Harnessing the Winds of Change

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THERE is an old Chinese proverb—"When the winds of change blow, some people build walls and others build windmills."

Conservative or passive innovation is analogous to building walls for stopping the winds of change. This conservative approach is planning reactively and trying to stop or prevent the winds of change from entering an organization. Building windmills takes advantage of the winds of change opportunities. Windmills harnessing the wind to generate energy and power are analogous to a more proactive and progressive innovation strategy.

This proverb is along the lines of—when given lemons, make lemonade. Making the best of the situation and even thriving in times of change also means being prepared with knowledge, creativity, and insight. This proactive situation is fostered by our journal—*IEEE Engineering Management Review* (*EMR*), which plays a role.

The COVID pandemic, new technologies, emergent and increasing social and political forces, and sustainability are current examples of the winds of change facing managers and their organizations. What do managers and organizations have to do to build windmills in these contexts? Should they be building windmills? What would windmills look like?

In our editorials, we have touched on a number of these principles and perspectives; in the last issue, we espoused the continuity of learning—where learning is a foundation and resource for windmill construction.

Having dynamic capabilities, developing innovation ecosystems, and learning from mistakes—which we have presented in previous editorials—are integral to this continuous innovation focus; having the capability and absorptive capacity to build windmills. *EMR* also offers resources for building resiliency and long-term competitiveness—as evidenced by the many COVID-related articles published over the past few issues.

All these *EMR* affordances are the ones we mentioned a few issues ago—where previous knowledge, evolving research, new ideas, and various new insights into an application, and are all materials to help build windmills that power organizational development and innovation. These developments can help organizations thrive in periods of uncertainty and crises.

This issue of *EMR* provides a number of articles that can support building windmills to harness the changing winds.

This *EMR* issue—as in all our issues for the past few years—begins with technology manager notebook (TMN) articles; although in this issue, we only have one TMN article. The rest of this *EMR* issue includes the materials for insightful practical and emergent issues facing engineering and technology managers, their organizations, and society.

TMN ARTICLES

We have a single TMN article in this *EMR* issue. This TMN article by Ng, Lee, and Ho relates to one of the strongest winds of change we have had in generations—the COVID-19

pandemic. As we shall see in the next section, the post-COVID-19 world is still generating insights for managers and organizations and being published in *EMR*. They talk about how information technology (IT) project management based on two popular frameworks—which are newly published—will practically work in the post-COVID environment.

WINDS OF CHANGE IN A POST-COVID-19 WORLD

In this issue, we have four additional articles—in addition to this issue's TMN article—applying new knowledge gained during a post-COVID-19 world that harnesses these presentiments. Post-COVID articles are more prominent as pent-up learning and innovation continues to be shared. This pattern will likely continue as lessons are harnessed by researchers and practitioners—and as the crisis matures and evolves.

Miethlich and colleagues in the first of the articles, of this EMR issue, related to the COVID-19 pandemic, consider digital enterprise management. This digitalization theme has recurred throughout many of the post-COVID-19 papers appearing in previous issues of EMR (e.g., [1]–[5]) as well as the TMN article by Ng and colleagues and other articles in this issue.

Miethlich and colleagues proposed a general digital transformation management framework oriented toward distinct priority areas of digital transformation. Its universality is expressed in the possibility of choosing a suitable digital enterprise management strategy focusing on customers and restructuring business through digital innovation and transformation—especially given the challenges of the COVID-19 crisis.

Sometimes winds of change arrive unexpectedly—sometimes they are planned; organizations can prepare for them by building windmills earlier.

An example of planned winds may appear from various institutions and especially governmental institutions. It is within this context that Stanislow and colleagues investigate whether regulatory winds of change can lead to better and more effective innovations—windmills.

The context of this regulatory-induced innovation that Stanislow and colleagues consider relates to ventilator innovations during COVID. In this case, the crisis and the regulatory winds could have provided significant turbulence. Regulators, realizing that their regulatory winds could cause greater difficulties, relaxed them and allowed innovations to occur to address the COVID requirements. In this case, Stanislow's findings supported the adoption of new management practices to facilitate innovation, such as frugal design, a broader range of collaboration, and the use of open-source designs. The implication is that these practices can be more widely used by industry to reduce costs, increase innovation, and serve traditionally underserved markets. This study contributes to the expectations that innovations and expectations will alter due to new perspectives and expectations as found in previous observations appearing in *EMR* [6], [7].

Labor markets and labor supply have been a major concern on recovery issues related to the COVID crisis. The concerns are even more critical for skilled laborers, whose replacement are more difficult and may require additional time. It is from this perspective—from the next paper in this issue of *EMR*—that Wang and colleagues consider the IT labor market in the United States.

The IT labor market in the United States was investigated during the latter portions of the year 2020 with thousands of data points. They found that many fields faced scarcities, but

also practices ranged from "front-line" needs in some industries, such as health care, to more virtual setups for other industries. Thus, the winds of change can also affect different industries, jobs, and situations in unexpected ways. Having the flexibility of managing labor shortages and addressing unique scheduling concerns will be important for this labor market.

In the previous issue of *EMR* (Volume 49, No. 3), we had four articles related to education and learning for building important capabilities for change. Challenges and innovations in terms of tools and supporting technologies were made clear by studies where artificial intelligence [8] and facial recognition [9] among other educational technologies were occurring and had a significant influence on various industries.

It is necessary to understand potential challenges for online education and determine whether these innovations are enough to build educational windmills to strengthen labor markets and resources. This evolution in e-learning is necessary to take full advantage of the situation, and post-COVID knowledge is something used by Hang Lee in her article to offer insights and recommendations for optimizing online education environments. They recommend developing continuous training for teachers and learners on e-learning to improve their skills and acceptance of online education systems. They also recommend creating a more comprehensive technical environment to accelerate adoption and increase e-learning systems usage.

ORGANIZATIONS AND TECHNOLOGY MANAGEMENT

The online education environments—the topic of the previous article by Hang Lee—can also support corporate human resources training.

It is this topic of electronic human resource management (e-HRM) that Alam and Islam evaluate from the perspective of the technology, organization, environment framework.

Alam and Islam's article is based on a survey of human resources executives, which showed that the adoption of e-HRM has a variety of influences, including IT infrastructure, IT competence, and top management support. Thus, not only does there have to be technical capabilities, but also, importantly, organizational capabilities and support. They also found that external pressures on industry norms play an important role, which points to a competitiveness concern in integrating e-HRM systems.

The adoption of digital technologies like e-HRM systems requires that you use these systems to identify and build the availability of digital technology talent for firms involved in digital transformation. But organizations have to do this new training while taking advantage of the current availability of talent—an ambidextrous approach. This ambidextrous approach is something that Kar and colleagues investigated to determine how human resources behavior in organizations can play a role in this talent management strategy for digitalized knowledge.

Kar and colleagues used a case study to investigate the skill areas, factors for employee intention to learn, and factors that influence actual behavior in learning practices. Personal and skill-related factors are each examined. They argue for an S-shaped curve to reskilling resistance for digital technologies. They find reskilling resistance is lowest for the younger worker, whereas the resistance increases greatly than becomes level. They also find that learning aspiration is in an inverse S-shape where learning aspiration is highest for younger workers, drops quickly, and then levels off. These results are based on one case; organizations should consider whether this result exists for their circumstances. It would be interesting to hear from readers whether this case result is evident in their organizations for digital technology learning or any type of learning and acceptance. Understanding the proclivities of human resources in an organization is paramount to determining the level of available tools and resources organizations have in building the windmills necessary for harnessing the winds of change.

Having the right infrastructure is also important when the change arises. A flexible technological infrastructure depending on how future consumerism evolves is a focus of the article by Hossfeld and colleagues. They consider the cyber-physical platforms for vehicle technology. Cyber-physical systems integrate hardware and software across multiple systems and are part of the Industry 4.0 portfolio of technologies [10]. In this article, Hossfeld and colleagues consider how software and hardware interfaces are designed to adjust for varying market environments. For example, it is expected that vehicle ownership will decrease in the future as the sharing economy takes route.

There are also market forces that go beyond shared mobility and include changes to greater individualization or customization of products. Thus, not only are long-run issues arising, but short-term individual predilections will require a more flexible platform for the breezes and the gushes of wind that will occur over the short term and long term, respectively.

Trying to predict the directions of the winds of change requires foresight and forecasting. Organizations can try to determine direction of innovations and technology through *roadmapping*. Roadmapping supports innovation, technology, and strategic planning in a structured manner. Technology roadmapping for automotive vehicles [11] and aircraft [12] has appeared in *EMR*. It is a valuable tool for technologists, but also strategic planners and project managers [13].

As a tool, roadmapping has been popular in the technological forecasting literature. Yet, understanding how and why organizations adopt the tool is relatively less well known. The issues and concerns of how organizations adopt roadmapping—especially in the defense industry—is the challenge that Hirose and colleagues seek to address. They evaluated and presented a model with various stages for roadmapping adoption at the QinetiQ group, which provides roadmapping services in a departmental setting. Having a group dedicated to this process is not common. This situation makes the case unique and informative.

To survive the changes in broad ecosystems, living organisms need to evolve and change. There is the basic theory of evolution that essentially posits that the fittest will survive. This principle is important for biological systems, and it is with this biological transformative idea that Matt and Rauch introduce this concept within a manufacturing setting.

Evolutionary change requires some trial and error in genetics and mutations. But, in organizational systems, relying completely on chance can be costly, and it is why adaptability becomes critical. Matt and Rauch argue that there are multiple aspects of biology that are analogous and can be applied to manufacturing processes and products. They show some weak and strong correlations with various biological characteristics and various manufacturing operations, such as materials surfaces, machine tools, and their relationships to skeletal

bodies and muscle systems—as examples of biological characteristics.

The core elements of a biological transformation is across three major stages, inspire with bioinspired systems, and then integrate and evolve—as bio-intelligent manufacturing is the latest and most advanced evolutionary stage of biological transformation. These insightful practices are available to all that observe the world around them and can be critical to capturing the winds of change for useful purposes.

PROJECT AND SUPPLY CHAIN MANAGEMENT CONCERNS

The final four articles in this issue of *EMR* focus on supply chain management issues—where the last article focuses on marketing, arguably an aspect of the supply chain's demand management. Initially, before the set of supply chain articles, we introduce an article on project management.

Project management in construction has many complexities and difficulties, with some of the world's largest projects having to be managed. Often, these projects are building structures that literally have to manage high-speed winds and shifts.

In their article, Wasfy and Nassar complete a delay analysis of factors—figurative winds of change—that can delay a project. They seek to determine who faces the risks and costs of these delays. They utilized a survey of over 390 engineering managers to arrive at the various results related to which issues such as contractual, compensation, and float factors caused the delays. They provide some lessons for managers based on these results.

When thinking of the Internet, most people think of a global network of

communication and information sharing that the world has never seen before. The concept of the Internet is that communication packets and information go through various processing stages to be shared globally. This is an information supply chain.

The virtual Internet concepts have been adopted to help manage supply chain logistics through the *physical Internet*. It is this physical Internet innovation that can help address customization and efficiency concerns associated with the delivery of products and goods. It is also the topic of concern for Fahim and colleagues in the next article in this issue of *EMR*. In this case, the authors focus on how the physical Internet can be used within maritime ports.

The authors look to the future and how these innovations can help effectively manage maritime ports. Interestingly, maritime ports have been an important topic for over a year during the COVID pandemic. The delays at ports, caused by whatever winds of change are occurring, have caused shortages of many types in 2020 and 2021; maybe the physical Internet can be the windmills to operate maritime ports more efficiently.

Making operations and supply chains more efficient, responsive, and sustainable are part of preparing them for the winds of change. This is part of what the maritime ports' activities were attempting to do with the physical Internet. Blockchain technology for supply chains and sustainability has also been argued—in the pages of EMR—to contribute to address these process improvement factors (e.g., see, [14], [15]).

Part of this blockchain contribution to sustainable supply chains is through their governance—and this is the issue that Kleinknecht brings to the forefront in their article. Kleinknecht

considers how the various capabilities of blockchain technology, such as immutability, transparency and visibility, and traceability, play a role for regulatory and voluntary management of sustainable supply chains. Using qualitative interviews with experts, they provide insights into the potential within an electronics equipment standards setting with significant managerial and organizational insights.

Sustainability of supply chains is part of the winds of change requiring organizations to rethink how they manage supply chain activities and strategy; winds that have picked up since the advent of COVID (e.g., see, [4], [16]). Supply chains are inherently complex; adding the social and environmental dimensions of sustainability only adds to this complexity. Managing the complexities of corporate and supply chain sustainability can be a maze. Allen and Tomoaia-Cotisel provide guidance to managers in managing this maze—where winds come and go from every direction.

Allen and Tomoaia-Cotisel provide a systemic perspective of the various influences and provide general and conceptual guidance on the issues that arise. They introduce a dynamic sustainable supply chain-circular economy model to address the various concerns simultaneously in an integrative model. Not only has EMR provided insights into how *sustainable supply chains* can weather major winds and crises such as COVID, but also how *circular economy* principles can do this [17]. This article further integrates the two fields with this integrative model.

The final article of this *EMR* issue by Kim features the end of a traditional supply chain, the purchase of the product by an end-user consumer. In this case, they provide insights for managers and organizations on how online reviews can be evaluated for

their products. The online reviews provide insights into knowing consumer sentiment analysis. Kim provides insights into using text mining approaches—an important big data tool—to complete sentiment analysis. They also utilize alternative metrics to provide developers and managers insights into the benefits and disadvantages of their products as evaluated by consumers. This important information can prove invaluable in identifying the wind direction from consumer sources.

CONCLUSION

In the last issue and editorial, we mentioned that change is a constant that faces managers and organizations. The level of change can depend on the context of industry, product market, or technology—as examples. In the history of *EMR*, we have seen articles address each of these and other areas, with potential solutions provided by various authors and contributors. Given that a major scope of our journal involves technology and innovation management, it is not surprising we have provided tools to help build the proverbial windmills to take advantage of the winds of change.

But, it is not only windmills that can be built, there are also wind chimes that provide musical and aesthetic contributions from wind, sails can harness winds that can aid in transporting across waters and level land, and kites can take advantage of winds to fly high, which may also serve as sources of enjoyment. All these are various ways to harness the power of winds and have the corollaries in innovations and responses by individuals and organizations.

We have shown that *EMR* has been and will continue to be an important resource that practitioners, scholars, and students can learn about tools and resources to harness the winds.

We continue to encourage our readership to take advantage of these articles and insights, and hopefully, even contribute their own insights that can help build future windmills.

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