KNOWLEDGE TRANSFER DIGITAL TRANSFORMATION

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Abstract

The paper presents new concepts, principles, and approaches, developed by the author, for creating more efficient knowledge transfer (KT) by digitally transforming it. It describes a new digitized knowledge structure combined with an innovative digital knowledge transfer process integrating:

- a new digital knowledge structure created as a multidimensional dynamically linked knowledge hyperspace
- a more efficient digitally transformed KT combining a new concept of “active” digital knowledge objects and Lean transformation of KT process management
- a new metadata system integrating both knowledge and transfer management components.

The new digitized KT process helps this task to be better managed and more efficient. It guides the self-directed (active) knowledge consumers throughout well designed knowledge structures (knowledge maps) following the shortest knowledge transfer path(s). As a result an individual acquires the required knowledge in less time. The major advantage of the digitized KT, built on the new concepts proposed in the paper, is that the individuals looking for new knowledge or updates will get the exact required results (= quality knowledge) with no waste of time (= improved efficiency of knowledge transfer).

The radically new concepts, principles, approaches and architectures proposed in the paper paved the way for a further development of Artificial Intelligence (AI)-based KT applications such as Personal Assistants for Learning (PALS).

Keywords: cognitive technologies, digital transformation of knowledge transfer, improved knowledge transfer, new knowledge structure, active knowledge objects concept.

1 INTRODUCTION

The global economy is in transition to a "Knowledge Economy" which is seen as the latest stage of development in global economic restructuring. The key component of a knowledge economy is a greater use of knowledge that can be treated as a business product and productive asset. Knowledge and knowledge technologies became major resources in business activities.

As the economy has grown more global and more knowledge-based, businesses shifted their competitive strategies, marketing techniques, and business models to Internet. The Internet economy is also called the "Digital Economy". Internet changed the way people do business. The main components of the digital economy are the global network infrastructure development and use of e-business/e-commerce by companies. The growth of the digital economy has widespread impact on the whole economy.

A Digital Single Market (DSM) is one in which the free movement of persons, services and capital is ensured and where the individuals and businesses can seamlessly access and exercise online activities under conditions of fair competition, and a high level of consumer and personal data protection, irrespective of their nationality or place of residence. The DSM maximizes the growth potential of the digital economy.

The European Commission (EC) has identified the completion of the DSM as one of its 10 political priorities [1]. The EC Digital Single Market strategy aims to open up digital opportunities for people and business and enhance Europe's position as a world leader in the digital economy. The Digital Transformation is the profound and accelerating transformation of business activities, processes, competencies and models to fully leverage the changes and opportunities of digital technologies and their impact across society in a strategic and prioritized way [2]. The digital transformation of business is a new phenomenon, and no company has yet reached the end state nor definitively defined it. But the contours are becoming clearer, as are the practices that move companies forward. Digitally
transformed organizations are committed to transformative strategies supported by collaborative cultures that are open to innovation. Leaders and employees at digitally maturing organizations have easy access to the resources they need to develop digital skills and know-how. The use of digital technology radically improves performance of enterprises.

According to the World Economic Forum (WEF) “Digital Transformation of Industries” report the media industry is in the vanguard of digital transformation [3]. Almost 20 years ago an influential essay entitled “Content is King” was published [4]. At a time when most people did not even have email accounts, it made some bold predictions, most notably that “content is where... much of the real money will be made on the Internet”. For the best part of two decades, its author, Bill Gates, has been proved spectacularly right.

But today the picture is even more complicated. The media industry has already been transformed by several waves of digitalization – file sharing, streaming, social and mobile – driven by the impatience of consumers to access any content from anywhere in the world at any time. Social media, video streaming services and smartphone apps compete continuously for consumers’ attention. With gigabytes of content being created every second, media companies are engaged in a battle for consumers' attention [3].

In this hypercompetitive market, having great content is no longer enough. Knowledge providers and media enterprises need to re-structure and integrate their content into high quality user experiences, with customized and more personalized content delivered on-demand.

Each digital technology-based knowledge transfer (KT) process cannot start without a major component – digitized content conveying knowledge. The digitized content is a necessary starting block for the Digital Transformation of knowledge transfer that is going to take place across the world in the coming years. But almost all today's digital content repositories (online libraries, bookshops, databases, etc) are still built around the book/textbook-like form in different digital formats. The content stored online continues to be in an unstructured form that vastly reduces the reusability of the huge knowledgebase created and published by humankind so far. In this book-like oriented environment the knowledge workers, instructional designers and other KT professionals are unable to find ready highly structured knowledge-building elements and use them as “bricks” to easily construct and transfer new knowledge.

Another disappointing feature of today's knowledge transfer technologies and tools is that they continue to split up the digital content conveying knowledge from the knowledge transfer process management and thus reduce the advantages of using digital technology. Even transferred online the KT process management continues to follow the old classroom-based learning/teaching model. It still tries to simulate the traditional instructor-led learning process. A skilful integration of both content and KT management elements into the same digital information workflow may vastly increase the overall process efficiency and the quality of the final results (knowledge acquired by the consumers).

There is an obvious need for significantly improved knowledge transfer concepts, approaches and technologies that can meet the ever-rising demands of the Knowledge society. For organizations adopting new ways of more efficient knowledge transfer mean to see time and costs reduced, their staff (workforce) more skilled and productive, and their results soar.

2 “ACTIVE” CONTENT CONCEPT

Integrated digital and Lean transformation of knowledge transfer

The “active” content concept is based on a new digital knowledge structure, instructional design and KT process management approaches based on innovative principles making knowledge transfer more efficient by:

- shifting from the “passive” content (book-like) paradigm to a new “active” digital content structure and information flow conveying knowledge
- integrating KT metrics, analytics and management elements into the digital content thus improving the efficiency of the whole KT process and its outcomes.

In order to be able to make the KT process more efficient, knowledge providers (authors, subject matter experts, etc knowledge delivery professionals), instructional designer teams and system developers have to “unite” and shift from the old textbook-like paradigm to a new digital content
structure conveying the required knowledge by integrating process management elements into the
digital content information flow thus improving the outcomes and efficiency of the KT process.

There are already many examples of such integration in production and company management based
on Lean principles aiming at improving production workflow in industry [5]. The core idea of Lean is to
maximize customer value while minimizing waste. Simply, Lean means creating more value for
customers with lesser resources. To be successfully accomplished this goal the approach to planning
and execution is broken down into elementary steps in three business “dimensions”: strategy,
performance metrics and architecture.

Nowadays the leaders in a wide range of industries, non-profit organizations, government agencies,
healthcare, and other areas are finding ways to apply the principles of Lean as a means of producing
goods and delivering services that provide value for the customer with the minimum amount of waste
and the maximum degree of quality. They use Lean principles, practices, and tools to create precise
customer value - goods and services with higher quality and fewer defects - with less human effort,
less space, less capital, and less time than the traditional system of mass production. The recent
studies show the application of Lean thinking has made a significant impact in many industrial circles
over the last decades. Fostered by a rapid spread into other industry sectors beyond the initial
applications in automotive industry, there has been a significant development and “localisation” of the
Lean concept. “Borrowing” from Lean the core principles and techniques developed in industry and
applying them to knowledge management and learning in the workplace, the KT professionals can
refine the training content, pedagogy, organization, management and assessment methods employed
in their courses to help the self-managed learners (employees) gain the exact knowledge and skills
that will make them most desirable to employers. This way, in an integrated Lean KT and
manufacturing environment, process improvement and the skill level of the workforce would lead the
organization toward an optimal point of performance efficiency.

The five basic Lean principles defined by Womack, Jones and Roos in [5] can be applied successfully
to the knowledge transfer process, the core and the main goal of each learning delivery process, as
follows:

1. Define value (from the customer's point of view) = define the KT need(s) clearly and the exact
   knowledge that should be acquired at the end of the transfer process
2. Map the value stream = design knowledge maps and chart the shortest KT path(s) on them
3. Make the activities flow = design information flow that convey the required knowledge and set
   up an 24/7 online delivery environment and access channel(s)
4. Respond to customer demand = let the customers (learners) login and start self-managed KT by
   “pulling” the content/knowledge from the virtual environment at their own pace
5. Seek perfection by continuous improvement = use the collected feedback information to
   constantly improve the KT process and its outcomes.

The Lean principles applied skillfully to KT can improve its quality and efficiency. Those are in the core
of the innovative methodology described further below.

3 METHODOLOGY

The proposed integrated digital and Lean transformed KT instructional design methodology relies on
the following innovative concepts and approaches:

- design of digital content by small chunks/fragments (knowledge objects) that convey the
  required knowledge
- integration of process control components into the knowledge objects and this way building
  “active” knowledge objects for managing the complete KT process in real time
- using advanced metadata systems/descriptors for both knowledge and “active” knowledge
  objects
- mapping the “active” knowledge objects (creating multidimensional knowledge maps) and pre-
  defining shortest learning path(s) on the knowledge map(s)
- designing and integrating multitude of KT quality control “check points” into the content structure
- linking all “active” knowledge objects into units and modules thus designing “active” KT content
• tracking the users' learners' behaviour, performance, progress and results using an innovative business intelligence-based KT metrics and analytics system
• presenting each learner's progress and results in visual form as interactive knowledge maps helping the self-guided learners (and involved online tutors if needed) to easily get and analyse the "big" picture/data of the completed KT process including the current progress, failures, achieved results, process history and statistics based on advanced KT analytics.

3.1 Creating and designing “active” content
The process of creating and designing "active” KT content passes several phases.

3.1.1 Authoring phase
A knowledge base is created and published by authors or teams of co-authors (copyright owners) in form of small portions/fragments of information – knowledge objects (KOs). Any KO could include text, still images and/or dynamic multimedia objects (video, animation, sound, etc.). Each of created KOs conveys a “piece” of knowledge in any knowledge/subject matter area. The authors use pre-designed templates and menus for linking semantically and taxonomically all created KOs, thus creating a dynamically linked ever-growing knowledge hyperspace. All created KOs are published and stored in "standard" web file formats in digital knowledge repository (DKR).

3.1.2 Instructional design phase
1st step
Based on any pre-detected KT need(s) a team of instructional designers (ID) defines the required KT and develops knowledge maps by linking selected KOs and defines/charts the shortest KT/learning paths on those maps. The ID team retrieves all needed KOs from the digital knowledge repository where those are stored. If needed, they may create new KOs complementing the existing ones.

2nd step
The ID team continues its work creating “active” knowledge objects (AKOs) using the selected KOs by adding to them additional KT process management and control data. Any “active” KO is created by one selected KO by adding to it the corresponding KT metrics and corresponding to it knowledge management data. All created AKOs are stored also into the DKR.

3rd step
The ID team creates multitude of “check points” (tests, quizzes, etc KT assessment techniques) and integrates those into the branches/paths on the knowledge maps.

4th step
The ID team develops content sections, modules and complete courses just linking all created AKOs using the pre-designed knowledge maps and learning paths by following a developed KT scenario/storyboard best suited for the selected subject matter area and target group of users. Each AKO has a pre-defined position on the knowledge map and in the learning path as it is linked to the corresponding KO.

Following this approach/methodology “active” content can be developed for any selected/needed knowledge area.

3.1.3 Knowledge delivering/transfer phase
1st step
All developed “active” content courses are published online on a KT platform/system. The KT system communicates with several online databases storing complete data on users’ behavior and interaction with the content, including feedback data from the integrated KT metrics. To complete those tasks the system includes a learner’s behavior tracking module and a KT measurement module.

2nd step
A registered/authorized user logs into the system and selects a course from a list/library. He/she starts reading the course just by using any web browser.
3d step
The system constantly tracks and monitors the user behavior and his/her outcomes and stores all collected data in several especially designed learner record stores (LRS). Those data are used in the next phase for process analyzing and correcting purposes.

3.1.4 Analysis phase
The process of analysis uses data generated on the KT transfer phase which should be retrieved from the corresponding LRS. To make the analysis process easier the data are presented in visual form (as knowledge maps and related statistics). This way a constant feedback is generated by the system for keeping the whole process under control and guiding the user, thus improving the KT efficiency.

The analysis of the KT outcomes/results has two main purposes:

- The first one is to help the learner to improve his/her own outcomes along the learning path (personalisation). In case everything is OK, the learner will just go ahead following the pre-defined learning path and probably will not need any feedback data or outside help for improvement of his/her own outcomes. But if the learners' results start decline (measured by the integrated learning metrics) or he/she failed some tests, he/she can “review” the learning history on the knowledge map and get the exact picture what went wrong, where, when and why. The acquired knowledge is also represented as maps what makes the analysis process easily understandable. The learner has two options from here – to manage the problem by him/herself by getting hints from the system how to “fill in” the existing knowledge gaps or to ask for an outside help offered by an online tutor (authorized to monitor his/her results). This approach helps the problem to be solved immediately when and where it appeared using the branched learning scenario pre-designed by the ID team. This way the learner will keep the right learning path without any delays caused by cumulative failures.

- The second one is for improvement of the learning content based on complete collected data statistics and this is a collaborative task for online tutors, the ID team and the authors. As a result of a collaborative re-authoring process, an updated and improved KT content may be published online replacing the initial version.

4 UNIQUE FEATURES AND ADVANTAGES
The innovative characteristics of the digitized “active” content are as follows:

- The “raw” knowledge resides (is published) in a digital knowledge repository in highly granulated form of digital knowledge objects making them highly reusable and easily retrieved from the digital repository. The repository is built as a multidimensional dynamically linked digital knowledge hyperspace based on new ideas, architecture and concepts. Each “dimension” represents a specific knowledge area.

- New metadata systems are used for describing and dynamically hyper linking all knowledge objects semantically (by meaning) and taxonomically (by classification)

- The “active” KT content consists of “active” knowledge objects which are built by integrating KOs, the corresponding learning metrics, tracking elements and process management parameters/data

- KT metrics, process management and tracking elements (time, learner’s results and behaviour) are integrated into all LOs using a specially designed metadata system

- The required KT content is easily created by selecting and linking the needed “active” knowledge objects thus forming the “active” content just following the well-known Lego® building principle. This approach allows the learning content to be easily personalized by multiply branching and graded by complexity level, e.g. for beginners, mid-level, advanced users and experts

- The designed in such way KT content combines knowledge with integrated metrics, analytics, and management functions and can be defined as “active” in contrast to the traditional “passive” content that just presents the knowledge
The constant feedback data generated and collected at each step and phase of the KT process is used by the system to increase the efficiency of the whole process and the quality of the final outcomes.

The digitally transformed KT process offers 24/7 online access and the users (knowledge consumers) can “pull” the required knowledge on-demand at their own pace.

This new approach of delivering knowledge is targeted to help knowledge providers and instructional design teams to create more efficient ways of delivering self-directed “knowledge on-demand”. It enables the teams of skillful instructional designers produce “active” content-based self-directed personalised modules and courses by integrating knowledge and management of the process into the digitally transformed KT content. The “active” content helps the self-directed knowledge consumers (learners) to follow the shortest pre-designed learning path(s) on the knowledge maps acquiring the required knowledge thus enhancing efficiency and quality of the whole KT process. The major advantage of the proposed innovative concept and methodology is that the well performed self-guided learners get the exact required outcomes (= knowledge) with no waste of time (= improved efficiency).

The “active” content concept described above was developed by the author [6], [7], [8], [9], [10], [11].

5 APPLICATION AREAS

The new concepts and approaches of KTDT described above can be used for creating a Global Knowledge Platform (GKP) offering services as a unified digital knowledge marketplace. This marketplace, and the developments offered by the KTDT approaches and practices, will allow to be developed and implemented new digital knowledge publishing business models for a more efficient knowledge transfer that will be used for supporting the digital transformation initiatives in various organisations in Europe and worldwide.

According to a recent IDC study [12], by 2019, 40 percent of all digital transformation initiatives will be supported by cognitive/AI capabilities. AI-based automation will ultimately aid productivity and digital efforts of all kind of organisations. Increased automation in knowledge transfer will help the most creative people in organisations to be more productive. The cognitive technologies and AI supported digitized knowledge transfer will not only improve the customer experience, but also change the way organizations operate knowledge.

Using the principles under laying the Global Knowledge Platform new cognitive technologies and tools could be developed and implemented, such as:

- AI-based software agents – personal assistants for learning/KT
- AI-based software robo-advisers to help (knowledge) workers manage/complete their tasks/jobs improving business performance
- Integrating machine learning (AI-based) for greater (including predictive) analytics.

Functional modules of GKP could be easily integrated into the new generation of Enterprise Resource Planning (ERP) software system – the fast emerging Enterprise Resource Platforms (erPL) - boosting knowledge transfer and management in all kind of enterprises.

6 CONCLUSIONS

Technology now touches and transforms every aspect of personal productivity including in the workplace. For managers effectively collaborating with technology is as important as effectively collaborating with people. Using digital media, mobile devices and transforming information flow conveying knowledge from analog to digital gives them unprecedented opportunity for managing efficiently KT and operations in organisations.

Digital transformation of KT makes it more open, personalised, efficient, collaborative, creative, and closer to the society.

A project proposal based on the new ideas, concepts and approaches described above was submitted to the last call of EC H2020 Work programme 2016-2017 FET-Open [13].
REFERENCES


