Chapter 2

How to Manage Projects in Industry 4.0 Environment: Aligning Management Style With Complexity

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ABSTRACT

With the increased complexity in technology, projects are becoming more complex, and their outcomes are hard to predict. As we are entering the Industry 4.0 revolution, the complexities associated with technology will likely to increase to unprecedented levels. The main motivation of this chapter is to understand the link between the complexities associated with the projects and the project management style in dealing with these complexities. In this study, the project management style is defined as a dominant paradigm that a manager uses as a mental model in dealing with the management problems. The chapter investigates the effects of the alignment between project management style and project complexity on the project management outcomes. The implications of this research are that with the increased complexity as in the case of Industry 4.0, the project management approaches will need to become more agile, with shortened planning horizons and more involvement and communication with the stakeholders.

INTRODUCTION

Human history witnessed constant change over the millennia and the speed of change has been accelerating over the last couple of hundred years, mainly due to the scientific and technological advances starting with the first industrial revolution. There are two main views of change when regarding the human technological development (Agassi, 1973). The first one is the continuous view that sees the human development a constant change and the other one is the discontinuous view according to which the


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change happens in a discrete, discontinuous manner as humans invent or innovate new solutions. Agassi (1973) posits that most historians take a hybrid view that there are both discontinuous and continuous change in human history. In reality there are usually a continuous change or development following a discontinuous change. And when several of these related discontinuities happen at the same era, they might cause a radical change in the society that we call revolution. Yoder (1926) defines a revolution as a radical change in society based on prior deeper changes in the human thinking. Even though the term has been mostly used in the political context, it has been applied to wide range of areas from agriculture to industry, to theology. Over the millennia humans achieved many revolutions in production, but the term, industrial revolutions, is applied to relatively recent periods in history where the confluence of enabling technologies instigated changes in industry and in overall society as first seen during the 8th century.

There has been almost universal consensus on the number of industrial revolutions to date in modern era (Vilenius, 2014). Industrial revolutions do not happen in vacuum, they are usually based on the accumulation of technology and knowledge of the previous eras. An industrial revolution is a juxtaposition of several disruptive innovations whose combined effects were far greater than the single innovation would have created. For example, the first industrial revolution started in textiles industry with the invention of flying shuttle that made weaving easy, spinning jenny that increased the productivity of yarn production exponentially and cotton gin, which mechanized the cotton production and to drive these machines the steam power.

Three industrial revolutions to date took place in stages starting from late 18th century to late 20th century and each of these revolutions caused great transformations in technology, culture and society (Vilenius, 2014). Also aligning the industrial revolutions with Kontradieff waves, which are long term economic cycles first theorized by Soviet economist Nikolai D. Kondratieff, Vilenius (2014) posits that humanity is at the beginning of the fourth industrial revolution.

Ever since the dawn of humanity, projects have been parts of human experience as societies evolved through creating artefacts for different needs. Some of these artefacts can still be seen in historical remains of old civilizations. A project is a planned, unique undertaking first conceptualized inside a human brain, then set to motion to achieve the intended outcomes. As projects are common in history, managing projects has always been a crucial job within societies. Even though the term project management is relatively new, there have always been people responsible for the management of the projects regardless of the era the project was undertaken. As the technology complexity increases, the outcomes of projects get more uncertain and project management discipline evolves.

In pre-industrial societies artisans and tradesmen were organized around trade organizations called guilds. At the top of this system there were masters, who by definition owned the business and employ other artisans. The aspiring artisans were educated and trained through apprenticeship and became journeymen within a trade guild. Until the first industrial revolution all major human projects were managed through master-journeyman-apprentice system. In a project managed by a master artisan, the patron or the customer provided the financing and the project would continue as long as the financing continued. The masters developed the projects, planned and hired other artisans. In the pre-industrial era, the scope of the project is determined by the mastery or the experience of the master who undertook the project. They are the technical and administrative leaders of the project.

The first industrial revolution started in England with the advent of mechanization with water power and later steam power to drive the machines in textiles industry. The major outcome of these advances was the unprecedented growth in productivity in manufacturing, that had further social, political and cultural consequences first in Britain, then all over the world. First time in human history, economies began to