



The Power To Change

The Reality Reflection Model

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INTRODUCTION

Project Background: In October of 1999, MetaPower, LLC was contracted by the Tennessee Valley Authority (TVA) to perform a current assessment that would determine the feasibility of creating an Information Architecture Infrastructure for the processes and systems of their Chief Operating Officer (COO) division. By January of 2000, TVA, with the assistance of MetaPower, had determined that a radically new paradigm of knowledge management would be needed in order to achieve the vision of an Information Architecture Infrastructure. That paradigm shift would begin with the TVA-COO Document Management Program Design. This paper recounts the fundamental thoughts and ideas that served as the basis for that Document Management Program.

HISTORICAL PERSPECTIVE

Wealth (and thus, power) has been defined by different entities during different periods of history. Prior to the Industrial Revolution, power was almost entirely determined by land. During the Industrial Age, capital surpassed land as the most significant factor. Now, in the Information Age, data is being heralded as the new definition of wealth. Nevertheless, power in the Information Age is more than just raw data. It is knowledge, or "the right information, at the right time, in the right amount." This last statement best represents the essence of what TVA wished to accomplish as the Document Management Program Design (DMP) began. However, as the employer of over 13,000 individuals, TVA has hundreds (if not thousands) of document types, and millions of documents dating back to the early 1930s. How, in light of these seemingly impossible obstacles, can a Document Management Program consistently provide "the right information, at the right time, in the right amount"?

INITIAL PHILISOPHICAL DISCUSSIONS

In order to achieve radical change, our team facilitated "out of the box" thinking by discussing document management in extremely abstract terms, and by posing to ourselves metaphysical questions related to documentation. The following list of questions and corresponding answers chronicles our thought processes over several weeks:

Can a document ever be real?

No. It is true, the paper, the floppy disk, the hard drive computer file, etc., a document is "carried on" (i.e., written on) is real. Nevertheless, it is the entity being described within that document, not the document itself, which is real.

Then, what is a document?

A document is a reflection of reality.



What is the purpose of documentation?

1. To facilitate communication, and
2. To capture history and/or audit trails (i.e., in anticipation of the "Messy World") .

HOW SHOULD DOCUMENTS BE CONTROLLED?

Document management is not achieved by controlling documents. Rather, one must control changes to reality, and then synchronize documentation to the "new" or "updated" reality.

INITIAL MISSION STATEMENT

From the above discussions, our team created the following mission statement for the DMP project:

The Document Management Program must provide accurate, relevant and accessible documents (i.e., reflections of reality). In regard to accuracy, documents must be as precise as demanded by external regulations and/or by internal safety/quality assurance guidelines. Concerning relevancy, documents must reflect an appropriate level of reality while being as cost effective as possible. Pertaining to accessibility, documents must be appropriately archived meeting necessary internal endurance standards while meeting all external regulatory retention requirements. As well, document management must allow appropriate access for users, while adhering to enforceable security measures.

CYCLICAL ARGUMENTS

As our team moved forward into the Document Management Program design phase, we began to notice certain recurring and/or cyclical arguments emerge. For example, while we had come to the conclusion that "a document was a reflection of reality", we had not clearly defined the terms document, reflection, or reality. When our team used the term reality, were we referring to configuration management, or to something more? Did reflection mean record, or document, or both? Did it matter what media a document was "carried on" (i.e., paper, disk, CD, etc.)? Another issue that arose centered on the question: Does reality control procedure, or vice versa? After a period of struggling with questions such as these mentioned here, it became clear that our DMP design required a "scientific model" that would serve as a foundation for the project. That foundation would become know as the Reality/Reflection Model.



THE REALITY/REFLECTION MODEL-INTRODUCTION

The crux of the Reality/Reflection Model is the assumption that any attempt to manage a business by controlling documentation will ultimately be ineffective. The reason is simple: documents are not reality. Control must first be placed on reality, not on the reflections of reality. By considering the following example, the core of the Model can be appreciated. Imagine an individual, T, looking at his own movements in a mirror. If another individual, S, wanted to control the movements of T, would she attempt to control individual T or his reflection? The answer is so obvious as to seem frivolous. Nevertheless, this example demonstrates the futility of a document management program that does not appropriately address reality.

To better understand the Reality/Reflection paradigm, we need to look more closely at the following five features of the Model:

1. Reality Defined
2. Types of Reflection
3. The Purpose of Documents
4. The Purpose of Controls
5. Axioms of the Model

THE MODEL PART ONE - REALITY DEFINED

Tangible vs. Intangible: For obvious reasons, the first step must be to define reality. Reality can be thought of as everything that is, divided into two distinct categories: tangible and intangible. Our team was extremely comfortable with the former, that is, tangible reality. Examples of tangible reality from the electric utility industry include a valve, a pump, a generator, etc. The latter category of reality, intangible reality, is somewhat more complicated, but just as real, and equally important. To better illustrate intangible reality, let us consider the following analogy. John Q. Public has come up with an idea for the next great widget. His first order of business is to document his thoughts in the form of a blueprint. John now uses his blueprint to create his widget. While seemingly simple, let us further examine this analogy by asking the question: What is "real" in this situation? From the above discussion, we know that the widget is "real" (tangible reality), and that the blueprint is not "real" (a document is a reflection of reality). However, this raises two important, and related questions:

1. Where does John's original idea fit into this model?
2. The blueprint is a reflection of what? (It exists before the widget is created).

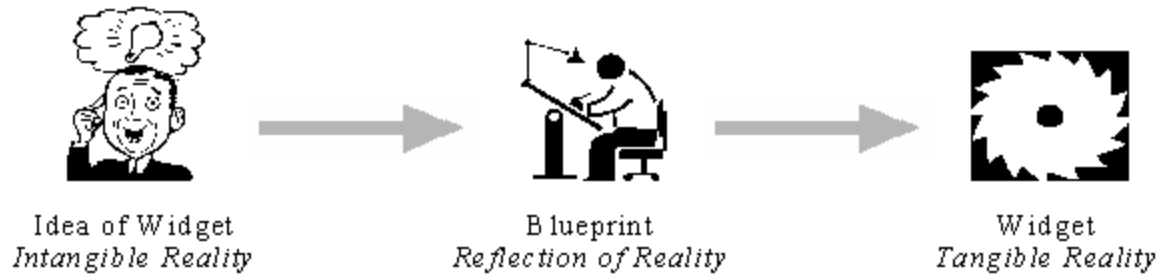


Figure 1 - The Invention Analogy

As Figure 1 shows, John's original idea (that which the blueprint is reflecting) is an example of the second type of reality, intangible reality. Other examples include philosophy and political ideology. Within the electric utility industry, the ideas, thoughts, discussions, etc. behind a procedure or a new design are instances of intangible reality.

"Snapshot" vs. "Continuum"

Within this model, reality may also be categorized using the dimension of time. In order to comprehend, and/or discuss the reality around us, humans can consider reality at one moment in time, and thus, take a "snapshot" of reality, or they may regard a period of time (i.e., history), and observe "continuum" reality. It is important to understand that both tangible and intangible reality can be contemplated in terms of a "snapshot" and/or a "continuum" time frame. below, Figure 2 examines generic examples of tangible (Pump X) and intangible (Procedure Z) reality from both "snapshot" and "continuum" reality perspectives.



	Tangible Reality	Intangible Reality
"Snapshot" Reality	At time = 0, Pump X consists of: Valve A Pipe B Pipe C Meter D Reflected in Document X - Rev 0	At time = 0, Procedure Z states: When Q occurs, Do R Reflected in Document Y - Rev 0
	At time = 1, Pump X consists of: Valve L Pipe B Pipe C Meter D Reflected in Document X - Rev 1	At time = 1, Procedure Z states: When Q or T occurs, Do R Reflected in Document Y - Rev 1
"Continuum" Reality	Period = $0 < t < 1$, Reality Change Y on Pump X: At time = 0, Reality Change is Requested Reality Change Control Status = "Requested" At time = $\frac{1}{4}$, Reality Change is Planned Reality Change Control Status = "Planned" At time = $\frac{1}{2}$, Reality Change is Scheduled Reality Change Control Status = "Scheduled" At time = $\frac{3}{4}$, Reality Change Occurs Reality Change Control Status = "Changed" At time = 1, Reality Change is Approved Reality Change Control Status = "Approved" Reflected in Reality Change - Control Y + Status	Period = $0 < t < 1$, Reality Change N on Procedure Z: At time = 0, Reality Change is Requested Reality Change Control Status = "Requested" At time = $\frac{1}{4}$, Reality Change is Planned Reality Change Control Status = "Planned" At time = $\frac{1}{2}$, Reality Change is Scheduled Reality Change Control Status = "Scheduled" At time = $\frac{3}{4}$, Reality Change Occurs Reality Change Control Status = "Changed" At time = 1, Reality Change is Approved Reality Change Control Status = "Approved" Reflected in Reality Change - Control N + Status

Figure 2 - Reality Matrix

The Model Part II - Types of Reflection

With reality defined, we can now turn our attention to the terms reflection and document. According to our model, a document is a reflection of reality. If reality can be classified as either "snapshot" or "continuum", then there must be two distinct manifestations that correspond to each type of reality, respectively. As shown in Figure 2 above, a moment in time or "snapshot" reality is reflected by a document that is revised, and a period of time or "continuum" reality is reflected by a control that is statused. Examples of controls from the electric utility industry are work orders, purchase orders, etc., while examples of documents include drawings, procedures, etc. At this point, it is important to consider that a reflection, whether a document or a control, can only ever represent "relative truth".

"Relative truth" is the concept that reality can never be reflected or described in its entirety. The reason behind this is simple: any given reality possesses seemingly infinite attributes. First, let us contemplate "snapshot" reality. Consider a typical office chair. It has dimensions such as height and width, physical attributes such as color and texture, measurements such as weight, chemical attributes such as elements present, atomic properties such as the magnetic spin of any given electron at any given time, etc. Perhaps, this dialogue seems trivial. Nevertheless, it is crucial to appreciate that a document has the ability to reflect only the "relative truth" of reality. It is also important to consider that the reflection of "continuum" reality, i.e., a control, is actually a compilation of multiple reflections of "snapshot" reality, and therefore a reflection of "relative truth" reality twice over. In other words, not only is a control

reflecting the "relative truth" of each "snapshot" reality that is included in that control, but also, reflecting the "relative truth" of the period of time being observed. below, Figure 3 shows the entities we have defined and the relationships between them. For the sake of the model, reality has not been broken into its components of tangible, intangible, "snapshot", or "continuum." However, both types of reflections of reality, i.e. a document as a reflection of "snapshot" reality, and a reality change control as a reflection of "continuum" reality have been included.

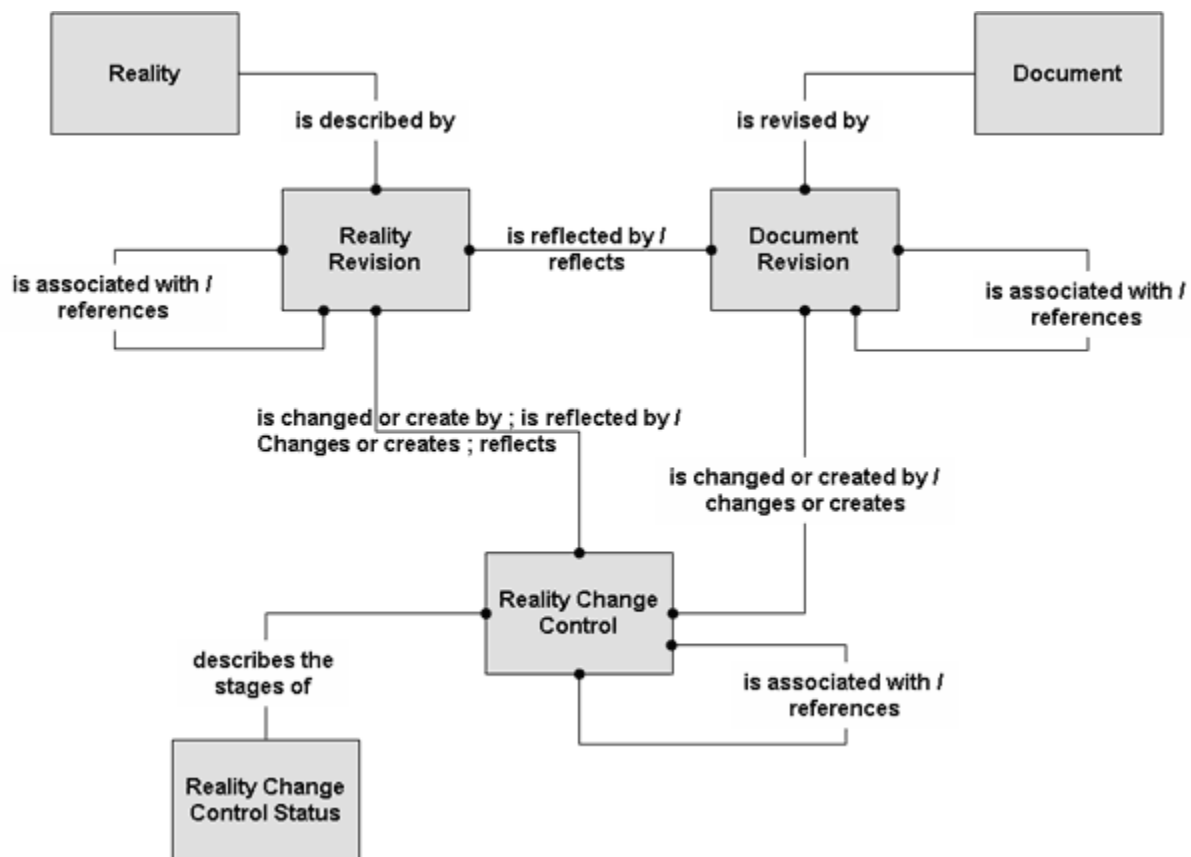


Figure 3 - Logical Entity Relationship Diagram

The Model Part III - The Purpose of Documents

"THE MESSY WORLD" COMMUNICATION

Humans must manage enormous amounts of information, and do not possess enough (mental) memory to remember it all. Hence, we document to insure that important information will be shared, remembered, and/or passed on. Through documentation, ideas, thoughts, facts, events, etc. can be recorded and communicated. Documents allow individuals to obtain information from the past for the purposes of lessons learned, audit inquiries, training, etc. As well, information is much more accessible and enduring (and ultimately, more cost effective) when documented, as opposed to being undocumented and/or within one's mind. Also, when documents regarding the same or similar subjects are

combined, another purpose of documentation becomes apparent: the creation of a(n) history/audit trail. This allows one to view reality over time, to look for and discover patterns, and to attempt to predict the future.

Transformation/Complexity

Referring back to our above mentioned invention analogy, we can understand the last purpose of documentation. John's blueprint allowed a complex and intangible reality, his idea, to be "transformed" into a tangible reality, the widget. The blueprint became a type of transformer.

A Procedure, like a blueprint, also acts as a transformer. The procedure takes the complex and intangible ideas of an individual or group, and "transforms" those concepts into tangible work (See Figure 4).

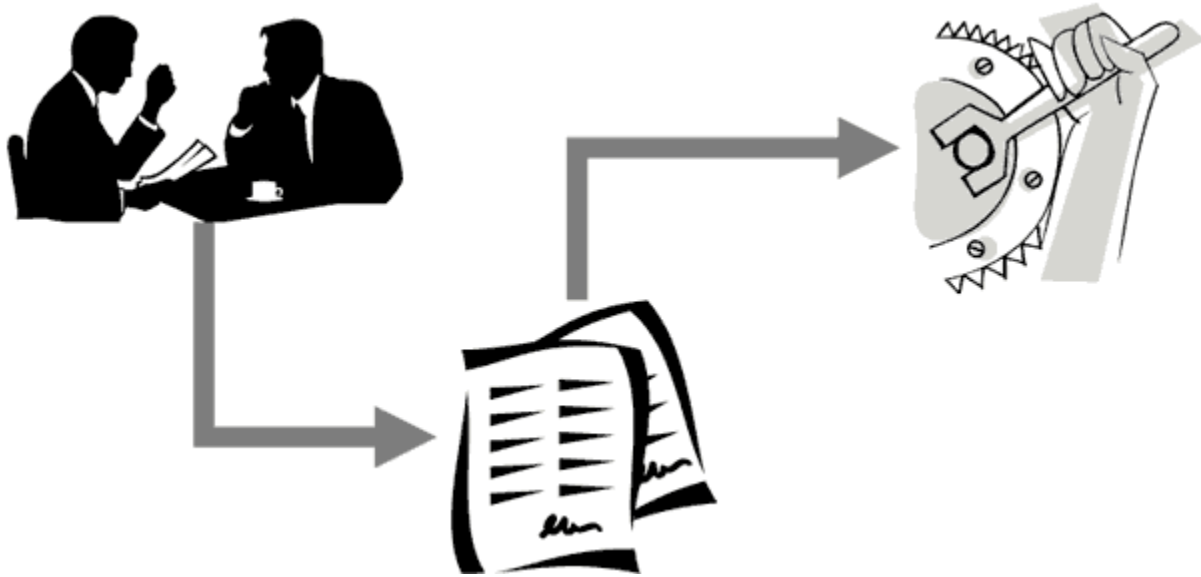


Figure 4 - Document (Procedure) as Transformer

The Model Part IV - The Purpose of Controls

While a control, like a document, reflects a type of reality ("continuum"), it also serves another purpose: it attempts to manage changes to reality, and therefore, the corresponding documents. By creating status requirements at specific points during a reality change, reality, and its documentation, can be monitored and regulated by a control. Thus, controls define the processes of a business.

A control may also manage and/or create other controls. For example, consider Reality Change Y on Pump X from Figure 2 (page 5). Suppose that at $t = _$, as the craftsman changed Valve A to Valve L, he/she discovered that Pipe C had been damaged, and needed to be replaced. A new control (Control H) is initiated to resolve the problem. Control H is created by



and associated with Control Y. Control Y will now reflect a relationship to Control H through the recursive line "is associated with / references" shown in the ERD (See Figure 3, page 7).

The Model Part V - Axioms of the Model

It is now appropriate to summarize the axioms of the model. They are as follows:

1. A document is a reflection of reality.
2. Reality can be both tangible and intangible.
3. Reality can be considered as a moment in time ("snapshot"), or as multiple moments over a period of time ("continuum").
4. A document is revised, and usually reflects "snapshot" reality. Nevertheless, even if a document reflects "continuum" reality (e.g., history), it remains distinct from a control based on their different purposes.
5. A control has statuses, and reflects "continuum" reality. As well, a control monitors and manages changes to reality (directly), and thus, the corresponding document(s) (indirectly).
6. Reality controls documentation (not vice versa).
7. Formal documentation requires appropriate (indirect) control.
8. Document management is not achieved by controlling documents. Rather, one must control change to reality, and then synchronize documents to the "new" or "updated" reality. This process is accomplished through controls.
9. Controls define work processes.

Formal Work Process Infrastructure

Now, having examined the axioms of the model, let us consider the logical conclusion of the Reality/Reflection Model: the Formal Work Process Infrastructure (See Figure 5).

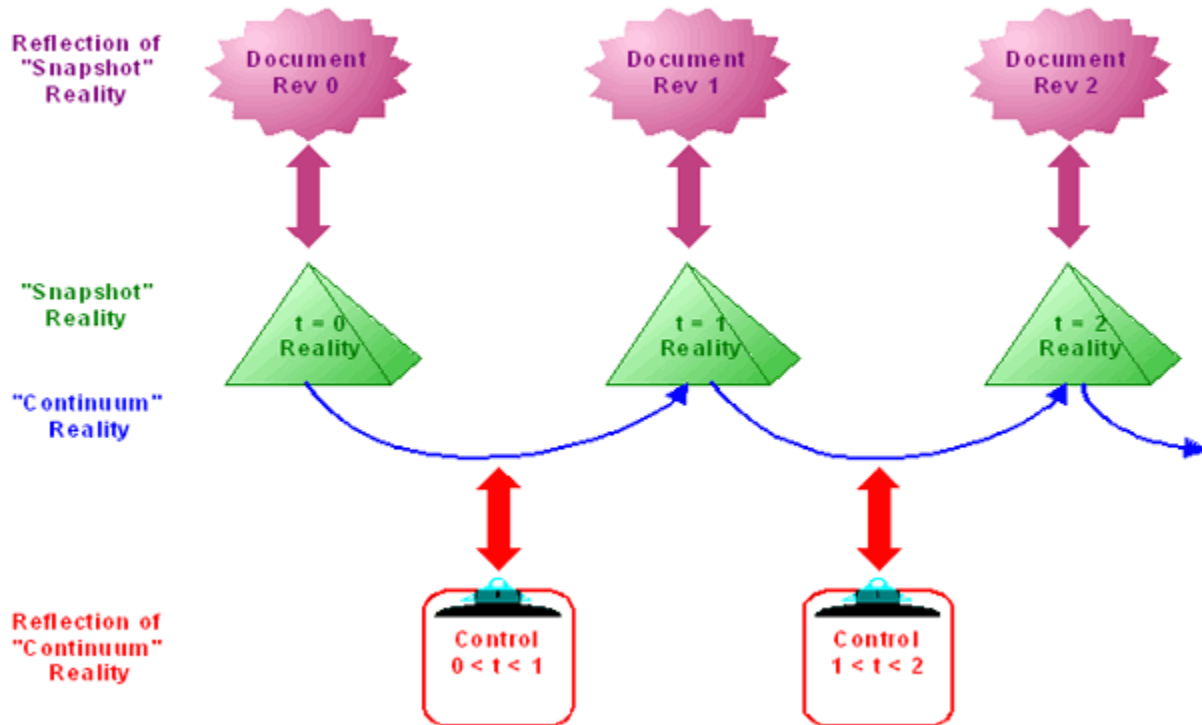


Figure 5 - Formal Work Process Infrastructure

From basic Newtonian Mechanics, we have the formulae,

$$\text{Work} = \text{Force} \times \text{Distance},$$

$$\text{Force} = \text{Mass} \times \text{Acceleration}, \text{ and}$$

$$\text{Distance} = \text{Rate} \times \text{Time}.$$

Therefore, by combining the formulae we have,

$$\text{Work} = \text{Mass} \times \text{Acceleration} \times \text{Rate} \times \text{Time}.$$

In its most basic or fundamental form, work can be thought of as changing reality over time, i.e., changing the state of reality. By "loosely" applying this theory to the equation, we can set,

Mass^a "Snapshot" Reality, and

Acceleration \neq Rate \neq Time^a "Continuum" Reality.

It then follows that

Work = "Snapshot" Reality \neq "Continuum" Reality, or

Work = Rate of Change of "Snapshot" Reality Over Time.

Thus, Document Management, being the reflections of "snapshot" and "continuum" realities (documents and controls, respectively), has the potential to define all the formal work processes of a business. Reality and their reflections together comprise the Formal Work Process Infrastructure (WPI) shown in Figure 5. This model has the potential to be applied to all work processes regardless of the industry being analyzed.

The Power behind the Formal Work Process Infrastructure

Once the Work Process Infrastructure has been fully designed and implemented, the profound and exciting benefits of the model become easily recognized and understood. Below, three such benefits are discussed.

The Assurance that Documentation is Appropriately Controlled

As we have previously stated, the validity of a document, that is, the degree of accuracy a reflection provides of reality, is managed indirectly by a control. A control directly manages changes to reality, and indirectly ensures that the corresponding documentation is appropriately synchronized to the new reality through the creation of a new document revision. In a fully implemented Work Process Infrastructure, all documents, and their respective controls, must be present on the entity relationship diagram. The ERD will quickly illustrate whether or not any given document is appropriately controlled. For example, if a relatively unimportant document is related to four separate controls, the processes most likely contain inappropriate redundancy. Conversely, if an extremely important document is not related to a control, the corresponding work process is probably incomplete.

An End to the Inappropriate Proliferation of Document Types

After the Work Process Infrastructure has been corrected (if necessary) to assure that all documentation is appropriately controlled, the second benefit of the WPI becomes apparent. A common "document management" problem is the vast number of document types often present within one company (or, even within one business unit). The Work Process Infrastructure, combined with a "new document type" request system, enables a business to easily end this unnecessary and inappropriate proliferation. This is accomplished through the previously mentioned "new document type" request system which has the authority to reject document type requests if a duplicate or similar type already exists in the WPI. For example, suppose that plant D (part of company ABC) will soon become operational. In preparation of



that event, plant D has submitted its drawing template as a "new" document type to be added to the Work Process Infrastructure. Company ABC, which owns three other plants, discovers that there are three drawing template document types already within the WPI. Each of these three existing document types, derived from the three operating plants, respectively, are extremely similar to each other, and to the "new" document type being requested. The process now has the ability to reject the "new" document type, and incorporate any new and/or unique information into an existing document type.

Beyond ending "new" document type proliferation, there is also the potential to reduce the existing number of document types by merging document types within the WPI when appropriate. Let us return to our example of company ABC. The "new" document type request of Plant D brought about the discovery that the WPI already contained three extremely similar drawing template document types. It is quite possible, that after studying the situation in more detail, company ABC would choose to merge those three document types into one, and therefore, decrease the total number of document types.

The Power to Quickly and Easily Recognize Change

Perhaps, the most profound benefit of the Work Process Infrastructure originates from the proposed equation work^a change. More specifically, by referring back to Figure 5 (page 11), we see that work^a "snapshot" reality x "continuum" reality. Through the utilization of the WPI, which captures the reflections of "snapshot" and "continuum" reality, a company can define and monitor all formal work processes of the business. Understanding this paradigm, a company then has the power to rapidly and efficiently recognize change within or to the business. Suppose company LMN approves a new document type, O. According to Axiom 7 (formal documentation requires appropriate control) O type documents must have at least one control. If a new control must be created to (indirectly) manage O type documents, then new work has been identified and/or created (refer back to Axiom 9 on page 8). Company LMN must now examine the situation to determine whether or not the work is truly original (i.e., was the work previously done, but not documented and/or controlled?). If the work is found to be new, then it would behoove company LMN to attempt to discern why the processes of the business have changed (e.g., market shift, internal strategy change, new external regulations, etc.). Without the Work Process Infrastructure, changes to the processes of a business are more difficult to identify, and thus, the implications of those changes are slower to be recognized.

CONCLUSION

We are now in the Information Age, where life has become constant and rapid change (work^a change^a life). Therefore, those individuals who can understand change; those who can predict change; those who can best manage change; those who can, at times, even control change; they will become the leaders of this "new world". The data, or information, needed to accomplish this must be managed through a model such as the one proposed in this paper. Hence, Document Management must be transformed from a necessary evil (i.e., "I love my job, but hate the paperwork,") to the power of the Information Age.