Digitalisation in Construction as an Educational Challenge for Universities

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Abstract. Digitization in the construction industry has become a reality, and universities have incorporated it into their curricula. There is currently a high percentage of workers in the construction sector who are not familiar with the digital processing of documentation. The Institute of Technology and Business in České Budějovice responded to this demand with a research project of intergenerational education, which is being tested in a large construction company. Research results so far show that construction companies can be helped to educate their workers by guiding the sharing of skills and competences. The paper deals with testing the intergenerational sharing of IT competences in construction production. Testing the managed transfer of IT competences brings a new dimension to the education process that will enable accelerated adaptation of staff to the new conditions. It will help companies to reduce their training costs and enable targeted training for a specific worker. The role of the university is in the professional guarantee of the transferred competences and the management of their transfer process. The article brings experience with this new educational methodology.

1. Introduction

The ageing population is one of the greatest challenges facing contemporary society in Europe. At present, approximately 2.5 million people over the age of 65 live in the Czech Republic. In 2050, it will be more than one third. Only citizens over 85 will be 5 times more in 2050 than in 2017 [1]. This extraordinary demographic change will have an impact on society as a whole, and the question is whether it can be prepared at all. One way to counter this trend is to count on it and respond to it not only by increasing the state budget for social benefits, but by systematically sweeping older people. Today we come across the notion of ageism as something approaching discrimination. However, there is also a second path towards the involvement of seniors in the active working process. There was even a new label for seniors aged 65 to 75 years. This is the so-called generation YOLD (young + old), which is quite rightly attributed to great work potency. In 1977, John D. MacDonald [2] wrote in his book "Condominium" that retirement age is an incredible waste of work and skills just because older people are not allowed to work anymore.

In order to be able to employ older workers, they need to be offered assistance, as the working environment has changed over the years and everyone does not have the opportunity to actively educate themselves. The effectiveness of courses offered, for example, by labour offices is not high, as they are directed towards general skills and are intended for relatively large numbers of candidates. An
older employee with a wealth of previous work experience does not need such wide-ranging or general training courses but would be sufficient to "educate" himself in a very specific area related to his work. This situation is reflected in the methodology of competence sharing, which allows supplementing education only in the area necessary for the profession in a particular job. To achieve this, it is necessary to create the conditions that allow this exceptionally effective and targeted type of adult education to work.

The authors of the article focused on intergenerational sharing of competences in the field of digitalization in the construction industry. The aim of the project, the pilot phase of which is currently underway, is to verify whether the competence-sharing methodology is applicable in a particular situation and therefore maps the conditions and requirements for developing mutual learning among employees in a large construction company. The methodology for sharing work competences is based on recent research conducted with the support of the European Commission in some EU countries. The Czech Republic successfully participated in a project aimed at intergenerational sharing of nurses’ competencies. Now, with the support of the Technology Agency of the Czech Republic, a team of academic staff from the Institute of Technology and Business in České Budějovice and the University of Economics in Prague is engaged in the issue of competence sharing in the field of digitalization.

2. Current trends in adult education focused on professional education of employees.

In the introduction, it is necessary to state the general links of the discussed topic to the principles of equal opportunities, to the issue of lifelong learning, to theories of management in various areas and to current social trends related to the processes we call Industry 4.0. The article provides information on the modern, in this context "revolutionary" method of employee education in an organization that eliminates the weaknesses of the younger and older generations and strengthens their strengths, which transforms into the desired effects of work performance.

Intergenerational communication in age heterogeneous teams (as part of intergenerational management) can be considered as an innovative educational method that has interdisciplinary character especially in relation to the current areas of diversity management, age management, a method that takes the form of mutual learning of different generations directly in the organization. When dealing with the question of how to educate employees in a particular area of information technology literacy (eg digitization of project documentation), we can use various traditional methods of education with the help of an internal or external lecturer. A new variant, however, is the method of intergenerational communication, which respects the above-mentioned principles and approaches to education. The current reality-proven reality is that education is a lifelong matter, i.e. not a youth issue, but also a middle and older age (age management).

Education is a basic prerequisite for managing change. Educated people are able to adapt to or even to change. In an organization, education is a tool for increasing employee flexibility, and flexible employees are a tool for organizational flexibility as a prerequisite for increasing competitiveness. The idea of adult education is not new, and we can associate this concept with the beginning of the 1970s. In 1972, the UNESCO Commission published the document "Learning to be", which contained a number of recommendations for adult education. One of the basic ideas was: „Every individual must be able to continue learning throughout life.” The idea of permanent lifelong learning is the cornerstone of the learning society [3]. In 1996, the UNESCO Commission issued a "Learning: The Treasure Within" report [4]. In Czech conditions, it is possible to mention the document National Program for the Development of Education in the Czech Republic - the White Paper. The Czech White Paper is conceived as a system project expressing ideas, general intentions and development programs to be decisive for the development of the educational system in the medium term [5].
The document “Strategy of Human Resources Development in the Czech Republic” [6] identifies the future global and national challenges, from which the demands placed on human resources are derived, based on the fact of globalization of the world economy and deepening internationalization of the Czech economy. From this position, it also assesses the future of large and small enterprises, the role of research, new forms of work organization, technological development, in particular the impact of ICT, the need for the craft and manual skills. Special attention is paid to changes in education, training and the role of corporate education [7]. “Adult education is a process of purposeful and systematic acquisition and consolidation of knowledge, skills, values, attitudes and social forms of behavior and behavior of persons who have completed school education and training and entered the labour market. In adult education, distance learning and correspondence studies are generally applied [8,9].

This general definition brings us closer to the standard approach to adult education and at the same time shows the innovativeness of intergenerational communication and work in heterogeneous teams as a method of education. In order to bring this issue closer, it is useful to recall methods of employee education as a form of professional education. Nowadays, with the rapid development of manufacturing and communications technologies, most companies should focus on continuous training and employee development, and employees themselves should be interested in improving their skills. The vocational training of employees is to systematically shape, deepen and expand work ability (knowledge, skills and behaviour) to perform the work agreed [10]. Continuous vocational training of employees during their employment with the employer leads to deepening and broadening their qualifications, which enables them to achieve the required performance and at the same time increases their chances of finding employment in the labour market.

The term vocational training of employees can be understood as training processes related to various stages of the employee's life cycle in the organization. It is training - we understand mostly adaptation and orientation. It's about additional training - we understand deepening qualifications. This phase can be seen as the core of vocational training. It is retraining - we understand retraining. It is about development - we understand the extension of qualifications. Where to include intergenerational communication in heterogeneous teams? The answer is certainly that this method can intersect all stages of an employee's life cycle.

At the end of the reflection on adult education, it is necessary to recall the idea of teamwork, which results in positive synergy effects. The method of intergenerational communication in heterogeneous teams is primarily aimed at vocational training (e.g. digitalization of project documentation), but it is also a method of soft skills development. To give you a detailed overview of the issue, the National System of Occupations [11] identifies 15 forms of soft skills (effective communication, cooperation, creativity, flexibility, meeting customer needs, performance, independence, problem-solving, work planning and organization, lifelong learning, lifelong learning, active approach, copying, discovery and orientation in information, leadership, influencing others), which are key to the performance of managerial functions.

3. Principles and methodology of intergenerational competence sharing
Inter-generational Portfolio Management is a method of developing knowledge, experience and skills, involving older and younger groups of workers working together. As part of human resource management, it can be set up as a complement to formal staff evaluation procedures and included in the annual staff evaluation. It gives employees the opportunity to uncover new learning opportunities and identify themselves with the need for training and expand their personal development plans. It is a process of supporting workers in the assessment of official and unofficial qualifications that have occurred during their lifetime outside their careers. Inter-Generation Portfolio Management (IM) is a process for developing a portfolio of knowledge, skills and competence through a partnership
between more experienced and less experienced workers, often representing the relationship between younger and older workers. The IM project shows that in order to do the job well, the importance of personal skills and qualities must be seen in addition to professional competence. The IM project brings a new dimension and offers a unique tool to take advantage of the individual's strengths and weaknesses, along with life values, attitudes and experiences that influence and enable workers to view their work. It offers them the opportunity to discuss issues with their colleagues who may have different values and experience different experiences in a confidential environment. The IM project allows them to realize the facts that they believe are important in order to be able to do their job well and well. These may include a wide range of skills and experience, continuing education and the whole system and context of their workplace. As a result of discussions and gradual learning, workers build their personal portfolio and find out how important it is for them to realize their strengths. Therefore, it is not only their professional curriculum vitae, i.e. the history of the schools completed, training and professional experience. The personal portfolio allows them to describe themselves as a complete personality and includes all the information they think is important in order to enjoy and enjoy their work.

The pilot phase of the project (see Chapter 5) has shown that there are indeed important reasons for decision-makers to initiate processes that are part of the IM project. There are benefits to the organization as well as cost savings in terms of saving the working time of staff for further education. However, it is impossible to forget that the results of the IM project depend in many cases on the context of the workplace itself. In some cases, when work evaluation and feedback are not common, it may be the IM project that acts as a tool to initiate communication in the first phase. In other cases, where competence development is a common practice, the IM project really contributes to the development of a human resources development strategy. This means that the IM project is a flexible process that can be used in different situations and contexts. Therefore, it is important at the outset to clearly identify objectives for each specific workplace so that the added value to existing evaluation processes offers additional real opportunities for professional employee evaluation. At the same time, the organization is also encouraged to discuss ways of evaluating human resources and their competence development. Working on a personal portfolio is a very practical activity that stimulates a discussion of one's own knowledge, skills and attitudes, but also about one's own image and ideas of how others see me. Are we really interested in who we are and who we are? Or are we afraid of criticism or other consequences. It can be said that the IM project can help the organization in many ways, but it requires sufficient support from superiors who should realize the benefits of sharing personal information as a benefit to their personnel work. The greatest benefit of the IM project can, therefore, be its participation in creating and changing the culture of the organization towards a more open and shared social community [12, 13].

The cost of an IM project depends on the specific situation but can be low because the IM project can be seen as part of the human resources development of the organization. Sufficient time is the most important factor for the implementation of the IM project. Well, thought out project implementation processes can be a decisive factor in getting time for it. The minimum time required is the burden of three or four sessions of two to three hours over approximately half a calendar year for each employee. It is also necessary to count on two to three hours per month that employees spend discussing and innovating their personal portfolios. For supervisors, the IM project is a time-consuming task of establishing pairs of workers and establishing the right relationships and interactions. The more clearly the expectations of pair work are defined, the easier the IM project will be to more effective.

The IM project brings a new dimension and offers a unique tool to take advantage of the individual's strengths and weaknesses, along with life values, attitudes and experiences that influence and enable the employee to look at their work. It offers workers the opportunity to discuss in
a confidential environment problem with their co-workers, who may profess different values and have a different life experience. The IM project enables them to realize the facts they think are important to be able to do their job better and better. These may include a wide range of skills and experience, continuing education and the whole system and context of their workplace. An organizational change like IM application includes both content and process dimension. For example, IM can is usually used in the functional organizational structure, but it can be used also in the company which works in any other organisational structure. It needs, therefore, a completely different approach that we can apply in its connection with the functional organizational structure. We would also find differences at different levels of management. However, standard change management processes remain the same, and this is the basic similarity of all changes made across organizations, industry and organizations that I consider to be my core business.

The outcome of using an IM project depends very much on how we implement it in the daily practice and activities of the organization. Customer-oriented organizations seem more successful in using the IM project. Also, organizations that have ever gone through a transformation process can more easily implement an IM project. To achieve greater impact, the IM project needs to be linked to the organisation’s goals, including a positive approach to human resource management and existing ways of transmitting information within the organization.

4. Problems with the introduction of digitalisation in a construction company

Although a literature represents the identification of barriers to BIM acceptance within organizations, we lack the identification of interdependencies and the importance of interrelationship between identified barriers. So, try to deduce these relationships. It can help learners to consider the worst obstacles during the implementation process and adopt a strategy to overcome them. Among all major barriers, 4 human resistances to any change have been identified.

A significant problem is the preparedness of employees, their education and experience. We perceive that companies want to digitize and innovate, but they do not know how to do it, and where to start and what technologies to choose. But they will not move out further until they find people with the necessary knowledge or provide the appropriate training to their employees.

4.1. Staff Resistance and ICT Literacy

A study by Mitchell and Demian [14] on the implementation of CPEs building project extranets indicated that it is common to meet resistance to change by employees. There is also a strong resistance of employees to the introduction of new technologies and processes. This is particularly the case where employees believe that they have not received sufficient training and/or that this technology may threaten their employment [15]. Arayici et al [16] concludes that the construction industry has been slow to cope with this resistance to change. Aouad et al. [17] further cite the lack of BIM skilled workers in the field as a significant obstacle to the adoption of BIM.

4.2. Social Aspects

Barriers from the point of social relationships have been described by Szabo and Sidor [18] for systems like BIM. Together with their findings, we argue that the adoption of BIM systems can trigger changes in strategy. It is, therefore, necessary to focus on critical social aspects, such as organizational culture style and communication with the organization or the project team.

4.3. Scale of Culture Change Required

Introducing new processes into an organization involves shifting the culture of the organization that entails, risks and challenges that are not limited to financial considerations, but also include the flexibility or universality of the people and systems of the organization. These factors have an impact on the strategic decisions of management, which must continually reference and expand its business
plan, in continuous efforts to ensure business success [19]. This process involves assessing the strengths and weaknesses of the organization, including with respect to people, finance, systems and physical resources. Implementation of BIM requires dramatic changes in business practices. This requires a major change in the culture of the organization [20]. It is possible that, when assessing the culture and skills base of an organization, as in the SWOT analysis, top management feels that by implementing BIM they would simply align their weaknesses with threats in their external operating environment [21, 19]. This contributed to the relatively gradual adoption of BIM in construction [20].

4.4. Lack of Senior Management Support
Ruikar et al [22] proposes a number of reasons why top managers are reluctant to introduce new technologies and processes to their organizations. However, support for management in implementing new technologies and processes is essential if the benefits are to be realized. Arayici et al [13] suggest that a bottom-up approach with "learning by doing" is a more effective means of implementing BIM and tackling change resistance rather than a top-down approach. However, they suggest that a successful implementation involves not only people and processes, but also the software and hardware used. They recognize that a Knowledge Transfer Partnership (KTP) has been introduced to start the process. This shows a buy-in from top management.

Jung and Joo [23] further confirm this by demonstrating that a strategy and policy for specific levels of adoption is necessary to accelerate the practical implementation of BIM. Coates et al [24] propose key performance indicators (KPIs) that management can use to measure the success of the implementation. Without this, there is not enough vision of the success that implementation can bring and documentation of benefits from the perspective of the top manager.

It may also be difficult for executives with financial expertise to determine the monetary value of BIM implementation [25]. When considering a purchase that has clearly identifiable costs and benefits, it is common to perform ROI calculations [25].

5. Managing the process of sharing competencies in a construction company
The pilot phase of the project has shown that there are indeed important reasons for decision-makers to initiate processes that are part of the IM project. There are benefits to the organization, as well as cost savings in terms of working time savings for their employees. However, it should not be forgotten that the answers to these questions depend in many cases on the context of the workplace. In some cases, when work evaluation and feedback are not common, it may be the IM project that acts as a tool to initiate communication in the first phase. In other cases, where competence development is a common practice, the IM project really contributes to the development of a human resources development strategy. This means that the IM project is a flexible process that can be used in different situations and contexts. Therefore, it is important at the outset to clearly identify objectives for each specific workplace so that the added value to existing evaluation processes offers additional real opportunities for professional employee evaluation.

In terms of increasing efficiency, the IM project creates space for initiating communication between workers and between workers and their supervisors. At the same time, the organization is also encouraged to discuss ways of evaluating human resources and their competence development. Working on a personal portfolio is a very practical activity that stimulates discussion about one's own knowledge, skills and attitudes, but also about one's own image and ideas of how others see me. Are we really interested in who we are and who we are? Or are we afraid of criticism or other consequences. Here, the IM project faced the problem that workers would not want the organization to be familiar with their personal portfolio and all that was listed in the portfolio was considered confidential. In order for an IM project to succeed in an organization, there is a need for a human resource development plan. The value of the portfolio is yet another expression. At present, it is not
possible to work without knowledge of computers and computers play an increasing role in the work of all employees and their operation is part of their profession. Of course, this does not mean that the workers themselves must necessarily have all the skills to work with the computer. The transfer of personal data over the network is still a threat due to the possibility of its misuse. The pilot phase of the project has shown that there are indeed important reasons for decision-makers to initiate processes that are part of the IM project. There are benefits to the organization, as well as cost savings in terms of working time for their subordinates.

**Figure 1.** Process of sharing competences (Source: authors)
The use of intergenerational sharing is broad both in terms of industry and the goal to be achieved. In the case of competence sharing in the field of digitalization in the construction industry, the following approach presents in process diagram - Figure 1.

6. Conclusions
Successful implementation of the IM project is only possible under two circumstances, which are both employee development and organization development. The basic prerequisite for the success of IM is the focus of the organization on the workforce development strategy and the future development plan of the organization.

Working with a portfolio, possibly with a partially published personal portfolio, requires a confidential working environment in which the worker is invited to express his / her views, openly talk about his / her weaknesses, and where the project coordinators or managers have the will to help and assist in problems. To overcome concerns about the disclosure of a personal portfolio, an agreement must be made in advance on how the coordinator or mentor, manager or supervisor will work with the portfolio, measure its outcomes and discuss the results. A very concrete outcome is that a way can be found to improve the skills and competences of workers in a pleasant and acceptable way, while identifying the need for further training or desired changes in the way they work. If the portfolio is updated regularly, for example, several times a year, it can be used to develop a personal development plan. Based on portfolio information, it is possible to identify and realize educational needs and achieve personal goals. On the basis of discussions between the subordinate and supervisors or the coordinator of the project's accountant, good bases are created for its further professional growth and desirable changes in her work. The opening of the portfolio offers more concrete information and ideas on how to increase the competence of employees. This makes it easier for them to work on creating new plans for further improving the organization's activities, identifying priorities, and streamlining discussions with top managers about the organization's human resources development rules. The IM project is also an effective tool for streamlining teamwork. Individual portfolios can be compared with the team's portfolio. When focusing on organizational development, it is very important that there is a link between the portfolio and the development of a personal development plan. The need for vocational training and education should be addressed systematically, either in the form of on-site training or in a broader context, as a systemic step of the organization. The portfolio can also be tied to the competency model used in the organization, and thus, be a useful tool for identifying educational needs in a broader context across all of the organization's activities.

The IM project mainly requires enough time, personal attention and commitment. Introducing and deploying an IM project requires an experienced project manager who is tied to the work of the organization and who can keep the implementation process running and can stimulate and support colleagues. Finally, the IM project requires the support and commitment of a broader management of the organization such as management, head of the department and human resources staff. They are the ones who should present their interest in the project, be constantly informed about the progress of the project and who can work with the vision and challenges of the project so that in the long term they will receive a number of benefits and improvements for their organization.

“We do not live so long to learn only from our own experience.” Eleanor Roosevelt

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