evaluated. Also documented digital transformation projects have been defined. The scope of the process changes as well as the plan for the implementation of new technologies has been defined. The necessary education is required for the purpose of digital transformation. Digital abilities are evaluated.

MANAGED ML4 (fourth maturity level): digital capability is recognized (through all aspects) and is valued and improved. The digital transformation strategy is integrated with the vision of the entire enterprise. The values and risks of digital transformation are estimated. Digital transformation projects are managed quantitatively in order to predict (digital) product quality. Procedures for implementing and testing new technologies have been developed. All the necessary responsibilities, knowledge and training plans are defined for the needs of digital transformation.

EXCELLENCE ML5 (fifth maturity level): digital capability is fully recognized and is continuously measured and improved. The digital transformation strategy is fully aligned with the business model of enterprises including external stakeholders. Risk management

is implemented so that it does not endanger the success of digital transformation. The results of the digital transformation are evaluated. Digital transformation projects are monitored and improved in terms of time, cost and quality. The processes take place according to defined end-to-end implementation plans and are continually improving. High integration of business applications and interoperability has been achieved. Training is provided for the needs of digital transformation.

2.3 Digital business transformation management and related assessment areas

The process of digital business transformation is a very complex process that radically changes the traditional organizational structure and thus affects all parts of the organization. Accordingly, the business transformation management methodology is of great importance to the enterprise in the context of coordination of all parts of the enterprise as well as alignment with strategic goals for the purpose of reducing costs and risks (Uhl & Gollenia, 2012).

Digital business transformation management includes eight management disciplines and one additional discipline - *meta management*. Each of these management discipline has three key areas to assess the maturity of enterprises within each key area of digital capabilities. Below is a description of the features of each management discipline. According to these disciplines, the study of the maturity of a higher education institution in the field of innovation as one of the areas of digital capability has been conducted (described in Chapter 3).

2.3.1 Strategy management

The strategy management analyzes the needs and causes of digital transformation as well as the level of readiness of enterprises for transformation. This management discipline has three key areas for assessment*: vision & goals; business models; execution (shown in Fig.2)*. In the first area, vision & goals, it is necessary to assess whether the goals of digital transformation are integrated into the overall vision of the enterprise. Furthermore, it is estimated whether these goals are linked to the business model within the enterprise and how the enterprise achieves financial results. In the end, it is necessary to assess whether the strategy of digital transformation carried out and whether it includes external stakeholders.

2.3.2 Value management

Value Management is second management discipline and has three key areas for assessment: *value identification; value realization planning and value realization (shown in Fig.2)*. This management discipline provides techniques for recognizing and managing the value of digital transformation. Values of digital business transformation can be quantitative and qualitative. Accordingly, it is important to plan their realization and

define relevant indicators by which management can manage value realization and initiate the necessary improvements.

2.3.3 Risk Management

Risk Management has three key areas for assessment*: risk identification; risk management planning and risk mitigation (shown in Fig.2)*. This discipline assesses strategic and operational risks that could be a threat to the success of digital transformation and develop plans and procedure to prevent risk or reduce risk to an acceptable measure.

2.3.4 Business Process Management

Business Process Management has three key areas for assessment: *governance; methods & tools; process optimization (shown in Fig.2)*. In the first area it is important to define the scope of process changes as well as the "end-to-end" implementation model of the process. To document, analyze, implement and execute processes, the enterprise requires the appropriate methods and tools. Activities of the process optimization track the effectiveness of business processes and initiate the necessary process improvements throughout the value chain. The goal is to achieve high business integration.

2.3.5 Transformational IT Management

Transformational IT Management has three key areas for assessment: *information and analytics; business applications and communication technology (shown in Fig.2)*. This management discipline assesses the technological changes and readiness of enterprises to implement new technologies. It is important to establish a high level of business application integration and interoperability. It is also important to provide integrated communication channels through business using communication technologies.

2.3.6 Organizational Change Management

Organizational Change Management has three key areas for assessment: *change impact analysis; change management planning; change management execution (shown in Fig.2)*. This part of business transformation management identifies the required types of changes and analyzes their impact on different parts of the organization including the exsternal stakeholders. In the process of analyzing the identified changes and their impact on business, it is necessary to evaluate their business efficiency, technological feasibility and related costs and risks.The necessary changes should be planned. It is important to establish mechanisms to monitor the effectiveness of organizational change implementation.

2.3.7 Training Management

Training Management has three key areas for assessment: *training needs analysis; curriculum development and training education (shown in Fig. 2)*. This part of management focuses on organizational abilities and individual skills as key business success factors for digital business transformation. It is important to identify new or improved competencies and skills, as well as the roles and people needed during the digital transformation. Training education should be monitored and continually improved.

2.3.8 Program and Project Management

Program and Project Management has three key areas for assessment: *framework; organization; execution (shown in Fig. 2)*. This discipline focuses on the application of the best practices and techniques for managing the portfolio of digital transformation program and projects especially in terms of cost, quality and time.

2.3.9 Meta management

Meta management connects all management disciplines within the digital business transformation management and also contains three key areas for assessment: *culture*; *leadership*; *values (shown in Fig. 2)*. Table 1 describes these three key areas and compares their initial and excellence maturity levels (Uhl et al., 2016).

Table 1: Comparison between initial and excellence maturity level within meta management (Uhl et al., 2016)

Meta management	INITIAL maturity level	EXCELLENCE maturity level
CULTURE	Digital capability is not recognized.	Digital capability is fully recognized and continuously measured and improved.
LEADERSHIP	There are no ideas about digital transformation and there are no initiatives.	Leadership continually supports the initiatives of digital transformation and provides conditions for their realization.
VALUES	Digital capability is not evaluated in the enterprise. There is no identification of the value of digital transformation in the enterprise and their implementation is not planned.	The value of digital capability and its advantages are the strategic goals of the enterprise. There is identification of the value of digital transformation in the enterprise and their implementation is planned.

3 Application of Innovation Capability Maturity Model within higher education institution

Innovation capability is the ability of enterprise (institution) to transform ideas into new and profitable products and services using digital technologies (cloud services; mobility; big dana; social media; IoT). There are several types of innovation: *product innovation*, *process innovation*, *organizational (strategic) innovation* and *technological innovation*. **Product innovation** is related to the introduction of new products or services to the market. **Process innovation** refers to changes within the business process models in order to achieve the quality, timely deliveries of products and services, optimal costs and various services that are suitable for customers as well as other organizational improvements. **Organizational (management) innovation** is related to the implementation of new organizational methods within the business practice. **Technological innovation** is related to the changes to technical systems supporting process or product innovations.

Innovation capability maturity model describes how to manage innovation in digital transformation holistically. The model characterizes innovation management as a digital capability of the enterprise and determines the maturity of innovation management for digital transformation. For a digital enterprise (institution), it is important to achieve greater maturity in managing innovation as one of the areas of digital capability.

The assessment results were collected within the higher education institution and mainly refer to *process innovations that digitalization of higher education and the implementation of educational technology* as well as the *digitalization of services to support the teaching, learning and evaluation processes, as well as digitalization of IT services to support the other processes (example: scientific research work)*. A method of

interviews with process owners within the institution was conducted. In this way, the existing maturity of innovation management for digital transformation within the institution was determined as the basis for defining improvements.

The results of the conducted maturity assessment of all nine management disciplines (decribed within the Chapter 2) *for the innovation capability as one of the key area of digital capabilities* within the higher education institution are shown in the Table 2 and Table 3. The assessment was conducted for all key areas within each management discipline.

Table 2: Maturity assessment of the innovation management as a digital capability within the higher education institution - 8 management disciplines (Source: Authors)

MATURITY LEVELS for INNOVATION MANAGEMENT as a DIGITAL CAPABILITY					
Kea areas of DCMM	**INITIAL (1)**	**REACTIVE (2)**	**DEFINED (3)**	**MANAGED (4)**	**EXCELLENCE (5)**
Assessment for Strategy management					
VISION & GOALS	Innovation is not included in the vision of the institution.	Innovation is involved in the vision of the institution. Innovation goals are partially aligned with the goals of the institution.	Innovation is included in the vision of the institution. Innovation goals are mostly aligned with the goals of the institution.	Innovation is included in the vision of the institution. Innovation goals are aligned with the goals of the institution.	Innovation is included in the vision of the institution. Innovation goals are **fully aligned** with the goals of the institution.
BUSINESS MODELS	Business processes are not aligned with strategic innovation goals.	Business processes are partially aligned with strategic innovation goals.	Business processes are mostly aligned with strategic innovation goals.	Business processes are aligned with strategic innovation goals.	Business processes are **fully aligned** with strategic innovation goals.
EXECUTION	Innovations are not implemented.	Innovations are partially implemented.	Innovations are mostly carried out.	Innovations are implemented. The innovation strategy is not fully executed.	Innovations are implemented. The innovation strategy is fully and effectively executed (***examples of KPIs:*** *percentage of e-courses,*

MATURITY LEVELS for INNOVATION MANAGEMENT as a DIGITAL CAPABILITY					
Kea areas of DCMM	**INITIAL (1)**	**REACTIVE (2)**	**DEFINED (3)**	**MANAGED (4)**	**EXCELLENCE (5)**
					percentage of implemented IT services).
Average value for Strategy management: 4.0					
Assessment for Value management					
VALUE IDENTIFICATION	The business value of innovation for the institution are not identified.	The business value of innovation for the institution are partially identified.	The business value of innovation for the institution are mostly identified.	The business value of innovation for the institution are identified.	The business value of innovation for the institution are **fully** identified.
VALUE REALIZATION PLANNING	Innovation value realization planning is not implemented and there are no indicators to measure these values.	Innovation value realization planning is partially implemented	Innovation value realization planning is mostly implemented. Mechanisms for measuring innovation values are poorly defined.	Innovation value realization planning is implemented. KPIs have been defined for quantitative and qualitative forms of these values. (***examples of KPIs:*** *integration of teaching processes, student satisfaction, motivation and employee productivity,* etc.).	Innovation value realization planning is fully implemented. A framework for measuring qualitative and quantitative benefits derived from innovation initiatives has been established.
VALUE REALIZATION	The business value of innovation is not realized.	The business value of innovation is partially realized. The measurement is reactive.	The business value of innovation is mostly realized. Value measurement is mostly performed.	The business value of innovation is realized. Value measurement is performed.	The business value of innovation is fully realized. Based on the measurement of values, decisions for improvement can be initiated.
Average value for Value management: 4.0					

MATURITY LEVELS for INNOVATION MANAGEMENT as a DIGITAL CAPABILITY					
Kea areas of DCMM	**INITIAL (1)**	**REACTIVE (2)**	**DEFINED (3)**	**MANAGED (4)**	**EXCELLENCE (5)**
Assessment for Risk management					
RISK IDENTIFICATION	Identification of risks associated with innovation initiatives is not implemented.	Identification of risks associated with innovation initiatives is partially implemented.	Identification of risks associated with innovation initiatives is mostly implemented.	Identification of risks associated with innovation initiatives is implemented.	Identification of strategic and operational risks associated with innovation initiatives is implemented and includes the external stakeholders.
RISK MANAGEMENT PLANNING	There is no risk management planning.	Risk management activities are partially planned.	Risk management activities are mostly planned.	Risk management activities are planned.	Risk management activities are fully planned
RISK MITIGATION	Risk mitigation activities are not carried out.	Risk mitigation activities are partially carried out.	Risk mitigation activities are mostly carried out.	Risk mitigation activities are carried out.	Options to implement activities to reduce the risks are fully developed.
Average value for Risk management: 3.0					
Assessment for Business process management					
GOVERNANCE	The processes do not improve through innovation.	The processes are partially improved through innovation.	The processes are mostly improved through innovation.	Processes are improved through innovation (***examples of KPIs***: *high level of educational technology implementation, high integration of IT services*).	The quality of teaching and other business processes is improved (***examples of KPIs***: *very high level of educational technology implementation, very high integration of IT services*).
METHODS & TOOLS	Tools do not support process implementation and	Tools partially support process implementation and	Tools mostly support process implementation and	Tools support the process implementation and process management,	Integral tools support process implementation and process management.

MATURITY LEVELS for INNOVATION MANAGEMENT as a DIGITAL CAPABILITY					
Kea areas of DCMM	**INITIAL (1)**	**REACTIVE (2)**	**DEFINED (3)**	**MANAGED (4)**	**EXCELLENCE (5)**
	process management.	process management.	process management	but not fully integral.	
PROCESS OPTIMIZATION	There is no process optimization.	The efficiency of the business processes is partially monitored for optimization.	The efficiency of the business processes is mostly monitored for optimization.	The efficiency of business processes is fully monitored using defined KPIs.	The efficiency of business processes is fully monitored using defined KPIs. **Improvements** are initiated for the purpose of process optimization.
Average value for Business process management: 3.7					
Assessment for IT management					
INFORMATION ANALYTICS	There is no defined information architecture model. IT is not used strategically.	Information analytics is partially focused on the amount and quality of data collected in IT systems.	Sharing knowledge is not integral within institution. IT is not used strategically.	Sharing knowledge is integral within institution. IT is used strategically.	Sharing and improving knowledge is integral within institution. IT potentials are used strategically and creatively through the integrated IT platform.
BUSINESS APPLICATIONS	Business applications are not related.	Business applications are partially related.	Business applications are mostly related.	Business applications are related.	The high integration of business applications.
COMMUNICATION TECHNOLOGY	There are no integrated communication channels through the business.	Communication technologies provide partial business integration.	Communication technologies mostly provide business integration.	Communication technologies provide business integration.	Communication technologies provide high levels of integration and interoperability.
Average value for IT management: 4.0					
Assessment for Organizational change management					
CHANGE IMPACT ANALYSIS	The changes are not identified and their impact on the	The changes are partially identified and their impact on the	The changes are mostly identified. Approving	The changes are identified. Approving changes is fully defined	The changes are identified. Approving changes is fully defined.

MATURITY LEVELS for INNOVATION MANAGEMENT as a DIGITAL CAPABILITY					
Kea areas of DCMM	**INITIAL (1)**	**REACTIVE (2)**	**DEFINED (3)**	**MANAGED (4)**	**EXCELLENCE (5)**
	operation of the institution is not assessed.	operation of the institution is partially assessed. Approving changes is intuitive.	changes is not fully defined.	and based on the change impact analysis.	Change impact analysis includes all financial, business and technical aspects for the implementation of the necessary changes.
CHANGE MANAGEMENT PLANNING	Change management is not planned.	Change management is partially planned.	Change management is mostly planned. Mechanisms for monitoring the effectiveness of the implementation of changes are mostly defined.	Change management is planned. Mechanisms for monitoring the effectiveness of the implementation of changes are defined.	Change management planning is carried out with the involvement of all stakeholders through communication on possible consequences.
CHANGE MANAGEMENT EXECUTION	Change management is not executed.	Change management is partially executed.	Changes are performed with multiple iterations.	Change management is executed. It monitors and analyzes the implementation of the change.	Change management is executed. It monitors and analyzes the implementation of the change. **Improvement plans** are being developed regarding the implementation of changes.
Average value for Organizational change management: 3.3					
Assessment for Training management					
TRAINING NEEDS ANALYSIS	An analysis of the required competencies for the	An analysis of the required competencies for the	An analysis of the required competencies for the	An analysis of the required competencies for the	The competences and roles of the people needed for the

MATURITY LEVELS for INNOVATION MANAGEMENT as a DIGITAL CAPABILITY					
Kea areas of DCMM	**INITIAL (1)**	**REACTIVE (2)**	**DEFINED (3)**	**MANAGED (4)**	**EXCELLENCE (5)**
	implementation of innovation is not performed.	implementation of the innovation is partially carried out.	implementation of the innovation is mostly carried out.	implementation of the innovation is carried out.	implementation of innovation have been established.
CURRICULUM DEVELOPMENT	There is no development of programs required for innovation education.	There is partially development of programs required for innovation education.	There is mostly development of programs required for innovation education.	There is development of programs required for innovation education. Not all stakeholders are involved.	Necessary resources and all materials to support staff and other stakeholders in education are defined.
TRAINING EDUCATION	Training education is not performed.	Training education is partially performed.	Training education is mostly performed.	Trainings are conducted. Effectiveness of their implementation are monitored and evaluated.	Training educations are conducted as well as their continuous monitoring and improvement.
Average value for Training management: 4.0					
Assessment for Program and project management					
FRAMEWORK	Innovation project portfolio is not recognized or defined.	Innovation project portfolio is recognized but partially defined.	Innovation project portfolio is mostly defined.	Innovation project portfolio is defined. External stakeholders are poorly involved.	Innovation project portfolio is fully defined.
ORGANIZATION	Organization and planning of execution of innovation projects are not implemented.	Planning of execution of innovation projects is partially carried out.	Planning of execution of innovation projects is mostly carried out.	Planning of execution of innovation projects is carried out. Indicators for the implementation of innovation projects are defined (***examples of KPIs***: *percentage of*	Planning is carried out through a combination of innovation projects and efficient use of available resources. A framework for measuring qualitative and quantitative benefits related to the

MATURITY LEVELS for INNOVATION MANAGEMENT as a DIGITAL CAPABILITY					
Kea areas of DCMM	**INITIAL (1)**	**REACTIVE (2)**	**DEFINED (3)**	**MANAGED (4)**	**EXCELLENCE (5)**
				e-courses within institution, *level of educational technology implementation*, *level of digitalization of other IT services*). Other indicators related to project execution (*quality*, *time*, *costs*) have been defined.	implementation of innovation projects has been established.
EXECUTION	Innovation projects are not carried out.	Innovation projects are partially carried out.	Innovation projects are mostly carried out.	Innovation projects are carried out by monitoring their quality, cost, and execution time.	Innovation projects are fully executed, monitored and improved.
Average value for Program and project management: 4.0					

Table 3: Maturity assessment of the innovation management as a digital capability within the higher education institution - *meta management*

MATURITY LEVELS for INNOVATION MANAGEMENT as a DIGITAL CAPABILITY					
Kea areas of DCMM	**INITIAL (1)**	**REACTIVE (2)**	**DEFINED (3)**	**MANAGED (4)**	**EXCELLENCE (5)**
Assessment for Meta management					
CULTURE	Innovative digital capability is not recognized	Innovative digital capability is partially recognized.	Innovative digital capability is mostly recognized.	Innovative digital capability is recognized but there is no understanding by all stakeholders.	Innovative digital capability is fully recognized. The progress of digital capabilities is continuously measured, reviewed and improved.
LEADERSHIP	Initiatives for the development of innovation digital capabilities are not being undertaken.	Leadership partially supports initiatives to develop digital innovation capabilities.	Leadership mostly supports initiatives to develop digital innovation capabilities.	Leadership supports initiatives to develop digital innovation capabilities.	Leadership fully supports innovative initiatives for the purpose of digital progress.
VALUES	Innovative digital capability is not valued.	Innovative digital capability is partially valued.	Innovative digital capability is mostly valued.	Innovative digital capability is evaluated since the values of such transformation are identified and their realization is planned.	The value of innovation digital capability is considered to be the strategic goal of the institution.
Average value for Meta management: 5.0					

According to the research results described within the Table 2, we can define AS-IS maturity model of innovation management as a digital capability shown in Fig. 3.

Figure 3: Maturity level of innovation management as a digital capability (AS-IS analysis for the higher education institution) (Source: Authors)

Remarks

The success of digital transformation does not depend on just introducing new technology. Enterprises (institutions) must carefully explore and analyze the possible use, benefits and risks of new technological trends (Kozina, 2007). It involves several aspects that have been analyzed in this study through nine management disciplines within innovation capabilities as one of the six areas of digital capabilities. According to the obtained results, the actual maturity level of innovation management as a digital capability within an higher education institution has an average value of 3.89. According to this value, we can conclude the following: digital capability within the institution is recognized; digital transformation strategy is defined and the values and risks of digital transformation are evaluate; digital transformation projects are managed quantitatively in order to predict (digital) product quality; procedures for implementing and testing new technologies have been developed; all the necessary responsibilities, knowledge and training plans are defined for the needs of digital transformation.

However, there is a need for improvement in the area of risk management and change management especially those areas that are related to the change impact analysis, change management planning and change management execution (decribed within the Table 2). Additionaly, there is also a need for the improvement of the business process management (higher level of efficiency of the business processes that improve through innovations; higher level of business process monitoring and optimization).

Future research focuses on assessing the maturity of the institution within other areas of digital capabilities such as: transformation capability; IT excellence; customer centricity; effective knowledge worker and operational excellence.

Acknowledgments

This work has been supported by the Croatian Science Foundation under the project Higher Decision IP-2014-09-7854.

References

CMMI Product Team (2006). *CMMI for Development*, Version 1.2, (CMU/SEI-2006-TR-008),Software Engineering Institute Carnegie Mellon University Pittsburgh, PA 15213.

Gartner (2003). *Defining the Business Value of IT*. Retrieved from: http://www. bus. umich. edu/KresgePublic/Journals/Gartner/research/112300/112350/112350. pdf

ISO/IEC 15504-5(2012). Information technology -- Process assessment -- Part 5: An exemplar software life cycle process assessment model.

Kozina, M. (2007). *Management of Company IT Organization*, DAAAM International Scientific Book , DAAAM International Vienna, Vienna, pp. 147-162.

Lawson, B. & Samson, D. (2001). *Developing Innovation Capability in Organizations: A Dynamic Capabilities Approach*. International Journal of Innovation Management. 5 (3): 377–400.

Labusch,N.,Winter,R.&Uhl,A.(2016a).*Transformation Capability*. Retrieved from http://www.gpmfirst.com/books/digital-enterprise-transformation/transformation-capability

Labusch, N., Winter, R. & Uhl, A. (2016b). *IT Excellence*. Retrieved from http://www.gpmfirst.com/books/digital-enterprise-transformation/it-excellence.

MacGillavry, K. & Uhl, A. (2016). *Customer Centricity*. Retrieved from http://www.gpmfirst.com/books/digital-enterprise-transformation/customer-centricity.

Salle, M. (2004): *IT Service Management and IT Governance: Review, Comparative Analysis and their Impact on Utility Computing*. HP Laboratories Palo Alto, June 2.

Safrudin, N., Rosemann, M., Jung, R. & Uhl, A.(2016). *Innovation Capability.* Retrieved from http://www.gpmfirst.com/books/digital-enterprise-transformation/innovation-capability.

Safrudin, N., & Uhl, A. (2016). *Effective Knowledge Worker*. Retrieved from http://www.gpmfirst.com/books/digital-enterprise-transformation/effective-knowledge-worker.

Schmiedel, T., Brocke, J.V. & Uhl, A. (2016). *Operational Excellence.* Retrieved from http://www.gpmfirst.com/books/digital-enterprise-transformation/operational-excellence.

Spremić, M. (2017): *Digitalna transformacija poslovanja*, Ekonomski fakultet Zagreb.

Uhl, A. & Gollenia, L.A. (2012). *A Handbook of Business Transformation Management Methodology*. Retrieved from http://www.pminj.org/13-mtg/files/03njmtg.pdf.

Uhl, A., Born, M., Koschmider, A. & Janasz, T. (2016). *Digital Capability Framework: A Toolset to Become a Digital Enterprise.* Retrieved from http://www.gpmfirst.com/books/digital-enterprise-transformation/digital-capability-framework-toolset-become-digital.