Detail REA Production Planning Model Including Overhead Costs

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Abstract. This paper designs advancement how to generate entities at the policy level in the context of the REA production planning model. To work out this challenge, controlling and controlled REA process models are introduced and delineated. Proposed solution not only helps to clear up relationships between different REA process models but also contributes to direct integration of overhead costs into REA model. Introducing this construction can be beneficial both for automatic generation of entities at the policy level and for overhead costs that are mostly neglected for the direct economic calculations. Design approach is demonstrated on attached figures of the REA production planning model.

Keywords: REA process model, overhead costs, controlling and controlled process

1 Introduction

A Value Chain concept, developed and introduced by Michael Porter (1985) can be arranged as a series of input-output processes with resource flows between them (see [4]) and thus used as a REA value chain. Input-output processes are modeled as REA exchange or conversion process models. A fundamental notion in value chain analysis is that a product gains value as it passes through a stream of production within the firm. Examining this construction in a detail way we can find out several principal features that are applied for this notation:

- only resources can flow between different REA models;
- entity flow between different REA models can only be done at the operational level of the REA models; policy level of the REA models does not have this possibility;
- while inside the REA model there is a relationship *resource-decrement event-increment event resource*, outside the REA model there is a direct relationship *resource-resource*;
- both a REA model that *provides* a resource and a REA model that *receives* a resource are semantically on the same level, their relationship can be denoted as peer-to-peer relationship.

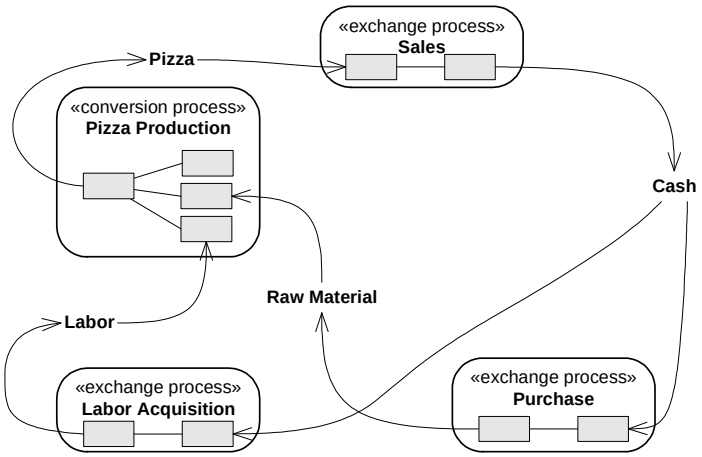

Fig. 1 Simple value chain of REA models
Source: [5]

A simple value chain of REA models of conversion and exchange processes is illustrated in Fig. 1 Only a flow of resources between different REA models can be modeled by this construction. However, a REA model is not only consisted of operational level but contains a policy level too. The difference between both levels can be shortly described as follows. At the operational level the model records the day-to-day events of the domain. At the policy level the model records the general rules that govern this structure. Instances of the policy level govern the configuration of the instances at the operational level.

To model a given domain, e.g. production planning, there is a need to introduce some relationships and notions that allow to influence the entities at the policy level too. At the operational level there is only *inflow* and *outflow* relationship between REA models. There is a challenge how to generate such entities as *Schedule* or *Contract* at the policy level.

Entities in the REA model are color coded, green color for operation level entities, pink color for planning entities at the policy level and yellow color for control entities (knowledge intensive description, validation rules, targets description). At the policy level two different types of entities are recognized and it has its real reason.

2 Closer Look at Contract and Schedule Entities

Both *Contract* and *Schedule* entities are related by a *clause* relationship to decrement/increment Commitments entities. *Contract* entity is used in the REA exchange process and specifies in the REA model what should happen if the commitments are unfulfilled. *Schedule* entity is utilized in the REA conversion process and specifies conversion processes that should occur in future. Their relationship to Commitment entities can roughly resemble a resource relationship to

events at the operational level. Resource used to be connected with something material (physical). *Contract* or *Schedule* represents rather "resource knowledge". However, inner structure of the *Contract* or *Schedule* differs from the inner structure of the *Resource*.

3 Controlling and Controlled Process

From the previous description follows that there is no relationship between operation level of one REA model and policy level of the other (neighboring) REA model. From the real example, one REA model can produce a resource that should be used as an entity at the policy level of another REA model. To overcome this gap we introduce two new notions of the REA models and one relationship between them.

A REA model that produces at its operational level a resource that should be reflected (outflow) into an entity at the policy level of another REA model is called *controlling REA model*. Vise versa the REA model that consumes (inflow) the resource from the controlling REA model into an entity at its policy level is noted as *controlled REA model*.

The reason for this notion is to distinguish from the standard relationship between REA models at operational level. In the proposed solution both REA models are related by a *reflection* relationship. This is a newly introduced relation that enables binding between a resource at the operation level of the *controlling REA model* and an entity at the policy level of the *controlled REA model*. There is a need to recognize these processes for a number of reasons:

- character of the resource produced by controlling process is rather a "knowledge" resource;
- *reflection* relationship causes that the resource is reflected from the operational level of the controlling process into an entity of the controlled process at its policy level.

Fig. 2 schematically presents the structure of both models.

4 Overhead Costs

Presented procedure fulfills only the first part of the challenge. The second part is a challenge how to introduce direct overhead costs into a REA model. By this we mean consumption of resources that were consumed or used in order to create outflowing resource from the controlling process. Generally, overhead costs could include e.g. planning documents, technological standards, norms and so on. They have not been employed yet. Overhead costs can be worked out only at the operational level of the REA model and have the character of a resource. The resource that would be used (consumed) during the process on the operational level could have some common properties with the other instances of the resource for subsequent processes. The final question is how these resources would be created (generated). These requirements can

be solved by a typification relationship between the entity that was created by reflection and the resource representing e.g. Schedule knowledge. This solution would fulfill all the requirements.

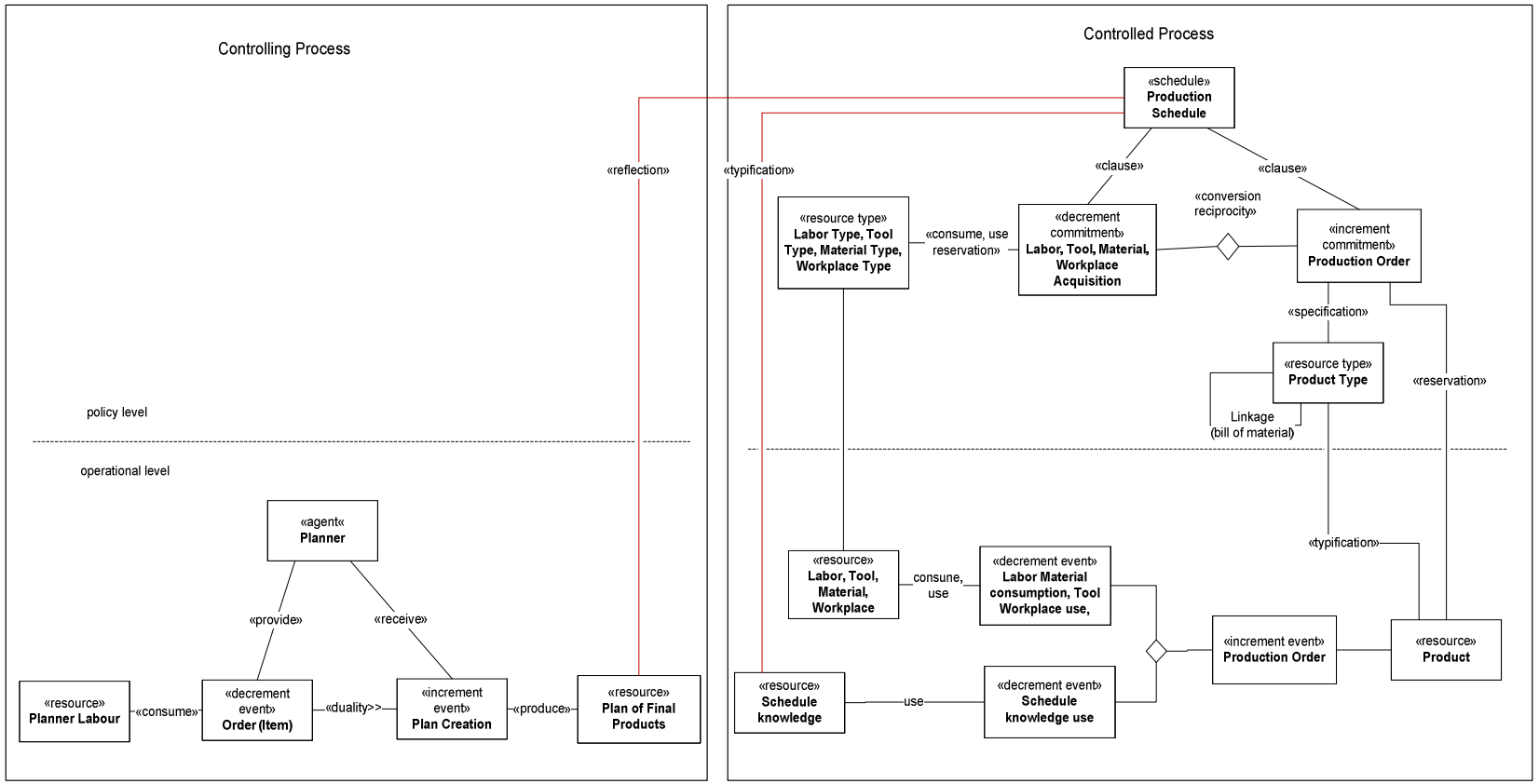

Fig 2. Schematic illustration of the Controlling and Controlled processes

5 Discussion of the Proposed Solution

Generally, entities at the policy level of the REA model govern the configuration of the entities (instances) at the operational level. Their role is in that context very important. However, current REA models were analyzed in the view of the value chains at the operational level. In practice application e.g. production planning model questions concerning planning documents and other "knowledge resources" come into foreground. This information should be worked out in the form of resources and transformed into entities at the policy level of the subsequent process. The first challenge the paper is dealing with is finding the way how to transform a resource of one process (controlling one) into an entity at the policy level of the other (controlled) process. Both processes are related with a reflection relationship. Proposed solution comes out from the REA ontology and takes into account all entities structure and relationships among them.

Closely connected with the first challenge there is a second one the overhead costs that are worth direct modeling but used to be neglected in the currents models. Introducing a typification relationship between the entity that was reflected at the policy level and a resource representing "knowledge" could enable to include directly these costs into the model.

6 Conclusion

The REA framework has a large potential for modeling business applications. The paper pursues to describe the way how to utilize these possibilities for more precise business models. The whole applications can be modeled in the form of value chains of the more specified processes. The benefit of the value chains structure is that it gives unique overall structure of the business application and that single processes in the value chains can be further specialized. Newly introduced and delineated notions of controlling and controlled processes related by a reflection relationship subsequently enable not only generation of entities at the policy level of the REA models but also facilitate direct overhead costs calculations too. Proposed changes of the REA framework extend its utilization in the practice.

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