

Web-based Portal to Support the Use of Reference Standard Process Model for Agriculture

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Abstract. Agriculture is a sector that continually demands a greater efficiency and thus relies extensively on the use of digitalisation. The experience with a large-scale EU-funded project with a consortium made up of several software companies shows that software companies have a wide range and unequal knowledge/understanding of agricultural processes. This finding together with what is known about the standard process model for the IT governance (COBIT) triggered the idea for a reference standard process model for agriculture (RSPMA) presented in the paper on the level of concepts, relations between them and a list of processes and attributes for the process description. The use of RSPMA in practice is more efficient with web-based portal presented in the paper together with the organisational structure of some bodies and processes to support further development of RSPMA.

Keywords: standard process model, reference process model, business process standardisation, conceptual model, web-based portal

Spletni portal za podporo uporabe referenčnega standardnega procesnega modela za kmetijstvo

Kmetijstvo je sektor, ki je izpostavljen stalnih zahtevam za povečanje učinkovitosti, ki jo lahko doseže z digitalizacijo. Izkušnje iz večjega s strani EU financiranega projekta, v katerem je bilo več podjetij za razvoj programske opreme, so pokazal, da imajo ta podjetja različna znanja o procesih v kmetijstvu. Omenjena ugotovitev in poznavanja standardnega procesnega modela za obvladovanje informatike v podjetjih (COBIT) sta sprožila idejo za referenčni standardni procesni model za kmetijstvo (RSPMA), ki je predstavljen v članku. RSPMA je predstavljen na nivoju konceptov, razmerij med njimi, seznamom procesov in atributov za opis procesov. Uporaba RSPMA v praksi je bolj učinkovita z uporabo spletnega portala, ki je ravno tako predstavljen v članku. Članek predstavlja tudi organizacijsko strukturo različnih teles, ki skrbijo za napredek in nadaljnji razvoj RSPMA. Predstavljen pa je tudi proces, po katerem delujejo omenjena telesa.

Ključne besede: standardni procesni model, referenčni procesni model, standardizacija poslovnih procesov, konceptualni model, spletni portal

1 INTRODUCTION

In recent years, agriculture has been exposed to demands for a greater efficiency and thus demands on the use of information systems and IoT systems. The experience gained in an EU-funded project called AgroIT has shown that software companies possess different and unequal knowledge/understanding of agricultural processes, activities within agricultural processes, and process

metrics. This altogether has created a problem not only for the pilot users of the software products and IoT systems, but also for the software companies in the consortium while integrating the software products and IoT systems.

The above stated together with expertise on COBIT, a standard process model for the governance and management of IT in companies, has triggered the idea for a standard process model for agriculture to provide a reference for managing farms and define other agricultural processes. The proposed model is called the reference standard process model for agriculture – RSPMA. Its first version presented in the paper is defined on the level of concepts, relations between them and a list of processes. We believe RSPMA will bring benefits for several target groups: government, farm managers, various workers on farms, agricultural consultants, students, and product managers in software companies that develop software or IoT systems for agriculture.

The adoption and use of RSPMA should be supported by using a structured and well-designed web-based portal with appropriate functionalities. In our opinion, the web-based portal is more efficient tool for reading and learning than a book or PDF file. For that reason, we introduce the key concepts of a portal to support the use of RSPMA, organisational structure of bodies of experts needed to achieve the progress of RSPMA and a process to support further development and advancement of RSPMA.

The paper is structured as follows. Section 2 presents RSPMA through the introduction of conceptual model of RSPMA, target groups to use RSPMA and processes defined. Section 3 describes the concept of portal to support the use of RSPMA from the technical point of view and the organisational point of view. Section 4 provides discussion and conclusions.

2 THE INTRODUCTION OF RSPMA

The idea for RSPMA emerged during the execution of a large EU-funded project AgroIT which covered the digitalisation of farming. The aim of the project was to integrate several software products through a cloud-based platform. During the analysis phase of the project, it became apparent that the software companies held different and unequal knowledge/understanding of agricultural processes, their activities and metrics. In the project finalisation phase, the idea of defining a reference standard process model for agriculture emerged.

In general, a reference standard process model is a generic abstract process representation based on a small number of unifying concepts that can be used as a baseline when defining, adapting and evaluating own processes [1, 2, 10, 11, 12]. Well-designed reference standard process models represent a blueprint of generally accepted best practices, i.e. a reusable and efficient business process upon which organisations can design their own process [3, 15, 16, 17].

RSPMA is designed and built based on various foundations. First and foremost, the COBIT mission and concepts [9, 13, 14] to create a standardised reference process model for a particular area, in our case agriculture. Any COBIT concept used is tailored to a structure suitable for agriculture. Additional concepts have been included based on our confidence in their benefit. Second, the model is triggered by the mentioned diversity of the knowledge/understanding of agricultural processes, activities within them, and process metrics, as identified in the AgroIT project. Third, it is based on the reference process models positive impact on the efficiency and effectiveness of processes that can be significantly improved when processes are defined by considering reference process models [4]. Fourth, it is built on the positive impact of reference process models on the efficiency of the software development [5, 6].

The RSPMA potential of is to facilitate farms to adapt their processes to the best practices or at least to learn and get hints for improvements.

2.1 The Conceptual RSPMA Model

RSPMA conceptual model, its concepts and the relationships between them is presented using the traditional rectangle-arrow technique. In the diagrams below, the titles on arrows show the name of the relationship to understand the meaning of the relationship and thereby the relationship between two concepts. The direction of an arrow indicates the direction to read and

understand the relationship, the concepts and relations between them are explained in the text: the names of concepts and the relationships between them are written in *italics*.

Process is a core RSPMA concept. Processes are grouped into process modules where each process module belongs to a particular area of agriculture. Process grouping is only one view to explain the need to apply modules and modularity in RSPMA. Another view is implied by the fact that agriculture encompasses several areas: livestock breeding, fruit growing, wine making etc. Some process modules are divided into process sub-modules because some areas of agriculture contain several sub-areas. For example, livestock breeding involves cattle breeding, pig breeding, sheep breeding etc. The domain is a concept representing the mission of the process module assigned to a domain and the hierarchical level: governance level, management level and implementation level. Each process module belongs to one of the three domains: Govern and monitor (GM) for the governance level, Plan and Manage (PM) for the management level and Implement and Execute (IE) for the implementation level. Each domain has common module which is common for every area of agriculture. Besides the common module, for each domain there is also a livestock module.

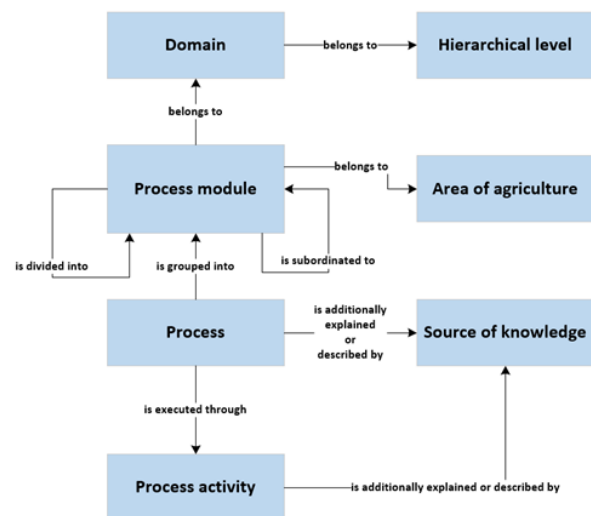


Figure 1: The RSPMA conceptual model

The RSPMA aim is not to prevail over any existing standard or source of knowledge for agriculture, i.e. textbooks, scientific journals, digital libraries, standards etc. RSPMA is defined and structured to have its own content, but also to be open and for several of its concepts it enables a reference to any existing source of knowledge. In the conceptual model, this is shown as follows: the process or process activity is additionally explained or described by the source of knowledge. RSPMA can therefore also be used for educational

purposes. The conceptual model is represented in Figure 1.

2.2 Target Groups

RSPMA is designed to support several target groups in agriculture where each of them benefits from using it. These are: product managers in software companies, managers and owners of big farms, consultants for agriculture, experts in agriculture, students and governments.

Product managers in software companies developing software products and IoT systems for agriculture will improve the scope of functionalities of their products. Namely, each RSPMA process is described with the following components: process goals, process metrics, KPIs (Key Performance Indicators) and process activities. RSPMA can therefore become a guideline for product managers when defining the functionalities of their products. Also, the integrations between various software products and IoT systems will become more straightforward if product managers of various software products base the functionalities on RSPMA.

For managers and owners of big farms, RSPMA will provide the best practice guidelines for the processes and activities on farms, because the knowledge and experience held by agricultural experts and academics would be gradually transferred to RSPMA to introduce best practices for agriculture. Also, the metrics and KPIs defined for the processes can help managers set goals, perform monitoring, lower the risks, identifying gaps in the process execution and monitoring and help them avoid or remove such gaps. Using RSPMA managers would also be better prepared for any auditing. Auditors and creditors would have a greater trust when a particular audited farm is RSPMA compliant.

Consultants for agriculture can use RSPMA as a knowledge base for their work. RSPMA is meant to be a hub where through the view of the standard process model provides links to other sources. It is designed to be open to any other source, standard, guideline: in general, i.e. any source of knowledge. As such, RSPMA represents a gateway to other relevant knowledge sources [7, 8]. If product managers and consultants for agriculture use the RSPMA, we may expect consultants will find it by default easier to become familiar with software products whose development is based on RSPMA. RSPMA will also be a good option for experts in agriculture and for students for the learning and knowledge improvement.

Governments and ministries responsible for agriculture would also benefit from RSPMA. By spreading the use of RSPMA compliant software products and electronic reporting of data based on RSPMA process parameters, governments can perform various analyses to adopt better policies for agriculture.

2.3 RSPMA Processes

Each RSPMA process is described with the following attributes: process acronym, process name, process description, process goals, process metrics, KPIs (Key Performance Indicators) and process activities. Due to the RSPMA openness, for each process and all its attributes there are one or several links to the related sources of knowledge (books, scientific papers, relevant web sites, etc.) which provide additional information. In the current stage of our research on RSPMA, processes are defined only for the livestock process module. Lists of the selected processes per process module are introduced below:

- **Govern and monitor (GM) – Common Module (CM):** Define and maintain strategy (GM.01), Ensure profitability (GM.02), Ensure risk governance (GM.03), Ensure machinery and equipment governance (GM.04), Ensure IT and innovation governance (GM.05), Ensure compliance with legislation (GM.06), Enable external and internal control (GM.07), Manage and monitor process definition and change (GM.08),
- **Plan and Manage (PM) – Common Module (CM):** Manage budget and costs (PM.CM.02), Manage risks (PM.CM.04), Manage products sales (PM.CM.07), Manage agricultural machinery (PM.CM.14), Manage IT (PM.CM.16), Manage information system (PM.CM.17), Manage changes based on legislation demands (PM.CM.22), Manage changes based on IT and innovation (PM.CM.25),
- **Plan and Manage (PM) – Livestock Module (LS):** Manage animal sales (PM.LS.01), Manage animal purchases (PM.LS.02), Manage animals health and veterinary service (PM.LS.03), Manage animal welfare (PM.LS.04), Manage hygiene (PM.LS.05), Manage animal feeding and grazing (PM.LS.06), Manage animal reproduction (PM.LS.07), Manage animal breeding plan (PM.LS.08),
- **Implement and Execute (IE) – Common Module (CM):** Perform internal control (IE.CM.01), Perform farm accounting (IE.CM.02), Perform maintenance of buildings (IE.CM.03), Perform employment and other human resource issues (IE.CM.04), Perform product sales (IE.CM.05), Perform purchases of equipment (IE.CM.06), Perform purchases of agricultural machinery (IE.CM.07), Perform asset maintenance (IE.CM.09), Perform purchases (IE.CM.10),
- **Implement and Execute (IE) – Livestock Module (LS):** Perform animal feeding (IE.LS.01), Perform animal movements and grazing (IE.LS.02), Perform animal health checking and health treatment (IE.LS.03), Perform animal sales (IE.LS.04), Perform animal

purchases (IE.LS.05), Perform animal selection (IE.LS.06), Perform animal reproduction (IE.LS.07).

Each process has a structured code with dot-separated parts. The first part represents the domain. The GM domain does not have process modules and for that reason the GM code is followed by a dot and a number. Other domains have process modules defined, and the codes of the process modules follow the code of the domain. The last part of a structured code is always a number.

3 THE PORTAL TO SUPPORT THE USE OF RSPMA

The use of RSPMA has three stages: reading the content, learning from a content and applying changes. Reading and learning from a book or PDF file is less efficient than using a structured well-designed portal with appropriate functionalities. In our opinion, a web-based portal is the most efficient tool for reading and learning. A portal which presents a lot of content needs well-defined processes to support a further development and advancement of RSPMA and well-defined organisational structure of the bodies which take part in those processes.

3.1 Organisational Structure

RSPMA is a standard process model and as such it is a living organism where the first edition is only the beginning of the path of changes, improvements and extensions. For that reason, an organisational structure of bodies of experts is needed to achieve the RSPMA progress. Agriculture is a broad area with characteristics that apply to the whole world on the one hand, and on the other hand there are also characteristics that are locally specific either for the whole country or for a part of it. Consequently, the bodies should be defined first on the international level. The bodies on the international level are responsible for the core of the process definitions, while the bodies on the country level are responsible for locally specifics of processes definitions. Figure 2 shows a schema for the proposed organisational structure. The body for the common modules is responsible for the progress of the common modules. In general, the modules have less specifics on a country level, while other bodies (the body for livestock, the body for fruit growing, etc.) have more specifics on the country level.

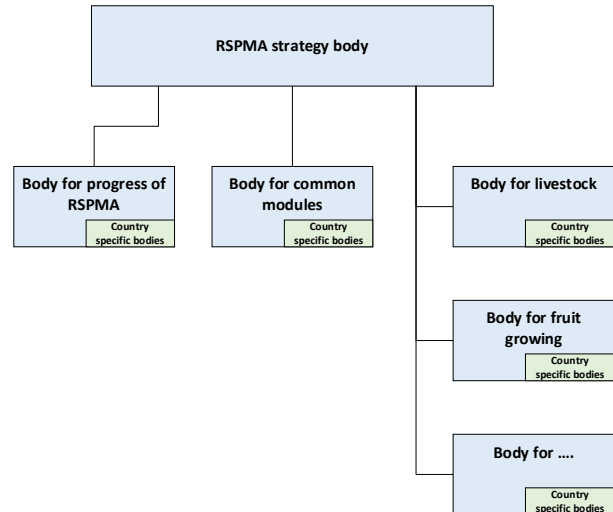


Figure 2: Schema of the organisational structure

The RSPMA strategy body defines the strategy and strategic directions of the RSPMA development. The members of the body are prominent experts and researchers from all over the world. The body for the RSPMA progress manages the progress and advancements of RSPMA based on strategy and strategic directions defined by the RSPMA strategy body. This body also coordinates the activities of other bodies. The schema of organisational structure is represented in Figure 2.

3.2 Process to Support a Further Development and Advancement of RSPMA

Adding a new content or making changes to an existing one does not mean that the content entered will be shown on the portal right away. The steps to be taken prior to adopting new or changed content are shown on the portal.

The content entry is performed by international level bodies and country specific bodies. At a particular milestone or at a certain frequency, the content to evaluate and review is being selected based on priorities and the policy of the RSPMA strategy body. After the selection, the content evaluation and review are performed by international level bodies and country specific bodies. Finally, changes and new content are being approved by the RSPMA strategy body based on proposals of other bodies. After being approved, the changes and new content are published on the portal and from that point they are visible to the users of the portal. The schema of the process is shown in Figure 3.

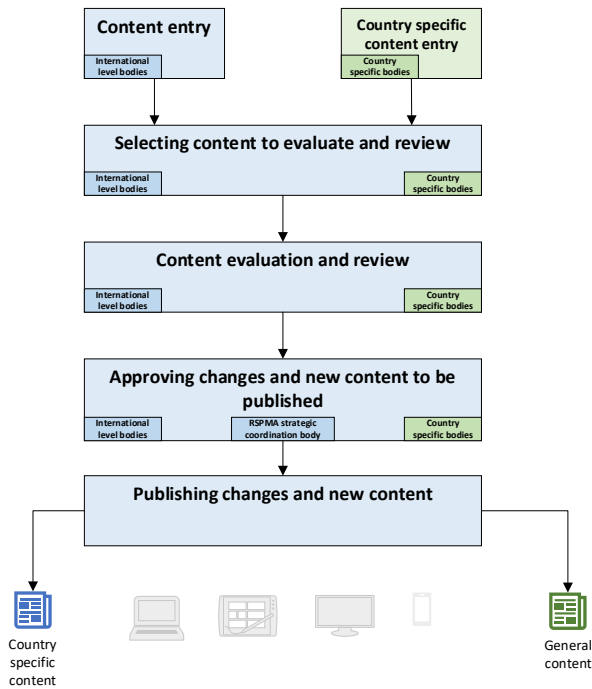


Figure 3: The schema of the process to support further development and advancement of RSPMA

3.3 RSPMA Portal Architecture and Module Structure

The architecture of the RSPMA portal is a standard three tier architecture: database server, backend server and client. The database server is responsible for the data, the backend server for the business logic and the client for the user interface. RSPMA can be accessed on various types of clients: smart phone, tablet, notebook or desktop. The schema of architecture is shown in Figure 4.

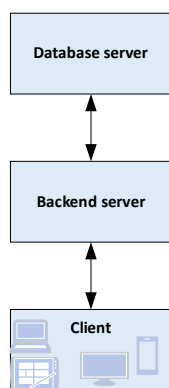


Figure 4: The schema of RSPMA portal architecture

The concept and content of the portal do not require any specific technologies, so the portal can be developed in technologies chosen by developers.

The RSPMA module structure to a high extent reflects the already introduced target groups and the organisational structure. The content maintenance module is used by the introduced bodies to maintain the

RSPMA content. The module enables the interface and is used in various languages. On the other hand, module also supports the workflow to support the process to support the further development and advancement of RSPMA. The administration module supports the maintenance of users, user groups, roles and functionalities for administration of multi-language use of the portal. The non-registered user module supports the basic content-browsing functionalities, on the other hand registered user module supports a wide range of functionalities with links to other sources of knowledge which enable learning and finding assistance for work on farms. Students module also has a wide range of functionalities, but it is a separate module due to the free access granted to students. The government module enables the government analysts and other experts to use the portal. The schema of the module structure is shown in Figure 5.

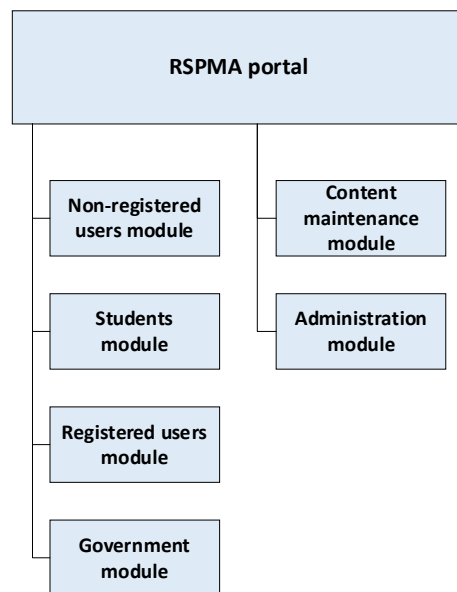


Figure 5: Schema of the RSPMA portal module structure

4 DISCUSSION

RSPMA presented in the paper is in its early stages of development leaving space for potential changes and improvements. For example, the list of the defined processes is quite extensive and some processes can be merged without losing sight of their mission and goals, for example: Manage IT and Manage information system.

Further, for the structure of the process description, which is based on the presented conceptual model there is also room for changes and improvements. Now, only a process module for livestock is covered by RSPMA. When further modules are added, a new or updated process description structure will probably be needed.

RSPMA can only be properly developed through a large-scale international project involving several teams of experts from different areas of agriculture. The

development of COBIT, for example, has now been going on for almost 20 years and shows that such standard process models are constantly evolving based on the coordinated work of different expert groups and that changes are based on observations and experience of the standard use in practice.

The concepts and characteristics of the portal to support the use of RSPMA are defined based on the initial analysis. There have been no discussions and workshops with the representatives of the target groups. We expect that such discussions and workshops will be performed during next stages of our research.

5 CONCLUSION

We presented the current stage of our research on RSPMA. We believe that RSPMA has the potential for implementation in agriculture. The idea for the RSPMA emerged in the final stages of a large-scale EU-funded project, where several software companies had diverse and unequal knowledge/understanding of agricultural processes, activities within agricultural processes, and process metrics. RSPMA is at present stage presented on the level of concepts, the relations between them, and a list of processes, and is accordingly not yet ready for the pilot use in practice. We believe that the use of RSPMA in practice should be accompanied with portal which will be used by various target groups. Besides, the organisational structure of several bodies should be established and process to support the further development of RSPMA should be defined. Preliminary ideas for organisational structure and process are introduced in the paper.

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