

Complexity and Material Handling Projects

Complexity

I have been hearing the term complexity much more frequently, lately, in discussions about business and Material Handling projects. It seems that our world is becoming increasingly complex, and we are concerned about how to work with and manage it and minimize risk as we initiate change.

Complexity is a provocative word. It can be intimidating, and seems to have many definitions. In looking back on my work, I have noticed that I have been recognizing and managing complexity in three ways. I hope that you will find these as useful as I have.

I define complexity in my work when

- 1) "A process or product cannot be understood in full detail by an individual expert sufficient to communicate all the details of the process or product across time and distance to other experts."¹
- 2) I notice that I am not able understand a project when looking only at a part or a component of it. This complexity is often referred to as "emergence" and relates well to work in science and engineering; and
- 3) When working with people, I notice a different complexity when the operators and stakeholders do not understand the operation as a whole, do not identify with it, and do not support the same objectives in their work.

In this article, I will briefly expand on these three definitions, and in the three articles that follow, I describe how I manage that complexity in material handling projects.

Complexity and material handling projects

I organize material handling projects into three Phases: developing Functional Requirements, creating the Design, and the supporting the Implementation and achieving effective Operation. In order to achieve the project goals we need to manage each Phase, paying attention to the unique forms of complexity, that characterize each Phase.

Phase 1: Developing Desired Outcomes and Functional Requirements: The work of Phase 1 focuses on information and includes defining, describing and documenting the desired outcomes and functional requirements of the project as a whole. Desired outcomes describe what the business and operations management want to achieve, that implementation of this project will make possible. Functional Requirements describe the material and data requirements that the design must be able to handle to meet current and future business needs in order to achieve those outcomes within the larger business system.

Requirements develop out of four areas.

- 1) The business environment, including government, laws and regulations, finance, infrastructure, etc.;

- 2) The supply chain including manufacturers, vendors, carriers, customers, competition, etc.; and
- 3) The company including other departments like accounting, sales, and purchasing along with senior management and the Board of Directors that work on developing a clear direction for the company performance in the marketplace; and
- 4) The existing material handling organization including other facilities, equipment, systems, people and management.

Collectively they are stakeholders that have a stake in the design and results of the material handling project.

Complexity in Phase 1 develops out of the need to:

- 1) Consider material handling project from a business strategic perspective and over longer time frames than operations usually consider, so that we can expect the results will be beneficial for some time;
- 2) Identify all the relevant stakeholders and understand their expectations from each of their different perspectives, both physically and operationally; and
- 3) Integrate the information obtained from these stakeholders into a document, sufficient for owners and designers to confirm that the desired outcomes and requirements are understandable, comprehensive and sufficient to guide the balance of the project.

Phase 2: Creating the Design: The work of Phase 2 focuses defining the parts (equipment and systems), and the relationships of the parts to the whole and the whole to its environment. We do this by creating and documenting the Design by describing and specifying each of the components, which, when installed, integrated and operated together, will allow the company to achieve the project's desired outcomes. This documentation must be sufficient for management to make the decision to invest funds to purchase and implement the design and create the desired change. I include in the Design Phase:

- 1) Drawings of physical elements;
- 2) Detailed performance specifications for all of the equipment and systems, so that the owner, operators, and potential vendors will know what will be expected from implementing the design;
- 3) Support for obtaining pricing, evaluating vendors, calculating return on investment, etc.; and
- 4) Support for developing testing protocols, user training, etc.

Complexity in Phase 2 develops out of the need to understand how the components will work together to achieve the desired outcomes. There are generally two sets of relationships to understand.

- 1) The first set is the working relationships of the physical and system components with each other, so that the complete system provides the functionality that this unique combination of elements will provide, as defined in the Functional Requirements. This task is generally referred to as the work of Systems Integration; and

- 2) The second set is the working network relationship between the new system and the company, together as a part of the company with the supply chain and the environment, to meet the defined needs, and as the needs grow and change in the near future. This work is also a form of Systems Integration, but not generally included in the business of systems integration.

Phase 3: Supporting the Installation and Operation of the new Design: The work of Phase 3 focuses on bringing all the components together to achieve the desired outcomes, including installation, commissioning and operation of all aspects of the Design. This Phase includes:

- 1) Supporting the contracting with vendors (external and internal);
- 2) Supporting the development, delivery and installation of purchased and internally developed items;
- 3) Supporting the physical and data integration of the project components and sub-systems with each other and into larger mechanical, information and human systems including the business and supply chain;
- 4) Supporting the development and implementation of training, testing and final acceptance; and
- 5) Supporting the operating staff in becoming effective operators of the new system.

Complexity in Phase 3 develops out of the ability of the operators and company to

- 1) Change their sense of identity and position in the market through the effective use of the new equipment and systems; and
- 2) Manage that new sense of identity in relationships with all the stakeholders included in Phase 2 of the project.

In the next three articles in this series, I will expand on my understanding of complexity and the management of the risks in each of the three Phases in Material Handling projects, and suggest methods to consider as you face the challenge of successfully managing complexity and risk in our Material Handling projects.

If you would like help with a material handling project, please send a note to me at Don@warehousecoach.com, or call me at 1-503-296-7249.

¹ Ryroft, p. 8

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