

# *Harrington Principles*

## **Introduction**

The purpose of this paper is to document these “Harrington Principles” to illustrate how systems integration is in a state of change. Change is inevitable and progress comes about as you gain new insights ensuring you can manage change.

*“Learning is, in the ultimate analysis, the transfer of experience gained in the past to problems of the present.”<sup>1</sup> Progress is your ability to view current circumstances differently. New perspectives are the catalyst for new frameworks that bend the arc of progress upward.*

Joseph Harrington nascent idea about manufacturing. *“We are entering a third and new mode of manufacturing operations. It is characterized by the fact that every one of the many acts of manufacturing, and every bit of the managerial control of those acts, can be represented by data. Data are generated, transformed, and transmitted. To the ultimate analysis, all of manufacturing is a continuum of data processing. It provides the one base to which all the parts of the process may be related, the one thread which ties all of the parts together.”<sup>2</sup>*

An article in a Production Magazine circa 1980 was an epiphany moment that set my focus to a different Systems Integration Paradigm. The following describes the impact of these Harrington principles that are relevant paradigms for the digital culture.

Kevin Kelly has the perfect insight into understanding the digital evolution. *“The actual path of a raindrop as it does down the valley is unpredictable, but the general direction is inevitable.”*

Harrington was way ahead of the times. The technological foundation is now ready to realize this state of development. While Harrington refers to manufacturing, his ideas are applicable to any enterprise today. Manufacturing with its complexity is the ideal prototyping that supports to this stage.

- *“While the details of manufacturing technology are in a state of rapid evolution, the basic structure of manufacturing is not, and it is important to design the management control systems on this already developed base.”<sup>3</sup>*
- *“The term computer integrated manufacturing does not mean an automated factory. ... new skills are required at the working level and of course in the supervision of the working level”<sup>4</sup>*
- *“...it appears that the day of the specialist is passing. The managers of tomorrow must be multispecialists (not generalists)”<sup>5</sup>*
- *“it is the flow of data rather than the medium of the data flow which is of importance”<sup>6</sup>*

---

<sup>1</sup> Joseph Harrington, Jr., Sc.D., **Computer Integrated Manufacturing**, Robert E. Krieger Publishing Company, Malabar, Florida, 1973, page 1.

<sup>2</sup> Joseph Harrington, **Understanding the Manufacturing Process**, Marcel Dekker, Inc., New York, 1984, page 6.

<sup>3</sup> Computer Integrated Manufacturing – page xii

<sup>4</sup> Computer Integrated Manufacturing - page 6

<sup>5</sup> Ibid

<sup>6</sup> Computer Integrated Manufacturing – page 8

## *Harrington Principles*

### **Harrington Principles**

#### **Principle #1 – Analyzing Behavior**

*"Manufacturing is a science and not an art. As a science, it is subject to analytical procedures, which can identify rules, which govern its behavior. When we understand our profession as a science, we can subject it to well-defined methods of analysis. Having analyzed, we can predict; we can determine what the basic parameters are and how they are measured. When we can measure, we can control; and when we control we succeed!"<sup>7</sup>*

The key point is that any enterprise is a system that is subject to analysis. Thus, you can identify the rules and parameters that govern its behavior. Looking at the DNA of an enterprise is essential to advance viable solutions. The DNA of an enterprise is a composite of its people, offerings (products and services), outcomes, processes, procedures, resources, capacity, policies, and management.

Any nascent endeavor begins as an *art*. Improvements build on understanding and the challenges for optimizing the organism. The breakthrough of this principle was to view manufacturing as a total system with its activities and their relationships to the system. This paradigm shifted our attention from material transformation to coordination of the activities required to fulfill the goals of the enterprise.

**NOTE:** International engagements and experience in other industries reinforce this principle.

#### **Principle #2 – Thruput Systems**

*"Manufacturing is an indivisible, continuous fabric extending from the first conception of a product, through design, production, and distribution, to field maintenance. Although it is a continuum, discrete parts manufacture has an incredibly complex, fine structure of many individual functions, each inextricably connected to and dependent upon every other function."<sup>8</sup>*

Every enterprise is a composite of subsystems that coordinate its various activities to produce an outcome. It is analogous to an organism whose physiology determines the success or failure of the enterprise. It uses inputs and processes to create output value. When you see the processes as thrupt, it shifts how you analyze the behavior. Systems thinking sees the organic enterprise as an entity which is greater than the its parts. Thus, the total system has an inconspicuous dimension whose physiology determine the characteristics of the subject thrupt system.

**NOTE:** This is the essence of all organisms which includes all enterprises.

#### **Principle #3 – Transaction Processes**

*"The principle activity of most of the people in a manufacturing organization is creating, analyzing, transmitting, and managing data and not the actual transformation of material as is generally believed. This questions many accepted beliefs which hold that improvements in productivity and competitive positions lie in new materials, new machinery, new processes, and unique design or research."<sup>9</sup>*

---

<sup>7</sup> Joseph Harrington Jr., Understanding the Manufacturing Process: Key to Successful CAD/CAM Implementation, Marcel Dekker, Inc, New York, 1984, page ix.

<sup>8</sup> Ibid, page 6

<sup>9</sup> Ibid, page 7

## *Harrington Principles*

Thruput requires effective coordination of its activities to achieve results. Systems exchange signals (data) with its environment representing its circumstances. Messages to the environment define actions, whereas feedback from the environment represent conditions. Thruput is subject to critical paths, constraints, and operant variability. Within the flow of activities lies the *Hidden Factory*<sup>10</sup>, that constrains the velocity of thruput. A major illumination came from the Theory of Constraints<sup>11</sup>, a new way of looking at operations management and identifying the thruput bottlenecks.

**NOTE:** The greater the number of variables like the health industry the more critical the need to understand the data transformation.

### **Principle # 4 – Digital Characteristic**

*“We are entering a third and new mode of manufacturing operations. It is characterized by the fact that every one of the many acts of manufacturing, and every bit of the managerial control of those acts, can be represented by data. Data are generated, transformed, and transmitted. To the ultimate analysis, all of manufacturing is a continuum of data processing. It provides the one base to which all the parts of the process may be related, the one thread which ties all of the parts together.”*<sup>12</sup>

The digital age allows simulations, modeling, voice recognition, robotics, new processes (3D Printing), virtual reality, and Artificial Intelligence which is providing an augmentation phase creating new opportunities and possibilities. Paradigms come from an understanding and perspective of any circumstance. The evolution of digital symbols, mathematics manifests ideas into objects that promote understandings and perspectives. Digital characteristics allow metaphors, symbols that simplify complex ideas. *“...it is the flow of data rather than the medium of the data flow which is of importance”*<sup>13</sup> Data analytics are how you understand the behavior of the enterprise.

**NOTE:** Data analysis is the nearest approach to objectivity. Behavior via data analysis applies the Pareto principle to separate the vital few from the trivial many. Classifications, segmentation, and surrogate quantification is the way to reveal behavior. Analytics provide the insight when you progress thru the following steps.

- *Validate* – what you know – make sure that your understanding is correct.
- *Explore* – what you know, you don’t know – reveals new perspectives.
- *Discover* – these steps will uncover what you don’t know that you don’t know.

## **Closing Thoughts**

Manufacturing improvements came from new paradigms. A significant change is a new and better perspective on organizations and enterprises. This understanding comes from combining multidisciplinary knowledge. Eliminating the silos among other fields and industry is a major transformative change impacting the future. The basic understanding of these principles is to

---

<sup>10</sup> Jeffrey G. Miller and Thomas E. Vollmann, *The Hidden Factory*, Harvard Business Review, September 1985 Issue.

<sup>11</sup> The Theory of Constraints introduced by [Eliyahu M. Goldratt](#) in his book **The Goal**, 1984.

<sup>12</sup> Joseph Harrington, **Understanding the Manufacturing Process**, Marcel Dekker, Inc., New York, 1984, page 6.

<sup>13</sup> Computer Integrated Manufacturing – page 8

## *Harrington Principles*

consider their implication to the requirements for successful integration of the digital culture into the contemporary enterprise.

- View the enterprise as a composite of rules and parameters that govern its behavior.
- The ability to analyze and study the enterprise identifies the measurable rules.
- Understanding the behavior allows you to change and control the behavior
- Functionality of behavior is a thruput system with inputs, processes, and outputs.
- Transaction processes drive the thruput – the physiology of the enterprise.
- Digitized transactions provide analytical material.

*“However, just as machines become an extension of man’s physical capabilities, the computer will become an extension of man’s capabilities”<sup>14</sup>*

*“Because manufacturing is a science, it is subject to analytical procedures that can identify the rules which govern its behavior. We can predict the effects of changes in conditions. Understating the science, we can correctly measure the performance of manufacture. If we can measure, we can control our performance. When we can control, then we can succeed.”<sup>15</sup>*

The journey to an evolving digital culture using the Harrington Principles will ensure your success. This sage thinking presents the guidelines for Computer Integration of Many things.

---

<sup>14</sup> Joseph Harrington, **Understanding the Manufacturing Process**, Marcel Dekker, inc, New York, 1984.

<sup>15</sup> Ibid.