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EVOLUTION OF THE GENERALIZED BODY OF KNOWLEDGE ON PROJECT MANAGEMENT

An analysis of the literature on the creation and application of hybrid project management methodologies on the basis of fully plan-driven and Agile methodologies is made. It is shown that every year the volume of application of methodologies, which combines the advantages of fully plan-driven and Agile approaches is growing. To create a special methodology for a particular project, a generalized body of knowledge on project management can be used. The task is to complement the generalized body of knowledge on project management components of popular Agile methodologies DSDM and FDD. Currently, the generalized body of knowledge includes the components of PMBOK Guide, the ISO21500 standard, the PRINCE2 methodology, the SWEBOK Guide, agile methodologies Scrum, XP, and Kanban. The structure of the generalized body of knowledge on project management is given. DSDM principles and FDD values are added to it. The DSDM principles fall into three groups: values and principles relating to the interaction of team members, values and principles relating to the product of the project, and values and principles relating to the project team working technology. The values of FDD are only in the last group. The life cycles, roles, and responsibilities of these methodologies are described. The concept of a process for DSDM is proposed. The process in DSDM is actually the project life cycle. Other processes in DSDM are not provided. DSDM uses the concept of Products. The analysis showed that for this framework, the concepts of processes can be introduced. The creation of each DSDM product requires an appropriate process. As a result of the DSDM analysis, a set of processes was proposed. The proposed DSDM processes and FDD operations are inserted into the knowledge areas and process groups table of the generalized body of knowledge on project management. The DSDM and FDD practices have been added to the knowledge base.

Keywords: fully plan-driven methodologies, Agile methodologies, the generalized body of knowledge, DSDM, FDD, principles, life cycles, roles and responsibilities, processes, practices.

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РОЗВИТОК УЗАГАЛЬНЕНОГО ЗВОДУ ЗНАТЬ З УПРАВЛІННЯ ПРОЕКТАМИ

Зроблено аналіз літератури з питань створення та застосування гібридних методологій управління проектами на основі планових і Agile методологій. Поставлено завдання доповнення узагальненого зводу знань з управління проектами компонентами популярних Agile методологій DSDM і FDD. Наведено структуру узагальненого зводу знань з управління проектами. У нього додані принципи DSDM і цінності FDD, життєві цикли, ролі і відповідальності цих методологій. Принципи DSDM потрапили в три групи: цінності та принципи, що стосуються взаємодії членів команди, цінності і принципи, які стосуються продукту проекту, цінності і принципи, що стосуються технології роботи команди проекту. Цінності FDD потрапили тільки в останню групу. Процеси DSDM і операції FDD вставлені в таблицю областей знань і груп процесів узагальненого зводу знань з управління проектами. У звід знань додані практики DSDM і FDD.

Ключові слова: планові методології, Agile методології, узагальнений звід знань, DSDM, FDD, принципи, життєві цикли, ролі і відповідальності, процеси, практики.

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РАЗВИТИЕ ОБОБЩЕННОГО СВОДА ЗНАНИЙ ПО УПРАВЛЕНИЮ ПРОЕКТАМИ

Сделан анализ литературы по вопросам создания и применения гибридных методологий управления проектами на основе плановых и Agile методологий. Поставлена задача дополнения обобщенного свода знаний по управлению проектами компонентами популярных Agile методологий DSDM и FDD. Приведена структура обобщенного свода знаний по управлению проектами. В него добавлены принципы DSDM и ценности FDD, жизненные циклы, роли и ответственности этих методологий. Принципы DSDM попали в три группы: ценности и принципы, касающиеся взаимодействия членов команды, ценности и принципы, относящиеся к продукту проекта, ценности и принципы, касающиеся технологии работы команды проекта. Ценности FDD попали только в последнюю группу. Процессы DSDM и операции FDD вставлены в таблицу областей знаний и групп процессов обобщенного свода знаний по управлению проектами. В свод знаний добавлены практики DSDM и FDD.

Ключевые слова: плановые методологии, Agile методологии, обобщенный свод знаний, DSDM, FDD, принципы, жизненные циклы, роли и ответственности, процессы, практики.

Introduction. The more popular Agile project management methods become the more attention from the various organization in IT and other industries they attract. There are a lot of companies that have already realized values and benefits of agile approaches' implementation. But there are also some significant concerns about agile methods' effectiveness in large, critical, complex, multi-teams projects. That's why the amount of the organizations implementing a hybrid project management approach (mix of traditional and agile project management methods) is inevitably growing.

In many cases, the applying of the one particular approach to project management is not already enough. Different researchers and research teams are trying to

combine various project management guides, standards, and methodologies in order to neutralize limitations of these approaches while maximizing the value gaining from all their strengths and advantages for increasing the probability of project's success.

Literature analysis and statement of the research problem. In the work [1] the AXELOS company presents the PRINCE2 Agile approach to project management. It describes how to configure PRINCE2 so that it can be used in the most effective way in combination with agile behaviors, concepts, frameworks, and techniques. It also emphasizes that both PRINCE2 and Agile methods have their own strengths and weaknesses. Authors explained

that whereas PRINCE2 provides comprehensive guidelines in the areas of project direction and project management it does not provide much focus on the field of product delivery. Conversely, Agile predominantly focuses on product delivery but relatively little on project direction and project management. It is considered in the work that these approaches can complement each other and when they are properly combined, the areas of project direction, project management, and project delivery are all addressed. For PRINCE2 Agile method's creation, the authors used the concepts of Scrum, Kanban and Lean Startup due to the high popularity of these Agile methodologies [1].

Works [2] and [3] are focused on combining the PRINCE2 and XP methodologies into one project management approach – XPrince and eXPeReINCE respectively. The authors of XPrince (eXtreme PRogramming IN Controlled Environments) believe that most of the present-day projects require a balance between agility and discipline and that it can be obtained by integrating different methodologies and supporting them with appropriate tools. In case of XPrince, such methodologies are XP, PRINCE2 and RUP [2].

The authors of [3] also consider that agile and discipline methods can be complementary: while agility contributes to creativeness and improves customer relationship, the discipline keeps the project on track and within budget, time, and quality constraints. Thereby, they decided to integrate XP and PRINCE2 methodologies (into a new method that called eXPeReINCE) and showed how they can enhance each other in software development projects.

In papers [4] and [5] the ways of combining an agile methodology DSDM (Dynamic Systems Development Method) with PRINCE2 and Scrum methods respectively are described and benefits of such combinations are highlighted. It is emphasized in [4] that integrating of DSDM and PRINCE2 together enables a PRINCE2 project to be executed in a more agile way without the need to make any fundamental changes to PRINCE2. It may be desirable when a project may meet with a lot of (or late) change. The work proposes the list of the DSDM additions to PRINCE2 as well as PRINCE2 and DSDM combined organizational structure.

It is shown in [5] that DSDM Agile Project Framework may complement Scrum and help to overcome challenges of scaling and governance for Scrum projects. The philosophy, principles, life cycle, roles and artifacts of the mixed approach are also described.

Works [6] and [7] address the issues of mutual using of Agile project management and the PMBOK® Guide. The author of [6] shows how project life cycle and processes of the PMBOK® Guide correlate to those in an agile project. And the author of [7] also suggests that the PMBOK's process groups (initiating, planning, executing, monitoring and controlling, and closing) can be used in an agile approach, but notes that there are several different terms, techniques, and outputs.

The authors of the research [8] propose a model and method for synthesis of project management methodology for a specific project. It is supposed that the best

methodology can be synthesized by creating some alternative combinations of the "full" methodology's processes and selecting the most appropriate one for a particular project in terms of the cost of the project's management, the laboriousness of the project's management and risks associated with the use of this combination. The "full" methodology is proposed to create based on the PMBOK guide, supplementing it with the processes of most popular Agile and plan-driven methodologies. It allows synthesizing a hybrid project management methodology using processes of Agile methods as well as processes of plan-driven project management approaches.

The given analysis enables us to conclude that the problem of creating the most beneficial for particular projects or organizations hybrid approaches to project management is extremely relevant. Currently, the basis for such creation in form of a Generalized body of knowledge on project management is proposed in works [9, 10]. Due to an increasing popularity of Agile methods, it is important now to extend an existing Generalized body of knowledge on project management by components of the most demanded Agile methodologies which are not yet included in its composition.

Objectives. The aim of the work lies in revisiting of a scope and structure of the Generalized body of knowledge on project management [9, 10] with a view to supplement it by components of such popular Agile project management methodologies as DSDM (Dynamic Systems Development Method) and FDD (Feature Driven Development).

An Extended Generalized body of knowledge on project management. According to [11], the DSDM and FDD methods are among the most widespread Agile project management methodologies along with XP which has been already included in the Generalized body of knowledge on project management.

To include DSDM and FDD methodologies to the Generalized body of knowledge on project management, it is necessary to make some changes in its structure. These changes are caused by the fact that for both these methodologies the adherence to some practices is vital. However, such a component of project management methodologies as "practices" is not identified in the structure. Modified structure of the Generalized body of knowledge on project management is presented in fig.1. Approaches that it covers are shown in fig.2.

Values and principles of project management. DSDM is based on the following philosophy: "best business value emerges when projects are aligned to clear business goals, deliver frequently and involve the collaboration of motivated and empowered people" [12]. Principles of DSDM include

1. Focus on the business need;
2. Deliver on time;
3. Collaborate;
4. Never compromise quality;
5. Build incrementally from firm foundations;

- 6. Develop iteratively;
 - 7. Communicate continuously and clearly;
 - 8. Demonstrate control.
- FDD is a feature-oriented development approach with following core values [13]:
- 1. A system for building systems is necessary in order to scale to larger projects.
 - 2. A simple, well-defined process works best.

- 3. Process steps should be logical and their worth immediately obvious to each team member.
- 4. 'Process pride' can keep the real work from happening.
- 5. Good processes move to the background so the team members can focus on results.
- 6. Short, iterative, feature-driven life cycles are best.

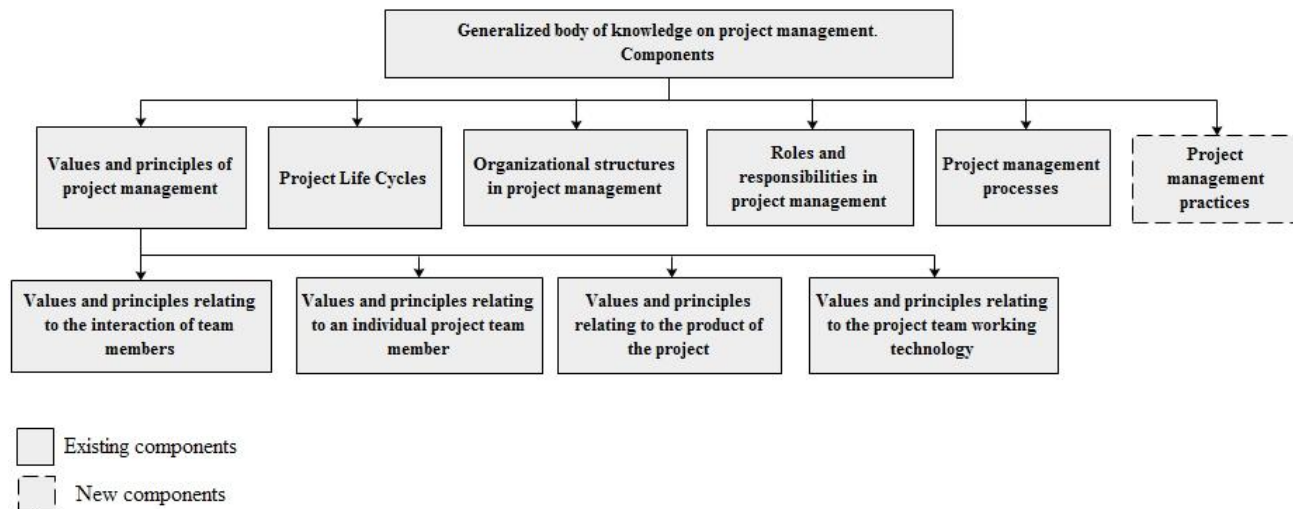


Fig. 1 – The structure of the Generalized body of knowledge on project management

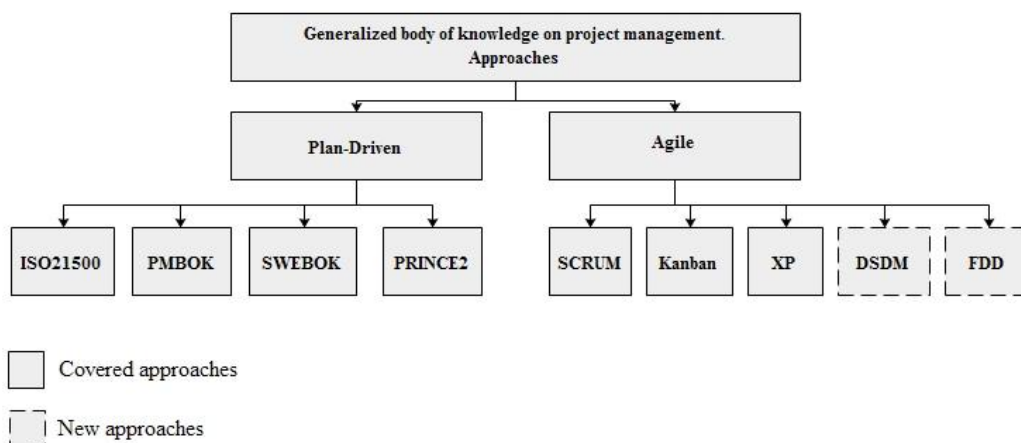


Fig. 2 – Approaches included to the Generalized body of knowledge on project management

The distribution of these values and principles according to their respective categories of values and principles of the Generalized body of knowledge on project management is shown in tables 1-3. The DSDM principles have entered into three of the four categories of values and principles. The principles relating to an individual member of the project team are not explicitly stated there. As for FDD values, they all refer to the team working technology.

Table 1 – Values and principles relating to the interaction of team members

Title	Value	Principle	Source
Collaborate	-	√	DSDM
Communicate continuously and clearly	-	√	DSDM

Table 2 – Values and principles relating to the product of the project

Title	Value	Principle	Source
Focus on the business need	-	√	DSDM

Project Life Cycles. The life cycle of a project is a set of phases through which the project passes from initiation to closure.

The DSDM project life cycle is called the process model. It consists of four main phases: Feasibility, Foundations, Evolutionary Development and Deployment. The main phases are preceded by the preliminary phase (Pre-Project) and followed by the Post-Project phase. A total of six phases of the project are considered. The life cycle of a project in DSDM is adaptive or Agile [12].

The FDD life cycle is also Agile and also has got a

name "the process model". It consists of five sequential phases (processes) during system design and development of solution: Develop an overall model, Build a feature list, Plan by feature, Design by feature and Build by feature [13].

Roles and responsibilities. DSDM has 13 roles, which are divided into five groups.

The first group includes roles reflecting business interests, i.e. interests of the customer. Representatives of the customer are usually appointed for these roles. The first role is Business Sponsor. The Business Sponsor has a special responsibility for the business project and the project budget, ensures the availability of funds and other resources, as appropriate, effective decision-making, rapid response to emerging issues, empowering business roles within the project. The second role is Business Visionary it provides a high-level project management and determines the vision of the future. The third one is Business Ambassador performing daily project management on behalf of the customer. The fourth role is Business Advisor. The Business Advisor acts as an expert on the business theme, provides specific and often specialized materials for product development or testing. This role relates to supporting roles.

Table 3 – Values and principles relating to the project team working technology

Title	Value	Principle	Source
Deliver on time	-	√	DSDM
Never compromise quality	-	√	DSDM
Build incrementally from firm foundations	-	√	DSDM
Develop iteratively	-	√	DSDM
Demonstrate control	-	√	DSDM
A system for building systems is necessary in order to scale to larger projects	√	-	FDD
A simple, well-defined process works best	√	-	FDD
Process steps should be logical and their worth immediately obvious to each team member	√	-	FDD
'Process pride' can keep the real work from happening	√	-	FDD
Good processes move to the background so the team members can focus on results	√	-	FDD
Short, iterative, feature-driven life cycles are best	√	-	FDD

The second group includes roles reflecting the technical point of view. They are responsible for creating the product. The group includes Technical Coordinator (which provides technical leadership and guidance), Solution Developers (persons who create the product), Solution Tester (a person or persons who create test plans, test products, perform product testing, inform Team

Leader about the results of testing, assist to the Business Ambassador and Business Advisor in planning and conducting tests in a qualitative and complete manner).

Moreover, there is a supporting role in the group – Technical Advisor. The Technical Advisor supports the development team by providing detailed and often specialized technical materials and recommendations regarding requirements, design, product development, and training of technical specialists.

The third group focuses on individuals that provide project management. This group includes Project Manager, who is responsible for leadership in the project, ensuring efficient and timely communications, performing high-level project planning, monitoring progress against the basic delivery plan, managing risks, motivating and ensuring team authority, solving problems encountered by Solution Development Team. The group also includes Team Leader, which directs the project in accordance with DSDM's life cycle (process).

The fourth group is formed by the roles that contribute to the successful use of DSDM. It includes Workshop Facilitator, the seminar leader, who plans the seminar, prepares participants for it, facilitates the seminar to achieve its goals, reviews the results, and distributes them to stakeholders. The second role in this group is DSDM Coach, which provides detailed knowledge and experience on using DSDM and helps the team to use DSDM methods.

The fifth group consists of roles that simultaneously cover different areas of interest. So the Business Analyst has both a business and technical focus. It helps to establish the relationship between the customer and technical roles. The Business Analyst ensures that business needs are properly analyzed and correctly reflected in the manual, according to which the team must create a solution.

According to [13–16], FDD classifies its roles into three categories: key roles, supporting roles, and additional roles.

The six key roles in an FDD project are [13-16]: Project Manager (an administrative head of the project), Chief Architect (a person who is responsible for the overall design of the system and has excellent technical, modeling and facilitation skills), Development Manager (a person that is responsible for leading the day-to-day development activities and acts as a coordinator of the team), Chief Programmer (an experienced developer who is very familiar with the development life cycle and is responsible for identifying different classes and the Class Owners as well as leading teams of developers through low level analysis, design and development of the new software's features), Class Owner (a developer who is responsible for formation of feature teams and building the assigned class(es)), and Domain Experts (may be users, business owners, business analyst, and clients).

The five supporting roles comprise Release Manager (ensures that the Chief Programmers report progress each week), Language Guru (a person who is responsible for knowing a programming language or a specific technology inside out), Build Engineer (a person who is responsible for setting up, maintaining, and running the

regular build process), Tool Smith (a person who creates utilities for the development team, test team, and data conversion team), and System Administrator (a person who configures, manages, and troubleshoots any servers and network of workstations specific to the project team) [13–16].

The three additional roles in a FDD project are: Testers (are responsible for verifying that the system's

functions meet the users' requirements and that the system performs those functions correctly), Deployers (convert existing data to the new formats required by the new system and work on the physical deployment of new releases of the system) and Technical Writers (write user documentation [13–16].

All roles and responsibilities described in DSDM and FDD are shown in table 4.

Table 4 – Roles and responsibilities in the Generalized body of knowledge on project management

Methodology	Roles	Responsibilities
DSDM	Business Sponsor	Has a special responsibility for the business project and its budget throughout the project
	Business Visionary	Defines the vision of the future
	Business Ambassador	Daily project management on behalf of the customer
	Business Advisor	Expert on the business theme
	Technical Coordinator	Technical guidance
	Solution Developers	Development of the project's product
	Solution Tester	Product testing
	Technical Advisor	Gives advice on technical issues
	Project Manager	High-level planning, monitoring progress, problem solving
	Team Leader	Direction of the project in accordance with the DSDM
	Workshop Facilitator	Facilitating of project's workshops
	DSDM Coach	Team training and assistance in using DSDM
	Business Analyst	Establishing the relationship between the customer and technical roles
FDD	Project Manager	Looking after administration and financial aspects of the project
	Chief Architect	Design of the system
	Development Manager	Daily developmental monitoring, identifying risks; resolving issues; planning releases and resources
	Class Owner	Formation of feature teams and building the assigned class(es)
	Chief Programmer	Identifying different classes and the Class Owners; leading feature teams
	Domain Experts	Domain knowledge representation and understanding system behavior
	Release Manager	Managing the development process
	Language Guru	Providing knowledge on the development technology
	Build Engineer	Executing a Build Process
	Tool Smith	Creating utilities for project
	System Administrator	Administration of a system
	Tester	System testing and verifying
Deployer	Deployment of features	

Project management processes. By the 'process' in DSDM is actually implied the life cycle of the project. There are not provided any others processes in DSDM. DSDM uses the concept of Products. It includes three types of products:

- Results delivered to the customer,
- Technical solutions needed to create a result,
- Management products.

The analysis has shown that for this framework, the concepts of processes can be introduced. The creation of each DSDM product requires an appropriate process. These processes, in turn, can be represented in the table of knowledge areas and process groups [10]. As a result of the DSDM analysis, we came to a set of processes, which is shown in table 5.

In FDD five stages of the project's lifecycle are called 'processes':

1. Process 1: Develop an overall model;
2. Process 2: Build a feature list;
3. Process 3: Plan by feature;
4. Process 4: Design by feature;
5. Process 5: Build by feature.

However, in each of these processes, a set of tasks and a verification activity are considered [17]. For example, the second process 'Build a feature list' requires the sequential execution of tasks 'Form the Features List Team' and 'Build Features List' and as a verification activity of the process' performance, 'Internal and External Assessment' is used.

In order to reflect the FDD processes in the table of

knowledge areas and process groups [10] at a sufficient level of detail, we will consider also tasks and activities described for each process [15, 17] (Table 6). In tables 6-7 are shown only that knowledge areas of project management which are directly addressed by processes of considered methodologies.

mentioned, practices are considerable elements of DSDM and FDD methodologies. That's why they are not optional and they could not be somehow replaced or ignored when describing DSDM and FDD methods. The reflection of practices using in DSDM and FDD projects in the Generalized body of knowledge on project management is shown in table 7.

Project management practices. As already

Table 5 – Displaying DSDM processes in the process table

Knowledge Areas	Process Groups							
	Initiation	Planning	Executing	Monitoring and Controlling				Closing
				Reporting and Forecasting	Controlling	Analysis	Decision making	
Project Integration Management	8.2.1 Producing the Terms of Reference	8.2.2 Producing the Business Case 8.2.7 Producing the Management Approach Definition	8.2.10 Creating the Evolving Solution		8.2.14 Benefits Assessment	8.2.2 Review of the Business-case		
	8.2.2 Producing the Baselines of the Business Case					8.2.12 Timebox Review Record		
	8.2.8 Feasibility Assessment	8.2.13 Project Review Report						
Project Scope Management		8.2.3 Producing of the Prioritised Requirement List	8.2.3 Revisiting the Prioritised Requirements List					
		8.2.4 Producing the Solution Architecture Definition						
		8.2.5 Producing the Development Approach Definition						
		8.2.9 Producing the Foundation Summary						
Project Time Management		8.2.6 Producing the delivery plan						
		8.2.11 Creating the Timebox Plan						

Table 6 – Displaying FDD processes in the process table

Knowledge Areas	Process Groups							
	Initiation	Planning	Executing	Monitoring and Controlling				Closing
				Reporting and Forecasting	Controlling	Analysis	Decision making	
1	2	3	4	5	6	7	8	9
Project Integration Management			Develop the Overall Object Model (Stage 1)	Internal and External Assessment (Stage 1)				
			Refine the Overall Object Model (Stages 1, 4)					
			Write Model Notes (Stage 1)					

The end of the Table 6

1	2	3	4	5	6	7	8	9	
Project Scope Management		Domain Walk-through (Stages 1, 4)	Study the Referenced Documents (Stage 4)	Internal and External Assessment (Stage 2)					
		Study Documents (Stage 1)		Develop the Sequence Diagram(s) (Stage 4)	Design Inspection (Stage 4)				
		Develop Small Group Models (Stage 1)	Write Class and Method Prologues (Stage 4)		Code Inspection and Unit Test (Stage 5)				
					Build Features List (Stage 2)	Implement Classes and Methods (Stage 5)	Promote to the Build (Stage 5)		
		Project Time Management		Determine the Development Sequence (Stage 3)		Self Assessment (Stage 3)			
Assign Business Activities to Chief Programmers (Stage 3)									
Assign Classes to Developers (Stage 3)									
Project Human Resource Management	Select Domain Experts, Chief Programmers, and the Chief Architect for the project (Entry Criteria for Stage 1)	Form the Features List Team (Stage 2)	Form Feature Team (Stage 4)						
		Form the Planning Team (Stage 3)							
	Form the Modelling Team (Stage 1)								

Table 7 – Project management practices in the Generalized body of knowledge on project management

Methodology	Practice	Main issues addressed
DSDM	The Facilitated Workshop	Project decision-making, stakeholders engagement, risks, communication
	MoSCoW prioritization	Business Vision, Business Expectations management, project scope
	Iterative development	Product development, testing, product quality
	Modelling	The scope and the boundaries of the solution
	Timeboxing	Product development, project changes, risks, communication
FDD	Domain Object Modeling	Project scope: studying and modeling of a problem domain
	Developing by Feature	Product development: representation the business activities as features
	Class (Code) Ownership	Human resource management: individual ownership and responsibilities
	Feature Team	Human resource management: coordination of the efforts of developers working on features
	Inspections	Product development: quality
	Regular Build Schedule	Product development: demonstrable system availability
	Configuration Management	Product development: identification of the latest version of product elements, fixing the history of their changes
Progress Reporting	Project progress reporting	

Conclusions. An extended version of the Generalized body of knowledge on project management is proposed. These extensions include an incorporation of the new component ‘Project management practices’ into the structure of the Generalized body of knowledge as well as adding values, principles, roles and

responsibilities, processes and practices of DSDM and FDD methodologies.

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