CHURCH/SMITH REA FRAMEWORK:
CLOSING THE LOOP AND INTEGRATING UNCERTAINTY

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Extended Abstract

The REA framework reflects enterprise economic activity but does not directly address the management activity related to control processes. The REA framework offers type images as the vehicle for modeling organizational policy, such as budgets, bills of material or pricing policies (Geerts and McCarthy 2001b, 2003). The REA type image structure does not, however, describe the managerial processes and control structures necessary to plan, link, communicate, or learn from type-level information. For example, REA policy type images can apply internal controls, such as segregation of duties, to operational level economic activity (Geerts and McCarthy 2003), but the REA policy infrastructure does not address how the internal control is established or who is responsible for monitoring its effectiveness. (Church/Smith 2007, 11).
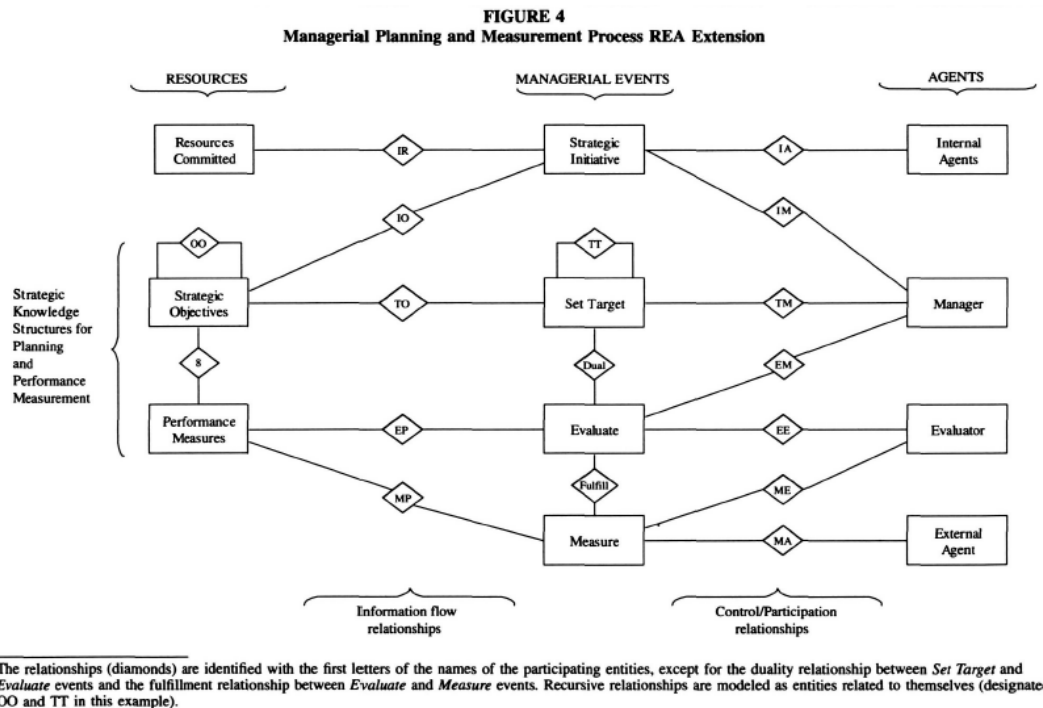
FIGURE 4
Managerial Planning and Measurement Process REA Extension

The relationships (diamonds) are identified with the first letters of the names of the participating entities, except for the duality relationship between *Set Target* and *Evaluate* events and the fulfillment relationship between *Evaluate* and *Measure* events. Recursive relationships are modeled as entities related to themselves (designated OO and TT in this example).

Figure 1: Church/Smith REA Framework (Church/Smith 2007, 17)

Geerts and McCarthy (2002, 2005) describe type images and the associations between type images as creating a policy-level infrastructure, which specifies the economic phenomena that could, should, or must occur. Through a series of examples, they restrict the type image structure to issues of operational control and traditional budget planning. We suggest a broader interpretation of a policy-level infrastructure that incorporates strategic management structures, such as balanced scorecard perspective, strategic initiatives, and strategic objectives as type images. These structures clearly specify the economic phenomena that should occur. Policy-level associations among these type images support causal linkages across balance scorecard perspectives. Management events create and use these policy-level structures, which control the firm's economic activities, according to the firm's strategy. (Church/Smith 2007, 16).

In Figure 1 the additional elements in the policy infrastructure of the Church/Smith REA framework can be seen by

- the informational resources (*resources committed*, *strategic objectives* and *performance measures*),

- the managerial events, which relate to the planning activities (*strategic initiative* and *set target*) and to the control activities (*evaluate* and *measure*) and

- the specific internal agents (*manager* and *evaluator*).

The Church/Smith REA framework specifies the policy-level so that not only operational planning and control process as well as budgeting processes but also strategic planning and control processes can be modeled. The framework explicitly models the informational requirements related to the Balanced Scorecard concept developed by Kaplan and Norton (1996) so that it supports not only the design of accounting information systems but also the design of strategic and operational management information systems.

Although its important extensions with respect to the informational requirements of operational and strategic management systems the Church/Smith REA framework is still incomplete concerning the different types of management systems and the inclusion of the uncertainty, which nowadays characterizes any business environment.
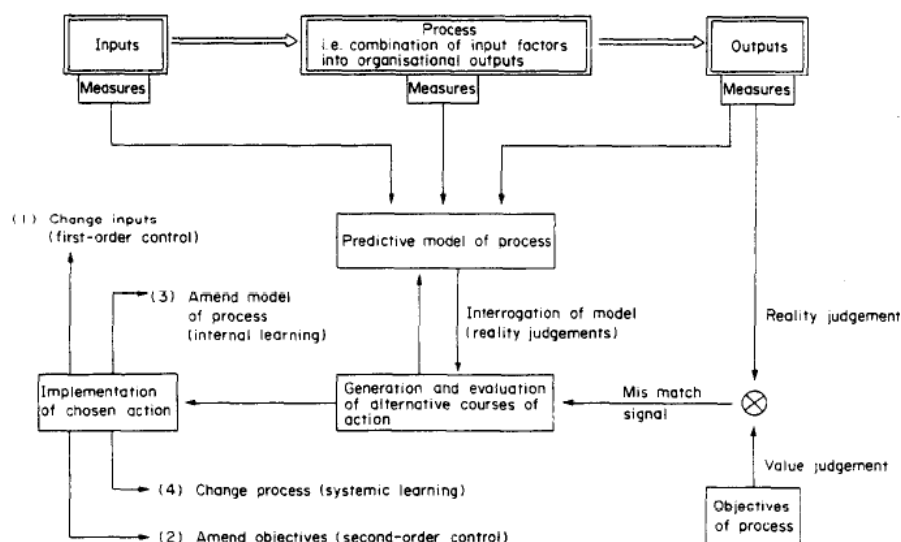

Fig. 2. Outline scheme of necessary conditions for a controlled process.

Figure 2: Categorization of Control Types (Otley/Berry, 1980, 236)

The control activities specified as managerial events relate to the measurement and the evaluation of the performance of the controlled (managed) systems. To make the REA framework compatible with the management control literature the control activities have to be distinguished between *check* activities and *act* activities. In the evaluation activity the measured actual performance is compared with the target value so that it constitutes a check activity. The corresponding act activity is not explicitly addressed in the Church/Smith REA framework. Otley and Berry (1980) distinguish – as can be seen in Figure 2 – four different types of control

- first- order control, which relates to changes in the process input,

- second-order control, which relates to changes of the objectives,

- internal learning, which relates to changes of the process model, and

- systemic learning, which relates to changes of the overall process itself.

In order to complete the Church/Smith REA framework with respect to the act activities the different types of acting are explicitly included in the framework. Being able to modeling different types of management systems UML activity diagrams are used. In these *management activity diagrams* the managerial events are modeled as activities and the informational resources and involved agents are modeled as objects.

The second shortcoming of the Church/Smith REA framework – dealing with the business environments' uncertainties – is addressed with the key concept of finance. In the option pricing literature the uncertainty of the future price developments is modeled as a stochastic process. Figure 3 shows the pricing of a stock put option with the binomial tree model introduced by Cox/Ross/Rubinstein (1979). There the stochastic developments of the prices of the underlying stock can be seen in the upper most values in each node. The second (third) values are the related put option prices (deltas). The stochastic process and stochastic calculus theory from the option pricing theory is introduced in the Church/Smith REA framework in form of *probabilistic event types*, which specify the different potential future developments of the controlled (managed) systems.
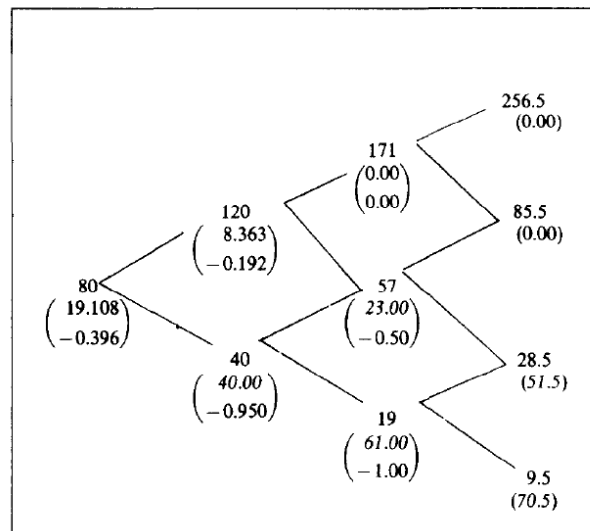

Table 3

Figure 3: Binomial Tree-based Put Option Pricing (Cox/Ross/Rubinstein 1979, 261)

The explicit specification of the act activities closes the management loops in the Church/Smith REA framework, so that it can be applied to all kinds of management systems (e.g. single closed loop, single open loop, double closed loop and double open loop). The explicit inclusion of the probabilistic event types allows the rational planning and control under uncertainty, which characterizes nowadays any business environment (e.g. rational sales planning, rational production planning, rational mainte-

nance planning and rational customer satisfaction planning). The benefiters of the extended Church/Smith REA framework are the same as for the original framework, i.e. *organizations that are implementing* accounting as well as operational and strategic management information *systems and the systems developers that assist them* (Church/Smith 2007, 23). Its main strength is now the completeness also with respect to the act activities and the business environment uncertainty, which allows more realistic and flexible designs and implementation of accounting and management information systems.

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