
Practice Periodical

LETTER FROM THE EDITORS

Welcome to the third volume third issue of our ASEM Practice Periodical! We do hope that you enjoyed our previous issue on April 1st, 2016, and our little joke on shutting down, though, we are always in peril of shutting down!

For this issue, Don Kennedy gives us a thought provoking piece on the value of “engineering” in engineering management. Continuing on his Domain Analysis in systems engineering, Ken Sexe presented a second instalment on developing competency model using domain analysis. Lastly, we have a current state analysis of engineering management in Brazil, by Fernando Deschamps, President of new ASEM Brazil Section.

We hope that you enjoy this issue and find the information useful for you. If you have something to say, be it a comment, or as a guest columnist, please email us at Practice.Periodical@asem.org.

Susan Murray and Ean H. Ng
Practice Periodicals Editors

THE KENNEDY COLUMN

Why the “Engineering” in Engineering Management?

By Donald Kennedy, PhD, P.Eng

Management fads or ideas become popular and go into hiding for a few years to resurface in a slightly different form. In the early 1990’s it was very fashionable to consider management as a set of rules or activities that were not really influenced by the particular business the manager was in. The street term for this was “widget” management. That is, the business produced a good or service that could be thought of as a generic widget, so the manager did not really need any great technical insight.

A ‘friend of mine’ worked for a very large EPC company at that time and they thought it would be a good idea to start manufacturing CDs since that business was growing. After investing many millions of dollars in physical plant and raw commodities, they discovered that knowing something about materials and bonding gives the advantage to the competitors who had a fraction of this company’s reject rate. The exercise was written off as a bad business choice. It

appeared that technical knowledge of the business you want to manage has value.

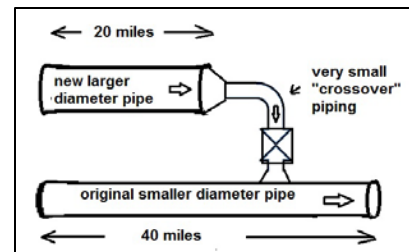
For another example showing that knowing fundamental engineering can save millions, a common practice in large cross country pipelines is to “loop” pipes of different diameters. In the diagram, the original pipeline is shown. The greater the pressure at the source, the higher the flow rate that can be achieved.

When the supply of liquid desired to flow through the pipe becomes greater than the original pipe size can

handle, you need to put in a larger diameter pipe. However, rather than spend the amount required to put in an entire new length, you can get a much higher capacity by spending half the amount and only running half the length with new larger pipe at the upstream end. It makes sense hydraulically, and like textbooks often say “the proof is left to the reader.” This is what company A did and the set-up is represented in the diagram.

After a decade, the supply of liquid to be shipped exceeded the capacity again. The management of company A developed the proposal to add 2 more miles of larger pipe. At a cost of about \$2 million it was economically feasible. During the project kick-off, an engineer asked more details about what they were proposing to do. Once he learned the reason, he pointed out that to save money, the original looping project put in small piping and valving for the crossover. The crossover was acting as a throttle. Increasing the crossover to a size more suitable to the application would cost about \$50,000 and provide much greater new capacity than the proposed \$2 million project. These concepts are not highly technical but they are technical enough to escape notice by the non-engineering managers.

Without passing judgment, it is a fact of business that engineers tend to become subservient to other professions (such as accounting) in managerial circles. In the above two examples, the value of having some engineering understanding was highlighted. It will benefit all engineers to have organizations understand



the value of technical know-how within its management

Dr. Donald Kennedy, Ph.D., P.Eng. has worked in a variety of roles that has placed him within the offices of over 40 companies. He is a strong proponent of reducing turnover within organizations and recognizing the value of organizational knowledge. He is particularly interested in getting some work at the time of writing this. Don can be reached at kennedyd@telusplanet.net

THE SEXE COLUMN

Developing a Competency Model using Work Domain and Activity Domain Analyses

By Frederick (Ken) Sexe

My last article discussed how to develop a work domain analysis as a means to define the work environment. This brief article will discuss how to use the work domain analysis mentioned in the article to develop a competency model. A competency model can be used for such tasks as identifying any potential work-related issues (i.e. tools, test equipment, training, skills) that may influence team performance. The competency model is also useful for going beyond general job requirements found in basic human resources (HR) job descriptions towards a more detailed description more applicable to the tasks that the job candidate will be performing once hired.

The competency model I will describe will also require developing an activity domain analysis. An activity domain analysis is similar to a work domain analysis except that it illustrates activities associated with work products identified in the work domain analysis. The activity domain analysis requires a certain level of expertise to capture work products and activities that can be gained from either subject matter experts (SME) or through a time analysis study. A time analysis study can be completed by capturing any actions and work products performed over a particular period of time (I tend to use 1-2 weeks for more detailed analyses but could be shortened based on the types and number of activities the team is responsible for). An activity domain analysis is created similar to a work domain analysis except that it focuses on activities instead of physical work products and processes.

The enclosed sample activity domain analysis illustrates that the team performs system testing, troubleshooting, periodic maintenance, system maintenance (repair, removal and replacement), and

system operation activities. Note that the sample work domain analysis does not include subsystem-related knowledge (i.e. electrical system, mechanical system) but would typically include these levels of system knowledge as they relate to the individual components identified in the analysis (for example, a battery would be listed as a component which would be related to the DC power system which would be a subset of the electrical system).

Equipment and skills required for each of the tasks identified using the time analysis or SME and are then be combined with the systems skills identified in the work domain analysis. A combination of these two analyses can then be used to develop a matrix defining skills and attributes required of team members as they apply to their particular roles. Each of the activities and work elements listed in the activity domain analysis can be listed with the applicable work elements from the work domain analysis as applicable (for example, system troubleshooting would include each subsystem, the components of the subsystem, and any particular skills required for performing troubleshooting the system). A sample competency model was not included in this article due to space reasons; please feel free to contact me directly if you would like me to send a sample competency model or if further clarification is needed.

Frederick Sexe is currently employed as a Senior Systems Engineer in the United Arab Emirates responsible for the integration of aircraft avionics systems. He has roughly 20 years of systems engineering experience, including over 10 years in Asian and Middle Eastern locations, coupled with another 10 years of experience managing geographically-distant systems engineering teams. He can be reached at kensex@gmail.com

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State of Engineering Management Engineering Management in Brazil

Academia, industry, societies
and service providers

By Fernando Deschamps, Ph.D.

As the engineering management profession starts to become more recognized in Brazil, it is useful to have an overview of how engineering management as a discipline presents itself in academia, industry, societies and service providers.

Academia

There is no specific undergraduate program in engineering management in Brazil. Although every engineering program must have a management-related course, engineering management as a discipline is taught, at this level, in 5-year industrial engineering programs and in 3-year production management/technology programs. There are currently 1,283 industrial engineering undergraduate programs in Brazil according to the Brazilian Ministry of Education throughout Brazil. There is no precise count on the number of production management/technology programs because the name of these programs greatly vary. An approximate number would be around 50, considering the last evaluation cycle of our Ministry of Education.

There are many certificate programs (360 hour programs) in industrial/production engineering and industrial management in Brazil. These programs usually take 1.5 year for someone to complete. Some of these programs are called MBA's, although the way the Brazilian version of the MBA is operationalised is much more like a certificate program than a proper MBA in the USA or Europe. It is difficult to know how many of these programs there are, as they are not considered regular programs and can be offered on demand. There are also many certificate programs in project management. Most of these programs are aimed at engineering majors and almost all of them base their structure on the PMBoK. Project management and lean/six-sigma have been "hot topics" for the past 5 years in Brazil.

Research in engineering management is performed mainly by research groups in Industrial, Production or Systems Engineering graduate programs and some Business graduate programs. There are 48 different graduate programs, according to the updated count of CAPES (which regulates graduate programs on behalf of the Ministry of Education), in Industrial, Production or Systems Engineering in Brazil. Most of them have some kind of focus on engineering management domain areas, such as those described

by the Engineering Management Body of Knowledge (EMBoK).

Industry

When a student graduates from an engineering program and goes to work in industry, he/she first learns the work environment and the particular methods of the organization he/she was hired by. When he/she's settled, he/she discovers the need to improve his managerial skills, usually looking for one of the before-mentioned certificate programs. Students tend to disregard such skills at first when they are taught at the undergraduate level, until they see their importance in the work environment.

Few organizations have a job position specifically labelled as Engineering Manager in Brazil. The ones that do are usually multinational companies that associate the Engineering Manager job with the management of large construction projects, like the building of a new industrial facility or its expansion.

Brazil will experience a period of economic downfall in the next couple of years. Industrial organizations are already adjusting to these scenario, laying people off or suspending work contracts. The expectation is that in order to keep their jobs or to get a new position people will start looking to become more productive. Brazilian industry is well-known for being quite unproductive because of the low qualification of its workforce, and this is an opportunity to be explored by engineering management professionals. One of the things to be noted here is that there is an increasing interest in industry for certification. PMP (Project Management Professional, Project Management Institute's certification) and Lean/Six-Sigma are very popular these days and industry has already understood the value of employing a certified professional.

Societies

ASEM is present in Brazil through its Brazil Section. Other than that, there is no society specifically aimed at engineering management in Brazil. Engineering management appears as an interest area in other societies, though, the largest of which is the Brazilian Society for Industrial Engineering (ABEPRO - Associação Brasileira de Engenharia de Produção). ABEPRO promotes two important events in Brazil each year that are of interest to Engineering Managers:

- The Brazilian Meeting in Production Engineering, which is the largest of them, gathering around 2,000 attendees both from academy and industry, held each year around October.
- The Symposium on Production Engineering, held each year in São Carlos, state of São Paulo, around November, with a stronger focus on research.

ABEPRO also publishes the Brazilian Journal of Operations and Production Management, which has Engineering Management as one of its topic areas.

The Symposium on Production Management, Logistics and International Operations, held each year in São Paulo around August by the Getulio Vargas Foundation (FGV) is also of interest for Engineering Managers, as well as other small events that are organized throughout the country by other local societies and organizations. It is also worth mentioning, as project management is a part of engineering management, that **PMI** is very well-known and recognised in Brazil, with many different chapters (15 in total).

Lastly, in Brazil, for you to practice the engineering profession with all of its attributions, you have to be a licensed engineer. The national governing body for licensed engineers is CONFEA (National Council for Engineering and Agronomy). CONFEA is divided in regional bodies, one for each state. In the organizational structure of each regional body there are committees that oversee the practice of the engineering profession in the different engineering specialties (mechanical, electrical, civil). Engineering Management, Production Engineering, Industrial Engineering and related areas do not have their own committee, but are rather governed by the mechanical engineering committee. As the number of people in these areas grow and their attributions become clearer, it is expected that a specific committee would be created.

Service providers

There are many organizations that provide services in engineering management, from major global consulting companies to small businesses that focus their activities in a city or region. They usually offer services such as training and consulting related to the trend of the moment (like lean, six-sigma, project management, process management and other topics). The market is very competitive and reputation-oriented.

A set of organizations that offer many services in the area of engineering management are the ones belonging to the “S” system. The “S” system is a set of para-governmental organizations whose main objective is to promote the development of industry. They offer courses, consulting services and technical services, do different types of projects and have their own faculties. They are spread throughout Brazil and are present in every Brazilian state.

Wrapping up

As can be seen from the previous sections, engineering management is fertile ground to be explored in Brazil. The basic infrastructure is already present – engineering management topics are taught

at the undergraduate level and researched at the graduate level, companies value the skills of engineering managers and people are seeking knowledge related to the area, societies exist that address engineering management topics and services are provided. What still needs to be done is to create an awareness for engineering management as an engineering discipline, explicitly focusing on its core values and knowledge areas, providing support for its development – a role very well suited for ASEM.

This is exactly what the Brazil Section of ASEM is focusing on right now: spreading the word about engineering management as a discipline, promoting the advantages of certification for both professionals and organizations, showing the value of the Engineering Management Body of Knowledge, and making people working in engineering management-related positions realize that through ASEM they can network with their peers, exchanging valuable experience and improving their careers.

Fernando Deschamps is a professor at Pontificia Catholic University of Paraná (PUCPR) in Brazil. He is also the President of the new ASEM Brazil Section. He can be reached at Fernando.deschamps@pucpr.br

AMERICAN SOCIETY FOR ENGINEERING MANAGEMENT

The society that speaks for the engineering management profession across the world



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