Design of an Agile Balanced SCorecard (AgBSC) platform:

Case of Med First University in Morocco

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Abstract - This paper proposes a Model-Driven Engineering (MDE) approach to post-Covid-19 situation in Med First University in Morocco. We will develop a CIM (Computation Independent Model) [1] covering the entire business of post-Covid-19 situation using the agile BSC [2]. We have introduced agility to deal with the uncertainties caused by the post-Covid-19 era. This CIM model contain relevant information to facilitate the task of the transformation to the PIM (Platform Independent Model) level. A Computation Independent Model (CIM) is a model defined within OMG (Object Management Group) as a primary model. This model reflects system and software knowledge from the business perspective. The CIM may contain business knowledge about system organization, roles, functions, processes and activities, documentation, constraints etc. In this paper, the CIM must contain business requirements for our platform based on agile BSC in the context of post-Covid-19.

Keywords - component; Balanced Scorecard; Agility; Post-COVID-19; MDA and CIM.

I. INTRODUCTION

We live in turbulent, unpredictable times. We live in a digitally driven world, where data and ideas move across the globe: The digital age is changing everything. Med First University in morocco experiences this turmoil and change all the time. The data we are talking about are those relating to course data, students, scientific information that changes continuously. The challenge is huge. Faced with this observation, our university is called upon to use agility and adaptability. If we add to this situation the non-visibility caused by the post-Covid-19 period, the challenges are unimaginable.

An agile university can innovate, drive transformation change, and be flexible, whilst also maintaining a strong focus on strategy and on the students. A useful definition of agility comes: Agility is the ability of an organization to synchronize the internal rate of change of the business with the rate of change imposed by the external business environment [3]. Strategy management must become agile and adaptive with the appropriate governance model to ensure that execution of plans can be modified as required without leading to chaos. Our organizations (universities) must shows a high level of agility and adaptiveness in the strategy management process [17][18].

In this paper, the modeling of such a platform is based on:

● The Balanced Score Card (BSC) [19] Kaplan and his colleagues have worked on more than 300 companies over several decades. They demonstrated how this powerful management tool, based on a few critical parameters, steers the company towards the creation of true value and wins its strategy with 4 perspectives: 1) The Financial perspective: how success is perceived by shareholders. 2) The Customer perspective: It's about how to complete our vision and how to see our customers? 3) The internal perspective: To satisfy our customers, what processes must we excel in? 4) The learning and Growth Perspective: To achieve our vision, how must our organization learn and improve?

● Model Driven Architecture: MDA [1] : We mainly use the first level of MDA, i.e. the CIM level (Computation Independent Model). In this paper, the CIM level for design of agile BSC platform in the context of post-Covid-19.

● Agile Management [3] : The platform must be agile. By agility, we mean especially the internal process perspective. Internal Process need budget. Let's take the example of the process: Passing exams. A budget is allocated to this process. The same applies to the pedagogical process. According to [17], budgeting is perhaps the most important task in being agile. The uncertainties caused by post-Covid-19 have prompted our university to manage other processes with agility, such as taking exams and attending courses online rather than face-to-face.

This paper is structured as follows: Section 2 presents related work on Balanced Scorecard (BSC) and model-driven architecture (MDA). This section details an effort to combine MDA and BSC. In section 3, we present the concepts of agility and BSC in the context of post-Covid-19. In section 4, we present the MDA approach to our agile BSC platform. Finally, we conclude with a synthesis of our paper and present our future work.

II. RELATED WORK

In this article, we aim to integrate two distinct fields of research, Agile BSC and modeling via MDA (especially CIM model). We explore the potential benefits of combining these two fields. Both Balanced Score card and MDA have been the subject of extensive research, with numerous studies investigating various aspects of these disciplines. Unfortunately, studies are separate.

In [21], the authors determine the advantages and disadvantages of the BSC and find out the effective of practical solutions that require; (1) the needs of translating and cascading strategy throughout an organization channels effectively; (2) the critical role of efficiently integrating approaches in operational procedure; (3) The design and use of indicators and its measurement.

In the paper [22] , the author's use implemented BSC in Mental Health Services (MHS) aims to inform future development of a more comprehensive mental health–focused benchmarking tool. A total of 17 unique BSCs were identified. A total of 434 indicators were subject to thematic analysis identifying 11 key themes: prevalence, accessibility, services provided, clinical outcomes, client satisfaction, client involvement, staff motivation, staffing levels, governance and compliance, development, and costs and revenue.

In the article [23], the study aims to describe how the University can move from mission to vision using goals and objectives articulated in its strategic plan 2017–2022. The study uses a qualitative research approach. It comprises an extensive review of relevant literature, an in-depth analysis of documentation of the University's strategic plan 2017–2022, and a comprehensive discussion and face-to-face interview with relevant executives. A BSC framework was developed as a complementary process for the University's strategic plan 2017–2022. In addition, a strategy map was designed based on the BSC model. The BSC framework and strategy map can be used to assess and monitor the University's performance towards achieving 'Educational and Research Excellence' status by translating its strategic objectives into action plans.

In the article [24] one of the aims of HEI (Higher Education Institution) is to achieve results in terms of products and services for the customers and other stake holders. The authors review recent studies in top journals using the Balanced Scorecard Framework in HEIs. The paper identifies the relenvant perspectives for HEIs and presents its contextual analysis. When implemented, this can be used to monitor their performance and enable them to adjust to emerging challenges that come as a result of implementing key strategies.

The authors [25] show that several studies with quantitative, qualitative or theoretical approaches have been carried out, focusing on the application of the Balanced Scorecard (BSC) in the educational sector. However, despite the literature on the subject, it is difficult to draw an overview of the use of the BSC in this sector. In order to fill this gap, the paper carried out a systematic literature review on the BSC methodology implemented in the educational sector. The Web of Science and Scopus databases are used as a source of article collection. A bibliometric analysis was performed using 65 articles extracted from these databases. The results suggest that the most discussed topics within the study are: 1) the diversity of the BSC in the education sector; 2) strategic management with the BSC; 3) statistical methods to manage the BSC and 4) the strategy map of the BSC.

In the following, we present a few articles in the MDA field. In the article [26] the models present several levels of abstraction such as business, task, dialog, presentation and layout models. The proposed architecture show how several individual models can be combined at different levels of abstraction into heterogeneous structures, which can be used as building blocks

in the development of Web applications. There is also others similar articles [27][28][29] [30]. All these articles focus on web applications in general. These articles have the advantage of using MDA, but do not take into account the particularities of Balanced score card framework. Additionally [31], the authors adopted to demonstrate the tandem of the MDA and HCI (Human Computer Interface). Based on the MDA approach and its principles, they elaborate the Platform Independent Model (PIM) to describe the interface's functionalities and not using just a simple Unified Modeling Language (UML) diagram.

Following these articles and other intensive research, we noticed that there are no articles combining MDA and BSC. This lack is even clearer when it comes to agility. This prompted us to focus on this combination

III. AGILITY AND BSC IN THE CONTEXT OF POST-COVID-19

The Balanced Score Card (BSC) [2] is a tool created by Kaplan and his colleagues. They have worked on more than 300 companies over several decades. They demonstrated how this powerful management tool, based on a few critical parameters, steers the company towards the creation of true value and wins its strategy with 4 perspectives:

● The Financial perspective: how success is perceived by shareholders

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According to the language of the BSC, the quantified cause-and-effect relationship between the indicators of the four perspectives and the objectives ensures that the targets set are in fact those that contribute to achieving the targets of the linked objectives. One of the key tasks of strategy reviews (the number of which has increased due to post-Covid-19) is to analyze the root causes of underperformance of objectives. A strategy, graphically translated by a strategy map [2] , is a set of objectives that are linked to each other by cause and effect relationships. Med First university managers can achieve certain goals in learning and internal process agility. With this assessment and reviews of the variety of data in the entire strategy map, they can win this challenge of the post-Covid-19 situation.

On the other hand, agile thinking reaches back many decades and has its roots in the lean/total quality thinking of the 1980s. However, it gained significant traction and general acceptance through the publication of the Agile Manifesto (PMI, 2017). Agile software development involves rapid coding, testing and rework to develop in an iterative manner, relying on rapid feedback throughout the process. Strategy is not like coding. It is not possible to divide the strategy into small sprints (according to the logic of the SCRUM agile method [11] and to keep changing the plan, because each block of the strategy is interconnected to other elements. Agility refers to rapid change

while adaptability is the ability to change in response to new events in the real world.

Strategy must have some continuity. It cannot be constantly reinvented [11]. Agile logic cannot be applied to the entire management process. We can apply agility to strategy at the level of short and medium term objectives and their mechanisms of realization. The mission of the company is not agile and it does not change often and may even remain the same for a very long time. This management component of strategy cannot be agile, and any attempt to make it so has a serious influence on the management process. Where strategy begins to become more agile is in the definition of short and medium term objectives and their delivery mechanisms. In the case of our university, the short and long term are mainly exams and year-long courses. The university's strategy covers a four-year period. It may not be agile, but the operational aspects are agile. In addition, the vision includes strategic initiatives that are defined in the medium term, which corresponds well to the Balanced Scorecard approach. It is in the short term that the strategy comes to life and becomes agile, without losing sight of the long-term goals. We must be careful in applying agile logic to all aspects of the strategy management process. However, it is easier to apply during execution. In the post-Covid-19 era, it is not appropriate to be rigid during the development and deployment of a Balanced Scorecard system. The dashboard becomes a barrier to agility and adaptability. The annual budget is a concrete example of the rigidity of the BSC application. The BSC needs to be constantly adaptable. The manager must have a clear understanding of the causal relationships between the goals of the four perspectives to embrace the turbulence caused by post Covid-19. Agility in BSC execution means being able to change quickly to exploit opportunities or mitigate risks caused by post Covid-19 in order to capture, interpret, and act on data and insights in as close to real time as possible.

Agility and adaptability are two activities that need feedback at all times. To achieve this, Med First university managers must constantly update their data. This data includes student satisfaction, faculty effort, scheduling adequacy and in general, all indicators related to the four BSC perspectives. For example, at the HR perspective, managers need to update data on the health status of employees in relation to post Covid-19. At the process perspective, managers need to check the agility of the educational process in relation to the post Covid-19 expansion.

IV. A MODEL DRIVEN APPROACH TO AGBSC PLATEFORM

Model Driven Architecture (MDA) is an approach to information systems design, development and implementation spearheaded by the OMG. It is based on the creation of source models and transforming them to multiple levels of abstraction until we automatically get a code. MDA separates business and application logic from underlying platform technology. The principle key of MDA consists in the use of models in different phases of the development cycle of an application. Specifically, MDA recommends the development of the CIM (Computation Independent Model), PIM (Platform Independent Model) and the PSM (Platform Specific Model).

The first level of MDA is the CIM (Computation Independent Model) presented as models used by all the stakeholders. The second level is the PIM (Platform Independent Model) which allows defining the models used by analysts and the software designers to realize an independent analysis and a conception of the developed software. The third level is the PSM (Platform Specific Model) which is considered as models of code used by software developers [1].

Transformations between the different levels of MDA begin with the transformations from CIM to PIM that aim to partially build, PIM models from CIM models. The goal is to rewrite the information existed in the CIM models into PIM models. These transformations are going to ensure that business information is conveyed and respected throughout the MDA process. Then, the transformation of PIM models to PSM models adds PIM technical information related to a target platform [1]. CIM (Computation Independent Model) means that this model does not disclose any information related to the computer system. The CIM level is presented to be representative of the real world. In our case, the real world is the Med First University. We are in the process of modeling all these elements relating to Agile BSC within the framework of a CIM. In a future work, we will model the PIM and finally generate an integrated IT platform that will be used by stakeholders of the university. Our CIM model contains three UML digrams. These are activity digram, use case diagram and sequence diagram.

The following table summarizes the components of our CIM. It presents three columns. The first column represents the diagram. The second represents the use of these diagrams. The third shows how to use this component in our case: our agile BSC platform in the post-Covid context:

TABLE I. TABLE STYLES

Components of the CIM model	The use of the component	How we use this component in our case
UML Use case diagram	It focuses on the identification of functional requirements of the system under consideration.	In our case, these are the use cases relating to the four perspectives of the AgBSC model. Managing expenses is one use case.
UML Activity Diagram	It focuses on sequential and parallel activities involved in each functional requirement of the system.	In our case, these are the use cases relating to the four perspectives of the AgBSC model. Manage the team work is one activity.
UML Sequence Diagram	It depicts the objects involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality	In our case, these are the use cases relating to the four perspectives of the AgBSC model. Manage the exams is one sequence diagram.

In what follows, we give the example of an activity digram. These activities are distributed across the four BSC perspectives. The platform must integrate the agility of these activities:

● Actvity#1: Manage the team work of the university (HR perspective of the BSC)
● Activity#2: Manage the courses and exams operations (Internal process of the BSC)
● Activity#3: Monitor the students (Client perspective)
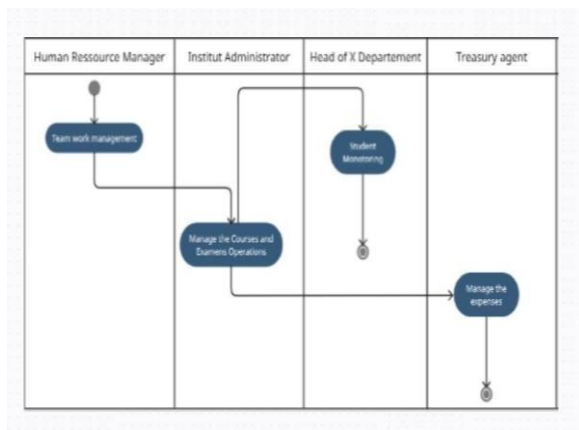● Activity#4: Manage the expenses (Finance perspective)

Fig. 1. The activity Diagram for the BSC of the university

Now, we present the following rules for moving from the activity diagram to the uses case diagram:

● R1: Each activity corresponding to a system functionality is transformed into a "use case".
● R2: Every "swimlane" becomes an "actor"
● R3: Each "decision node" between two activities becomes an "extend" relationship between two "use cases".
● R4: Each "control flow" between two activities becomes an "include" relationship between two "use cases".

After applying the following the rules, we will have this use case diagram:
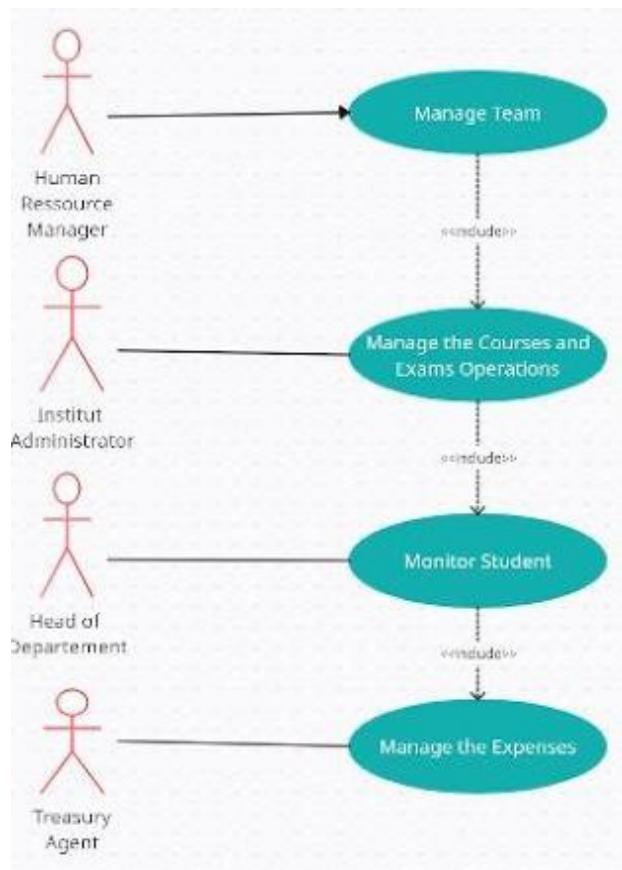

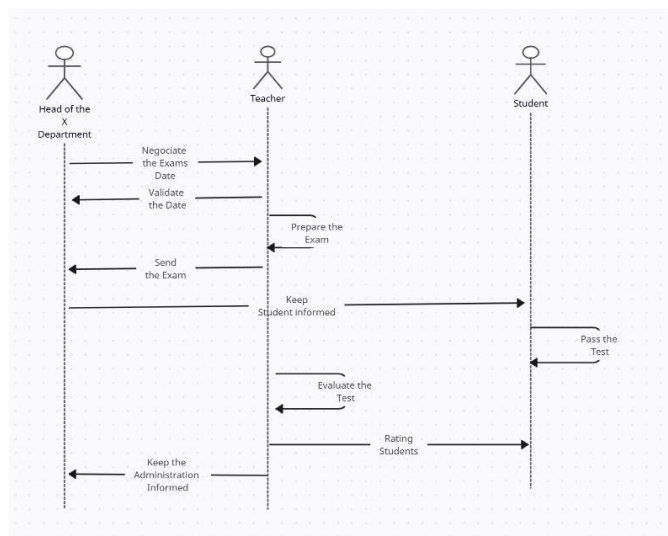Fig. 2. The use case diagram relating to the diagram activity

Fig. 3. The sequence diagram corresponding to the "Manage the exams operations" use case.

We can easily iterate to apply these transformations to different components of the BSC. The BSC contains 4 perspectives. Each perspective contains several activities that need to be integrated into the activity diagram. For example, the internal process perspective contains aspects of pedagogical production, student

relationship management, innovation, relations with the university's stakeholders, and so on.

V. CONCLUSION AND FUTURE WORK

We used the MDA approach to build our platform. MDA contains three levels of models: The CIM model, the PIM model and finally the PSM model. We focused primarily on the CIM model. This model is very interesting because it contains all the business requirements of our case study. This model is the starting point for any successful platform. In our case, it is based on tree diagrams: The activity diagram, the use case diagram and sequence diagram. These activities cover all four BSC perspectives.

At the platform level, these activities need to be agile, as universities are currently experiencing turbulence due to post-Covid-19 but also the disastrous crises our real world is experiencing. Pedagogical processes are carried out online with great agility. The same goes for examinations and other university processes. The CIM model incorporates all aspects based on UML, which is a preferred standard.

For future work, we want to use both the PIM and PSM levels. The PIM mainly contains the class diagram. It describes the structure of the system in terms of classes and objects. For example, the classes in this model are the student's account (Finance perspective), the student himself (Customer perspective), the exam the student has to pass (Internal process perspective) and finally, the teacher class (Human resource perspective).The PSM model is directly linked to a specific technological platform. For example, a need to implement our AgBSC platefrom. The system will need to store information regarding the student's account (Finance perspective), the student himself (Customer perspective), the exam the student has to pass (Internal process perspective) and finally, the teacher class (Human resource perspective). The designer might decide to use for this purpose an SQL database. This SQL specific relational model is an example of a Platform-specific model. The main idea is that it should be possible to use QVT (Query/View/Transformations) to transform a PIM into a PSM.

REFERENCES

[1] OMG. 2023. http://www.omg.org/mda.

[2] Robert S. Kaplan and David P. Norton. 1996. The Balanced Scorecard: Translating Strategy into Action. Harvard Business Review Press.

[3] David Wiraeus, James Creelman. 2019. Agile Strategy Management in the Digital Age: How Dynamic Balanced Scorecards Transform Decision Making, Speed and Effectiveness. Palgrave Macmillan.

[4] Danijela Ciric, Bojan Lalica, Danijela Gracanina, Nemanja Tasica, Milan Delica,Nenad Medica. 2019. Agile vs. Traditional Approach in Project Management: Strategies, Challenges and Reasons to Introduce Agile », Procedia Manufacturing vol. 39, 2019, P.1407–1414.

[5] Andrew Wells. 2013. Agile Management: strategies for Success in Rapidly Changing Times –an Australian University Library Perspective. UNSW Library, 2013, p.1-5.

[6] Bruce Gurd Panayiotis Ifandoudas. 2014. Moving towards agility: the contribution of a modified balanced scorecard system. Measuring Business Excellence, Vol. 18 Iss 2 pp. 1 – 13

[7] Marika Eve Katariina Säisä, Katariina Tiura, Rita Matikainen. 2019. Agile Project Management in University-Industry Collaboration Projects », International Journal of Information Technology Project Management Vol. 10.

[8] Ali Tizroo, Ahmad Esmaeili, Ehsan Khaksar, Jonas Šaparauskas & Mohammad Mahdi Mozaffari. 2017. Proposing an agile strategy for a steel industry supply chain through the integration of balance scorecard and Interpretive Structural Modeling », Journal of Business Economics and Management, 18(2): 288–308.

[9] Ardeshir Shiri. 2014. A study on relationship between conflict management styles and organizational agility: A case study of Ilam state University, Iran. Management Science Letters, 4, p. 87-94.

[10] Abdurrahman and Rudy Asrianto. 2019. Study of Performance Measurement Framework on Small Teams Using Agile Project Management and IT Balance Scorecard: Case Studies in IT Companies. Publisher: IEEE. ,DOI: 10.1109/ICCED46541.2019.9161086

[11] Pedro Serrador and Jeffrey K. Pinto. 2015. Does Agile work? — A quantitative analysis of agile project success. International Journal of Project Management.

[12] Azanha, Adrialdo ; Argoud, Ana Rita Tiradentes Terra ; Camargo Junior, João Batista de ; Antoniolli, Pedro Domingos. 2017. Agile project management with scrum: case study of a Brazilian pharmaceutical company IT project. International journal of managing projects in business. Emerald, ISSN 1753-8378, ZDB-ID 2473959-5. - Vol. 10.2017, 1, p. 121-142

[13] Katharina Harsch, Marion Festing. 2019. Dynamic talent management capabilities and organizational agility—A qualitative exploration. Hum Resour Manage. 2019;1–19.

[14] Pia-Maria Thoren. 2017. Agile People: A Radical Approach for HR & Managers (That Leads to Motivated Employees).

[15] Chuck Mollor. 2020. The Rise of the Agile Leader: Can You Make the Shift. Prominence Publishing.

[16] PMI. 2017. Agile Practice Guide. Project Management Institute.

[17] Michael E. Porter. 1998. Competitive Strategy: Techniques for Analyzing Industries and Competitors. Free Press; Illustrated edition.

[18] Bjarte Bogsnes. 2016. Implementing Beyond Budgeting: Unlocking the Performance Potential.Wiley edition.

[19] Paul R. Niven. 2014. Balanced Scorecard Evolution: A Dynamic Approach to Strategy Execution. Wiley edition.

[20] Robert S. Kaplan and David P. Norton. 2004. Strategy Maps: Converting Intangible Assets into Tangible Outcomes. Harvard Business Review Press.

[21] Michael Guttman and John Parodi. 2006. Real-Life MDA: Solving Business Problems with Model Driven Architecture. The MK/OMG Press.

[22] Nattarinee Kopecka. 2015. The Balanced Scorecard Implementation, Integrated Approach and the Quality of Its Measurement. Procedia Economics and Finance. Volume 25, 2015, Pages 59-69.

[23] Rachel E. Brimelow, Aneline Amalathas MD, Elizabeth Beattie, Gerard Byrne and Nadeeka N. Dissanayaka. 2022. The Use of Balanced Scorecards in Mental Health Services: an Integrative Review and Thematic Analysis. Published: 14 July 2022. volume 50, pages128–146 (2023). The Journal of Behavioral Health Services & Research

[24] Hussein H. Sharaf-Addin and Hesham Fazel. 2021. Balanced Scorecard Development as a Performance Management System in Saudi Public Universities: A Case Study Approach. Asia-Pacific Journal of Management Research and Innovation. Volume 17, Issue 1-2. https://doi.org/10.1177/2319510X211048591.

[25] Fahmi Fadhl Al-Hosaini and Saudah Sofian. 2015. A Review of Balanced Scorecard Framework in Higher Education Institution (HEIs). International Review of Management and Marketing Vol. 5, No. 1, 2015, pp.26-35. ISSN: 2146-4405.

[26] Isaias De Jesus Alvares Mendes Junior Junior and Maria Do Céu Alves. 2022. The balanced scorecard in the education sector: A literature review. Educational Leadership & Management. Article: 2160120. https://doi.org/10.1080/2331186X.2022.2160120

[27] Mohamed Taleb, Ahmed Seffah & Alain Abran, 2007. Model-Driven Architecture for Web Applications. Human-Computer Interaction. Interaction Design and Usability pp 1198–1205.

[28] Yassine Rhazali, Youssef Hadi and Abdelaaziz Mouloudi. 2016a. CIM to PIM Transformation in MDA: from Service-Oriented Business Models to Web-Based Design Models. International Journal of Software Engineering and Its Applications 10(4):125-142.

[29] [Yassine Rhazali, Youssef Hadi and Abdelaaziz Mouloudi. 2014. Transformation Method CIM to PIM: From Business Processes Models Defined in BPMN to Use Case and Class Models Defined in UML. World Academy of Science, Engineering and Technology International Journal of Computer and Information Engineering Vol:8, No:8, 2014.

[30] Yassine Rhazali, Youssef Hadi and Abdelaaziz Mouloudi. 2016b. CIM to PIM Transformation in MDA: from Service-Oriented Business Models to Web-Based Design Models. International Journal of Software Engineering and Its Applications 10(4):125-142.

[31] Lamlili El Mazoui Nadori yasser, Mohammed Erramdani, Ibtissam Arrassen, Esbai Redouane,and Mimoun Moussaoui. 2013. Web-Marketing in Social Networks using MDA Approach. JCSI International Journal of Computer Science Issues, Vol. 10, Issue 4, No 1, July 2013 ISSN (Print): 1694-0814 | ISSN (Online): 1694-0784.

[32] Sara Roubi, Mohammed Erramdani and Samir Mbarki. 2015. Model Driven Architecture as an Approach for Modeling and Generating Graphical User Interface. Proceedings of the Mediterranean Conference on Information & Communication Technologies 2015 (pp.651-656).