



AGILE SOFTWARE DEVELOPMENT PRODUCTS FOR FINTECH - FINANCIAL TECHNOLOGIES

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Abstract: *This paper presents research for software products and services, analyzed from aspect of modularization during the software structure development and application of new methods for customized development, as are agile and lean methods. The research of innovative edges of financial technologies (Fintech), for digital products and service transformation in the financial technologies era is presented. Analysis is addressed to the challenges of the financial sector where are new entrants such as technology companies, mainly in software engineering, that offer new strategic digital innovations, products and services.*

Key Words: Software development, Agile, financial technologies, Fintech software products.

1. INTRODUCTION

In the last twenty years, development of new products and services is tightly connected with the use of IT technology. The rapid expansion and growth in the use of computers in everyday life and business processes has set up the foundation for a new industry in the area of software development. This is followed with a great number of new software development companies competing between each other, creating one competitive environment in which surviving is not easy, especially having in mind the increasing requirements of market.

In order to compete and survive on the software market, today it is not only necessary to develop a product which would satisfy the needs and requirements of the customer, but it is required to achieve that goal in the shortest period of time, at the lowest possible cost and in the same time to have the flexibility and ability to easily change, adopt and in the end deliver the personalized product with best value and quality to the customer. Many of the companies that today operate on the software market find these imperatives hard to achieve and often missing to find the link to connect them, and by right since there is not a perfect formula to accomplish that.

In focus of this analysis are the software development companies oriented to the financial technologies. Fintech (financial technologies) is an emerging type of financial services in the 21st century mostly based on the technology platform for innovate products and perform financial services more efficiently. Those are achieved by software companies as well as start-up companies trying to change the form of the traditional transaction into new, modern and more effective methods by applying software products with high-tech devices in financial sectors such as mobile payments, money transfers, loans, fundraising and even asset management. Some examples of technology being applied to the financial transactions are peer-to-peer payment technology, peer-to-peer lending, mobile banking, digital wallets, cryptocurrency and Blockchain, which aim to bring further benefits and high efficiency for the financial transactions as well as help to reduce costs for customers.

According to Desai [1], 2000 was the year that marked the turning point for the incredible development of the Internet. It was because the Internet was able to connect and be widely used in most countries around the world, and so it obviously became an invaluable support tool for the ongoing development of Fintech. For instance, there was a lot of Fintech's infrastructure with sophisticated functions and high advanced applications, have been invented and widely used in many financial areas such as financial management risk, cash management, data analysis systems, and automated online trading systems. This remarkable progress of the Internet has made a precondition for the introduction of a lot of Fintech companies in many years later [2]. With digitalization and rapid growth of mobile technology, the financial transaction was continued to optimize and simplified by using the online financial support applications through mobile devices. New digital financial products are widely used with a variety of different forms to offer more online services with greater benefits for the customers such as online lending, online crediting, online payment and online funding. In this Fintech revolution, the area for growing new companies with new business models is open, in order to offer more

services, simplified for use but secured and trusted, and to have satisfied customers [3]. Those financial products and services have been developed and will continue to develop, mainly by technology companies with software development tools, based less on traditional and more on new IT software development approaches.

According to Accenture Fintech Innovation Lab [2], financial technology companies can be classified into two major categories that are competitive Fintech and collaborative Fintech companies. The competitive Fintech companies are those who will cause direct obstacles as well as create challenges for the financial services organizations by focusing mainly on providing new experiences and benefits to their customers through technology products. The collaborative Fintech companies consider the existing financial institutions as their potential customers, in driving the evolution of the financial products and services. They help the financial institutions for innovate their products and services through the application of the high-tech solutions, as well as break their traditional business model to bring a new and more sustainable development in the future.

2. TRADITIONAL SOFTWARE DEVELOPMENT APPROACHES

In the software development literature, the term *software engineering paradigm* is used to refer to a set of phases in development that consist of methods, tools and procedures [4]. Furthermore, phases can be decomposed into tasks, activities and tools, whereas forms and checklists are used [5].

The waterfall model is one of the oldest and best known Software Development Lifecycle (SDLC) model available to software developers. It has been used in the past decades [7] for the development of small and large projects consisted of the following phases: requirement, design, implementation or coding, integration, validation, installation and maintenance. During the years the model has evolved, as is presented in Fig.1 [6].

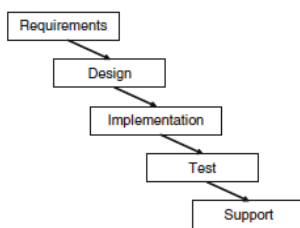


Fig. 1. Waterfall software development model [6]

The waterfall software development approach is mostly suitable for projects of controllable and predictable nature, where producers can regulate changes in design and requirements finishing the product with minimum influence from its stakeholders. It is apparent the waterfall framework is not suitable for creating new products in the fast moving, full of uncertainties and highly customer oriented software industry. In these cases of fast moving markets, trying to create detailed plan and specifications for the product, which for sure is not always possible, the only result will be outdated product even before it is launched or simply a product not satisfying customer needs.

In that line, numerous reports analyze using the traditional waterfall approach for software development and note large failure of projects based of this kind of methodology. For example, the study of IAG Consulting [8], as of 2014 nearly 68% of the companies experienced a waterfall project failure due to taking over 180% of target time, delivering under 70% of the required functionality and wasting over 41% of the IT development budget remaking the end product as a result of poor requirements gathering at the project initiation and planning stages.

3. CONTEMPORARY SOFTWARE DEVELOPMENT APPROACHES

Software development process is a highly complex field influenced by countless variables that impact the system. The “unknown” is created from many technical and non-technical problems that simply cannot be predicted in their entity at the beginning of the project. There are no laws or clear certainties on which software can be built, resulting in most of the times with sub-optimized outcome. Furthermore, the complexity of the infrastructure on which IT solutions are built has to be considered. This is mainly because building blocks (modules) of software projects are usually other software systems like programming languages, database platforms and etc., that often contains bugs and cannot be relied on with certainty. There are challenges arising from the globalization process, especially in the use of international and distributed teams. Commitments to stakeholders are another variable to be considered, as well as not yet identified dependencies, increasing costs, limited resources and trend of shrinking deadlines.

From all those reasons, the environment of software development is unstable, unreliable and unpredictable, where software development is complex new product development process. Software development process is consisted from innovation, discovery, and artistry; each foray into a development project presents new and difficult challenges.

Process and product development methodologies based on flexible and adaptable approaches, that can address all of the previously mentioned problems and variables, are used as new software development methods [11]. Due to this development, in recent years companies have started implementing the idea of being *nimble, active, ready and quick motion*, which is the common meaning for the term “agile” that is opening a new approach as Agile software development. As an addition approach that improves efficiency in IT industry can be recognized in the application of the famous Japanese management philosophy, Lean manufacturing and Lean management.

Lean and Agile share the same strategic goal, focusing on highly similar targets and without collisions into the enterprise governance:

- The core idea of Lean is maximizing customer value while minimizing waste.
- Agile priority is satisfying the customer through early and continuous delivery of valuable software.

Both development paradigms (agile and lean) seem similar in their goal of focusing on the customers and responding to their needs in a rapid manner [9] [14].

3.1. Agile software development methods

Agile methods are based to the four core values [10] and additional twelve principles that support those values. Four core values are:

1. Individuals and interactions *over* processes and tools
2. Working software *over* comprehensive documentation
3. Customer collaboration *over* contract negotiation
4. Responding to change *over* following a plan

The four core values of the Agile methods are further expanded and realized by the twelve principles:

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference for the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity – the art of maximizing the amount of work not done – is essential.
11. The best architectures, requirements, and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

On the basis of these, several agile methods have been developed and are increasingly used by organizations so far [12] [13]. In order to deal with the problems and overcome obstacles during the software development, agile methods, evolve around the principles and core values, defining own practices. Below are listed agile methods applied in software development: Extreme Programming – XP, SCRUM, Feature Driven Development – FDD, Adaptive Software Development, Test Driven Development – TDD, Crystal Clear, Agile Modeling, Rational Unified Process – RUP, Dynamic Systems Development Method – DSDM, Agile Unified Process – AUP, Essential Unified Process – EssUP and Open Unified Process – OpenUP.

3.1.1. Agile adoption in software development companies

Agile adoption today is a reality with constant increase among organizations across all kinds of

industries in adopting and using agile principles and methods. The number is increasing each year with more and more companies employing agile philosophy.

3.1.2. Reasons for adopting Agile

From Version One survey [15] the average success rate for agile teams was 77% and 79% overall success rate for organizations still in pilot project phase. The top three reasons for respondents to adopt agile were to accelerate time to market, increase productivity and to more easily manage changing priorities. Those three top reasons are followed by other reasons for adopting agile: better align IT business, enhance software quality, project visibility, reduce risk, simplify development process, reduce cost, and enhance software extensibility. Also 75% of respondents felt that agile projects were the same or faster to completion than projects that previously weren't Agile.

The positive impact of Agile on organizations' functioning is high, with Agile teams reporting significant improvements in productivity, quality, stakeholder satisfaction and reasonable improvements in costs [13]. Results from the survey are summarized in the following Table 1.

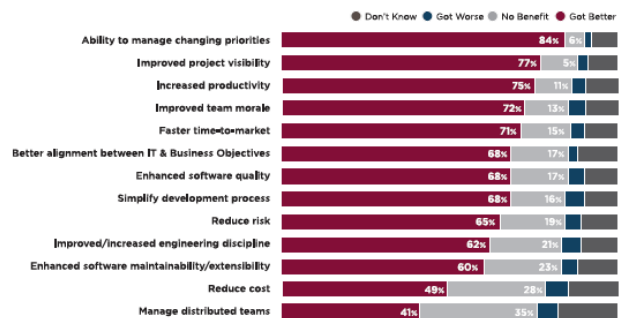
Table 1. *Improvements in organizations with Agile*[13]

Factor	Improved	No Change	Worsened
Productivity	82%	13%	5%
Quality	77%	14%	9%
Stakeholder Satisfaction	78%	15%	7%
Cost	37%	40%	23%

3.1.3. Benefits from adopting Agile

Project visibility and the ability to manage changing priorities have been ranked by the respondents, 77% and 84% respectively, as very important benefits from adopting Agile [15]. But there are many more, and according to Version One (2017) survey these top benefits are presented in the Table 2, given below.

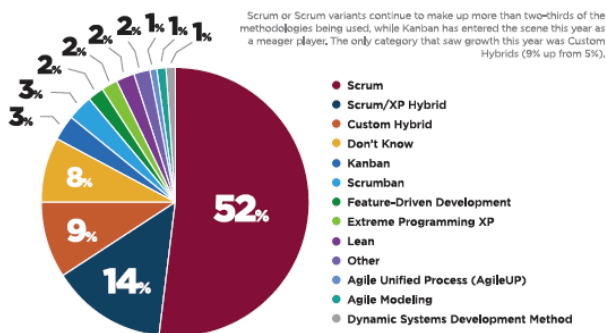
Table 2. *Benefits from adopting Agile*[15]



Regarding the use of specific Agile Method, Scrum or Scrum variants are the most popular ones with over 60% of respondents using them, according to results from Version One (2017) survey, given in Table 3.

These methods are different in their own way compared to each other, some are improvements or simplification of others, but all stand behind the Agile idea in creating software.

Table 3. Use of specific Agile Methods [15]



According to contemporary high tech applied in financial technologies, the Agile software development methods are most used in development of Fintech products and services.

3.2. Lean software development principles

The principles and practices developed from Lean manufacturing in general are deep, extensive, applicable and adaptable to other production industries. In addition to Lean IT, another very important for today's world and field of great potential for further application of Lean is software development. Applying Lean principles to software development projects is relatively new and its time is yet to come [9], [11], [14].

Great attention for implementing Lean in software development has been generated and according to Poppendieck [9], there are identified seven principles upon which Lean Software Development is based: eliminate waste, build quality in, create knowledge, defer commitment, deliver fast, respect people and optimize the whole.

- Eliminate waste – Everything that does not contribute and deliver value to the customer is considered as waste that obstructs development and should be properly managed.
 - Build quality in – Lean philosophy is based on quality, where quality of the software product in this case should be built in since the very beginning, and not later in development. Situations where defects and quality of not satisfactory level is discovered by testing in the end should be eliminated, as it only brings more efforts in fixing and build up costs. Quality should be built during the whole development cycle from its start till the end, and not only recognized at its finished. Achieving high quality and integrity build in every segment requires discipline and self-awareness.
- Create knowledge - Software development compared to manufacturing requires more intellectual engagement from “first line workers” or programmers, with intensive learning over the whole process. Achieving quality and reducing wastes requires continuous generation of knowledge and its diffusion among members.
- Defer commitment – Best decisions are made with the most information available. The option to change something should always be present for as long as possible, and irreversible decisions should be brought only when information and knowledge acquired are sufficient to deliver the best possible outcome.
 - Deliver fast – By developing features in small batches (modules) and in short iterations, the customer can

provide feedback quickly on them and any change required can be easily implemented without complicating future work. Short iteration provides an opportunity to cope with changes and reprioritization of requirements, resulting with a product close to customer needs.

- Respect people – People are the most sustainable competitive advantage in software development, and that is why they should be treated respectfully. There are suggested three principles for fostering respect:
 1. Entrepreneurial leadership
 2. Expert technical workforce
 3. Responsibility-based planning and control
- Optimize the whole – Lean requires optimizing over the entire value stream, meaning that improvement of the software development process is done with the whole value stream.

4. AGILE SOFTWARE DEVELOPMENT APPLIED IN FINTECH

4.1. Overview of financial technologies

During the last decade, financial technologies (Fintech) have built a new appearance for the financial world, where consumers are the most beneficiary from the rapid development of the Fintech industry [16].

Financial was considered as a conservative industry with its stable structure, business models, defined boundaries and customers' essentials such as depositing, sending and withdrawing money. However, this traditional structure began to change based on new innovative methods to execute these activities. Unstable nature of markets, rapid grown of new information technologies (IT), SD, digitalization and changes in demographics are some reasons lying behind this situation [17].

Mentioned conditions fostered financial innovation and many new services in financial sector are developed that are based on IT innovation and software tools [12] [13]. Those Fintech innovations build collaboration with software companies where new services are developed with application of software products developed with agile software methods. A wide range of financial products of services were introduced, where financial innovations contribute to increase efficiency of financial institutions.

Open architecture term was promoted regarding opening boundaries of financial institutions, according to changes in financial legislations that offer possibilities for variety of products FAsnat. Open Financial Services Architecture (OFSA) is strategic innovation in financial products based on IT and digitalization refers to a software system which manages financial services through mobile devices. These financial services have included mobile payments and have made new integration of payment and banking systems, where: trust factor between user and banking organization and between user and mobile device is regarded as the primary principle in this system; big data transfer takes place between these systems and core banking systems and every transaction requires security for authentication, integrity, confidentiality and authorization [18].

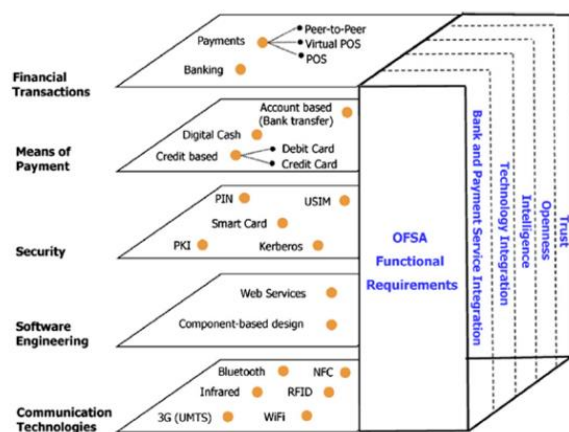


Fig. 2. *Open Financial Services Architecture (OFSA) based on intelligent mobile devices [18]*

4.2. Fintech agile and advance software solutions

Regarding to the new financial products and services based on software development and innovations, collaborations between financial institutions and IT companies become more important. Fintech area offers new products and services based on follow agile software solutions.

4.2.1. Mobile payment

Technology developments play important role in the payments services, where invention of mobile devices enabled the development of mobile payment services. Mobil payment refers to the use of mobile device for initiation, authorization and confirmation of any payment in return for goods and services [19]. Mobile payment solution where customers can use their smartphones as digital wallets [16] that enables cards and terminals to make transactions without any physical contact. Contactless technologies and application of these technologies in payments services, as are mobile wallets, peer-to-peer (P2P) apps, retailer-based closed loop applications and mobile money, are the leading developments. Design of the digital platforms is important as the timing of entry in mobile payments. In this sense, the ability of the new digital platform to evolve is a significant contributor to its success. According to [20], classify mobile payment platforms as one-sided, two-sided and multi-sided and posit that they are evolving to two-sided and multi-sided platforms. One-sided platforms are designed for specific groups and have limited features, they are easy to manage and they can be transformed to two-sided and multi-sided platforms according to needs. Two-sided and multi-sided platforms aggregate different groups in the same platform.

4.2.2. Big data

Big data as an enormous amount of information created every day that brings new technologies and methods for data management, processing and analyzing. Deployment of data standards, electronic data interchange formats, fast global connections, advanced databases and information systems facilitated the growth and development in this field [21], with overcoming

challenges regarding data' volume (large datasets of data), variety (multiple data formats), veracity (complex structure and anonymities), velocity (high rate of data flow), variability, visualization and value. Data acquisition, data mining, data aggregation and integration, data analysis, modelling and data interpretation are the process [22]. Software solutions are mainly developed as modules based, where modularization offer flexibility for different solutions.

4.2.3. Cloud computing

Cloud computing refers to the delivery of different IT resources and services over Internet on demand access model, where users don't have to own data-centers, IT infrastructure and software services applied in payment structures are more flexible than other services. There are three type of service models offered by cloud computing. These are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). SaaS refers to the deployment of software applications to consumers on a cloud infrastructure. These models can be deployed over private cloud, public cloud and hybrid cloud infrastructures. Cloud technology offers many opportunities for financial sectors due to their huge customer bases and database requirements, where private cloud deployments are for almost 70% of cloud initiatives in 2014 [23].

4.2.4. Application Programming Interface

Application Programming Interface (API) is a set of procedures and tools (developed as modules) enabling different software systems to communicate each other efficiently. Those are being used to facilitate the engagement of Fintech companies as innovation suppliers with finance institutions by building blocks of flexible services, combining different services and creating additional value [24]. They offer secure, controlled and cost-effective access to data and functionality by third parties (EBA, 2016). Boundaries can be established for the access of APIs. While "Closed APIs" or "Private APIs" can only be accessed in an organization, it is possible for third parties to access "Open APIs". In terms of the openness of API, it can be classified as Private APIs, Partner APIs, Member APIs, Acquaintance APIs and Public APIs. Financial information systems consist of three layers. They are respectively user layer, user contract layer and financial system layer. While user account layer represents platforms such as internet banking, financial system layer represents financial systems such as account or data system. Data flow between user layer and user contract layer is possible with APIs [25].

4.2.5. Cryptocurrency

Cryptocurrency is a form of electronic money that can be used to perform the financial transactions such as the payment or money transfer between the users through the computers.

Bitcoin is a typical example of the digital currency born in 2009, which allows the users to make the trading for goods and services with the vendors who accept Bitcoins as their payments [26].

Cryptocurrency is not subject to the control or assistance by anyone, and so, all the cryptocurrency transactions will be implemented independently out of the official financial market. Here are mentioned as a software development product in Fintech industry.

4.2.6. Blockchain technology

Blockchain technology relies on the white paper, as a Peer-to-Peer Electronic Cash System, published by an individual or a group under the name of Satoshi Nakamoto in 2008 [26] [27]. The most profound change in the global payment was the appearance of Blockchain, as a data structure that allows users to create a digital book for their transactions and share it widely through a distribution network of computers [28].

Blockchain term represents a distributed database or public ledger which is executed and shared among participants, with consensus to verify each transaction in the public ledger without to erase the information. It enables anonymous transactions without any control from third party, opposite to traditional finance, where is need a third entity as a certain trusted authority to secure assets and for verification of a digital certificate for transaction. Third parties in traditional online finance are important for validating entries, safeguard entries and preserving historical record in transactions, where this increases the cost of transactions.

Blockchain technology can revolutionize digital world through distributed consensus for every transaction. It enables this without any involvement of third parties, based on cryptographic proof. Main features of blockchain technology are distributed consensus and anonymity [26]. According to an Oliver Wyman report [29], systems for peer-to-peer transactions work near-certainly correctly, distributed ledgers eliminate supervision and IT infrastructure costs, but out of official regulation.

Better understanding of new technologies can contribute to comprehend the investment movements, new business models, collaboration and relationships between parties in Fintech space.

5. CONCLUSION

The evolution of software development was explained and a shortcoming of the waterfall and traditional software development was placed. Beside the listed shortcomings and problems, many companies are found using these approaches. Addressing these problems, software industry starts to use two very new, certainly very applicable and useful software development approaches, agile and lean.

Each of the approaches is of high relevance for the industry, especially for the companies by making them more agile and competent in responding the continuous market changes and requirements.

In this paper, analysis of agile approach implementation is done based of huge number of software industry reports around the world. The results for methods and techniques high implemented in this sector are applicable for growing the company culture of increasing number of software companies in the

Macedonia. The values and principles of agile approach were presented, as well as some of the most important and used practices and methods.

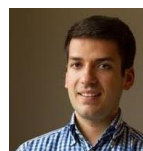
In this paper, it is given one overview of analyzed literature that contributes to agile software development in Fintech space with views of Fintech development, innovative products and services and their implementation in Fintech space.

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