Evoking Work Motivation in Industry 4.0

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Abstract

Many scholars are commenting the impossibility of high technologies to replace human at work. To motivate people to cope with variety of organizational and work changes in the dawn of forth industrial revolution, the science of motivation remains the key to answers. As the dissimilar of current industrial context and work content are leaving doubts on empirical findings collected in earlier industrial landscape, this article was written for two purposes: first is to synthesis development of behavioral science in the four stages of industrial revolution, while the second is to suggest future researches on work motivation in current industrial context. It is hopes that this article will enlighten researchers to conduct more empirical studies on work behaviors in this new industrial landscape.

Keywords

Industry 4.0, work motivation, industrial revolution, work behavior, organizational behavior, management, social sciences

Introduction

Industrial revolution is considered as the second most discussed matter besides human evolution, spanning right from the first to most current the fourth industrial revolution (Stearns, 2013). The term *industrial revolution* refers to the development of the industries from both economic and nature in which it operates (Clark, 2014). The first industrial revolution used water and steam power to run production. The second revolution employed electric power to reach mass production. The third revolution used the base of second revolution, which is electricity, on computers and automation to fasten productivity. The fourth industrial revolution that is also an expansion from the third revolution use more sophisticated and integrated software, hardware, and networks to reach the next level of productivity (Schwab, 2017).

While the new methods of work are reinforcing our understandings toward future, the authors postulate that human factor and involvement at work still remain its priority in determining organizations’ successes. Well-developed industrial strategies, models, and concepts still demand much support from industrial workers. New empirical findings and motivation models, thereby, are equally important as other studies on Industry 4.0.

This article, therefore, serves several purposes as follows:

1. To synthesize the chronicle of industrialization, its’ work contexts, and corresponding development of behavioral science.
2. To suggest future researches on work motivation in current industrial context.

Motivation

Motivation is academically explained as a series of modifying and directing human behaviors into a desired patterns of work, which is either activating one’s behavior, sustain the behavior over time, enhance the performance standards on particular tasks, or all (Reeve, 2018). Most managerial school of studies widely defined motivated individual as being impelled to do something on estimated forms of actions, which the actions are believed to satisfy his or her needs (Robbins & Judge, 2017). *The Oxford Handbook of Human Motivation* edited by Ryan (2012) defined work motivation as the human psychological processes that directs, energizes, and maintains actions toward a job-related behavior.

In this midst of motivation science’s “golden age,” researchers and motivation scholars are paying less attention on the three “Grand theories” of motivation such as Will, Instinct, and Drive that attempt to answer full range of motivational phenomenon (Appley, 1991) and focus on the applications of “mini-theories” of motivation (Reeve, 2018). Today, motivation researchers agree that behavior is energized and directed not by a single grand cause, but by a multitude of multilevel and variety of influences. Complex

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contributions of multiple motivational agents are applied to explain human behavior (Reeve, 2018).

**Work Motivation in First and Second Industrial Revolution**

Prior to 1760, the European and American society were agrarian society as such the prominent source of trade were based on agriculture. However, with the understanding and application of steam engine in machinery and transportation, the world saw a new era. The era was understood as industrialization. The first industrial revolution took place around 1760 and lasted until 1840. The main shift was from human muscle to special-purpose machinery, factories, and mass production. Industries were not dependent on human muscle factors to run operations. The iron and textile industries, along with the development of the steam engine, played central roles in the revolution. The spillover effect was felt in the second revolution, which brought about a different shift altogether created an improved system of transportation, communication, banking systems as well as factory systems dependent on owners and managers. Hundreds of thousands of miles of roads, railways, and canals were built. Great cities appeared and scores of factories and mills sprang up (Horn, Rosenband, & Smith, 2010).

One of the key outputs of the second revolution is the concern on human factors increased. This was a result of the increase in the number of workers in supporting mass production, and it also created more complications in the workplace. Thus, gave birth to the importance of understanding the human factor, triggering both behavioral scientists and business owners in uniting thus controlling the workforce. Faced with a huge number of workers, division of labor has to redesign work tasks into smaller parts for the purpose of efficiency. Workers’ behaviors are now becoming more important for business productivities (Horn et al., 2010;Sharrock, Hughes, & Martin, 2003).

Subsequently, the third industrial revolution gave the world the second peak on human behavior studies after the golden ages of humanity in ancient Greek. Business owners at that time concentrated on workers’ monotony behavior, where their tasks were arranged into specialized forms of mechanistic operations. Hugo Münsterberg (1913) indicated that the effects of psychological conditions such as monotony tasks will secure employees’ output in terms of both quantity and quality. Also, Taylor (1911) posits that output maximization with minimum time resource can be achieved through standardization of work methods and the enforced adoption of the best ways of working.

During the same period of time, the core of human behavior was well defined and accepted unanimously. The definition revolves around the “approach” or “avoid” intentions. Famous theories such as S-O-R (stimulus-organism-response) introduced by Woodworth (Tunnell, 1962); cause-and-effect of environmental stimuli introduced by founder of behaviorism, John Watson (1913); and Thorndike’s (1898, 1932) law of effect were among the key to the formulation and demonstrated the consensus agreement in defining the human behavior.

The development of both the industrial revolution and motivation science are on par to each other. Since the 20th century, researchers started bringing in concepts of intrinsic and extrinsic factors. Some famous experiments such as Harlow’s monkey experiment (Harlow, Harlow, & Meyer, 1950) and Elton Mayo’s Hawthorne study (Muldoon, 2017), as well as some great thinkers such as Tolman (1933, 1951) and his sign-gestalt theory, Murray (1938) and his concepts of primary needs and secondary needs, started debating the effect of intrinsic factors toward behavior. Due to the monotonic work pattern and minimum cognitive input at work, intrinsic motivation by that time received less attention. Because work outputs are the main concerns among industry owners, behavior of industrial workers was solely driven by extrinsic motivation, such as conduct good performance to approach rewards and avoid bad behavior to prevent punishment (Hergenhahn, 2009; Latham, 2007).

**Work Motivation in Third Industrial Revolution**

By the time, the industrial revolution reaches its third shift, motivation also reached its third peak of intellectual debates. Activities in research and practice of science were growing more systematic and mature in lightning speed. It greatly pushed advancements in various fields of knowledge including communication, engineering, travel, and medicine. By the end of the 20th century, technological advancement increased tremendously than in all of preceding history. Optic cables spread on seabed has greatly generalized the availability of Internet service, which further cultivated social networks and knowledge sharing that pierce through geographical boundaries (Friedman, 2005).

This century marks the dawn of cognition and contextual performance at work (Borman & Motowidlo, 1997; Elding, Tobias, & Walker, 2006). More thinking activities and emotions such as problem solving, bargaining and negotiation, creativity and innovative, teamwork and knowledge-sharing, and even perceptions toward people, event, or object are getting important at work. Meanwhile, many great cognition scholars such as David Chalmers, Douglas Hofstadter, and Daniel Dennett contributed valuable knowledge and insight into this long-exist science. Due to the strong theoretical backups and global trend, scholarly works and researches on human cognition flourish across variety of fields of studies, which included work motivation (Reeve, 2018).

In this period of time, the factor of intrinsic satisfaction started gaining more attention. Contemporary definition of intrinsic motivation generally refers to an emotional or spiritual state of satisfactions (Pinder, 2008; Pink, 2009; Ryan, 2012). Factors categorized under intrinsic motivation include all emotional or feelings response from stimulus, such as but
not limited to interest, enjoyment, interest, satisfaction of curiosity, self-expression, and challenge (Ryan, 2012). Motivation paradigm was no longer framed within environmental (extrinsic) factors. Emotion and cognition (intrinsic) attached to work is also influencing direction, intensity, and persistency of human behavior. The fundamental question of motivation therefore extended its dimension to a dualistic (intrinsic and extrinsic) form of stimulus.

Contextual performance that is becoming more important in determining organizational successes have subsequently raised demands for more research on intrinsic motivation. As one can imagine, numerous empirical findings confirmed correlations of intrinsic motivation and variety of work behaviors. For example, a study conducted by Putra, Cho, and Liu (2017) statistically concluded positive correlation between extrinsic and intrinsic motivation and work efforts, enthusiasm, and concentration. In another study conducted by Yidong and Xinxin (2013), intrinsic motivation was found partially mediated the relationship between perception of ethical leadership and innovative work behavior. Dewett (2007) also statistically concluded a positive correlation of intrinsic motivation and willingness to take risk and employee creativity.

Motivation researches in late third industrial revolution typically encircled intrinsic–extrinsic motivation and a variety of task-contextual performance, while some others are testing applicability of motivation theories within their context (Reeve, 2018). By then, a number of studies debated that intrinsic motivation works best for tasks that are complicated and require higher cognitive skills. Conversely, extrinsic motivation works best for tasks that are simple, straightforward, and do not require high level of cognitive skills (Mickel & Barron, 2008; Pink, 2009).

Subsequently, there are also research findings that support correlation of extrinsic factors and work behaviors. For example, Yuan and Woodman (2010) found that perceived organization support for innovation, supervisor relationship, job requirement for innovativeness, employee reputation as innovative, and individual dissatisfaction with the status quo correlate with innovative work behavior. Correspondingly, extrinsic motivation factors such as culture and climate of an organization are also effective to stimulate employees’ innovation (Ahmed, 1998; Büschgens, Bausch, & Balkin, 2013; Hogan & Coote, 2014). Moreover, Finkelstein (2011) reported positive correlations on intrinsic and extrinsic motivation and organizational citizenship behavior.

Hence, it is evident that an act is an outcome of reason to act. In simple term an individual will act when he or she has found the reason/s to act. And this explains vividly the contemporary ideology of motivation at work. Whereby, the employee will only respond when he finds the right reason for him or her to act upon. Compared with work behavior in earlier industrial revolution, the scope of work motivation has empirically expanded to intrinsic groups of factors, and outcome of motivation now includes contextual forms of performance.

Fourth Industrial Revolution: People Are to Work Wiser

The dawn of Industry 4.0 was announced by Professor Klaus Schwab in 2011 Hannover Messe. A common definition of this forth industrial revolution is the disruption of work (World Economic Forum, 2016, 2018). The deep integration of digitalization and mechanical hardware is remolding every range of industrial activities. Among most discussed contemporary industrial technologies are industrial Internet of things (IIOT), autonomous production, smart factory system, data integration, blockchain, 3D printing, new materials, and artificial intelligence (AI) (Lee et al., 2018; Liao, Deschamps, Loures & Ramos, 2017; Müller, Kiel, & Voigt, 2018).

The above breakthrough technologies together with other cutting-edge innovation are promising higher yet stable effectiveness and efficiency (Lorenz, Rüßmann, Strack, Lueth, & Bolle, 2015; Vuksanović, Ugarak, & Korčok, 2016). As a result, it is inevitable that need for human workforce in the new industrial revolution is reallocating (Loi, 2015; Xu, David, & Kim, 2018). Gardner (2017) also highlighted that one among traditional criticisms of AI is its potential to gradually eliminate low-skilled employees. Ambient intelligent, advanced robotics, machine learning, and all other kinds of cutting-edge technologies are showing better work performance than human, thus triggering lesser need for low-skilled human workforce (Mortensen, 2017).

Many contemporary observations have reported the phenomena of digitalization and technological disruption at work. At lower level, repetitive tasks such as of production line (Javelosa & Houser, 2017), line cook (Robinson, 2017), material measuring and sorting, and data scanning and recording are easily replaced by advanced technologies. At higher degree, digitalization, advanced robotics, and smart algorithm are penetrating into complex tasks such as data analysis and interpretation (Davenport & Ronanki, 2017), health diagnostics and operational technologies (Kalis, Collier, & Fu, 2018), decision making (“Algorithm Appointed Board Director,” 2014), and even handle law cases (Jesus, 2016).

While the above examples focus on how digitalization and technologies replacing people from work, there are also a huge collection of cases reporting how Industry 4.0 changes ways of work. Smart factory is the integration of virtual and physical systems, with the introducing cutting-edge technologies are promising higher yet stable effectiveness and efficiency (Lorenz, Rüßmann, Strack, Lueth, & Bolle, 2015; Vuksanović, Ugarak, & Korčok, 2016). As a result, it is inevitable that need for human workforce in the new industrial revolution is reallocating (Loi, 2015; Xu, David, & Kim, 2018). Gardner (2017) also highlighted that one among traditional criticisms of AI is its potential to gradually eliminate low-skilled employees. Ambient intelligent, advanced robotics, machine learning, and all other kinds of cutting-edge technologies are showing better work performance than human, thus triggering lesser need for low-skilled human workforce (Mortensen, 2017).

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This reflects the disruptive trend of reducing people in manufacture realm yet is able to improve both quantity and quality of outputs. Even though technologies and smart factories concepts are latest trend, it is impossible to deny the fact that humans are still important (Autor, 2015). Ingo Ruhmann, IT systems adviser to Germany’s Ministry of Education and Research, stated that “Complete automation is unrealistic. Technology will mainly increase productivity through physical and digital assistance systems, not the replacement of human labour” (Sirkkin, 2016). Importantly, the trend of Industry 4.0 is not about retrenching people from work, but to free human from low-skilled work and involve in high-cognitive work to better the world (Kopp, Howaldt, & Schultze, 2016; Schwab, 2017).

**Work Motivation in Industry 4.0: The Two Whats**

The transition from Industrial Revolution 3.0 to 4.0 brought about a massive psychological evolution to industrial worker. Skill and knowledge demand in Industry 4.0 are getting diverse and different from before. Historically, it is evident that each revolution introduces new production methods with higher level of effectiveness and efficiency. At every juncture of the revolution, the degree of muscular power and human involvement at work have reduced significantly. This is basically because each and every revolution moves closer to a new type of workforce. These new workforce are more inclined to be cognitive workers, and the demand for such intellectual workforce have increased. Likewise, Industry 4.0 requires employee with higher level of creativity, reasoning, problem solving, and all kinds of thinking ability, plus emotional attachments to work, such as passion, courage, innovative, and engagement. These characteristics are the key to organizational successes in the fourth revolution (Pfeiffer, 2016).

Literatures discussed in this article synthesized a remarkable change of human–work interactions in this new industrial revolution. To success in this industrial revolution, organizational leaders need to play a vital role in bridging the new revolutionary method to the workers. Furthermore, ensure that the workforce are able to adapt new models of work and careers (Deloitte Insight, 2018). Thus, it is significant that the work motivation is given due recognition and comprehended, in order that the organization is able to provide necessary input to the workers. Thereby, understanding work motivation in Industry 4.0 is as important as other issues listed.

Behaviors in first and second industrial revolutions demand relatively monotonic behavior to reach production effectiveness and efficiency; the third industrial revolution expanded to cognitive inputs and contextual performances to pump up job engagements. In this dawn of fourth industrial revolution where work context and interaction are changing (World Economic Forum, 2016, 2018), the essential work behaviors should be revisited. Thereby, “What” behavior is essential in this new industrial landscape should be widely identified throughout geographical and cultural districts.

Repeatedly, motivation is a sequence of responses toward stimulus. An “effective” motivation factor will direct, intensify, and persist a behavior (Reeve, 2018). It is undeniable that not all behaviors constitute to be motivated by single factor. As such, different work behaviors require different motivation factor/s to stimulate (Grant & Shin, 2012; Reeve, 2018). Paying high salary to a worker may motivate his or her task performance, but it may not effective to stimulate an individual to engage in knowledge sharing. In contrast, a sense of belongings may motivate an individual to share his or her knowledge, but it does not constitute to work intensity. Base on the theoretical foundation, “What” motivation factors that will correlate to many essential work behaviors nowadays are as important as the first question.

**Future Research Directions**

Motivation field of study provides fundamental explanations on human behavior. The authors repeated that through understanding why people “act” in such manner, motivation science allows practitioner to predict hence direct favorable behaviors that are essential toward organizational successes.

The evolving interactions between people and work are creating new work demands. Automation is in progress of taking over lower level jobs. At the same time, new jobs that require higher order thinking plus high work engagement are trending upward. Motivation models that “previously” well explained work behaviors in earlier industrial context may become obsolete.

The forth industrial revolution forges a new method of work (Popkova, Ragulina, & Bogoviz, 2018), thereby raises new manners to conduct work. In this new industrial landscape where skills and knowledge demand are getting diverse and different from before, workers are expected to engage in higher order cognitive and affective inputs such as creativity, lifelong learning, citizenship performance, environmental concerns, and many more (Deloitte Insight, 2018). Changing of the work demands subsequently refreshes the lists of vital work inputs and outputs. As these variables are important factors of contemporary organizational success, more relational data analysis should be conducted to explore essential work requirements and its significant variables. Findings of these studies include present-day work behavioral models that will be very useful for organizations in designing new jobs demands, facilitating staff recruitment, retraining, and work redesign.

Besides, the new industrial revolution is pushing organizations to launch their organizational change. The involvement of workers toward organizational change is undeniably crucial (Kopp et al., 2016). However, the painstaking process of changing business, management, and work methods always complements with conflicts and ambiguities, which
may subsequently increase human errors and deviant behaviors (Baharom, Sharfuddin, & Iqbal, 2017; Pinder, 2008). Organizations should reduce all human factors that will either hinder the change progress or increase change failure (Robbins & Judge, 2017). Other than job satisfaction, the authors highlight two intervening variables that may inflate during organizational change: job tenure insecurities and organizational justice. As found in several empirical findings, these two variables have positive correlations with deviant behavior (Iztkovich, 2016; Kiel, Müller, Arnold, & Voigt, 2017; Reisel, Probst, Chia, Maloles, & König, 2010). Case study and grounded theory should be widely conducted among workers who experiencing organizational change. Besides, relational data analysis should also include the two proposed variables. Findings of these intervening variables will assist organizations to better allocate their resources during changing process.

On top of that, the arriving of new generation also raising the necessity of reconstructing contemporary models of work behaviors (Montana & Petit, 2008; Reis & Durkin, 2018). These generational cohorts, whose members are linked to each other through shared life experiences during their formative years, were severely reported with distinct characteristics, aspirations, and expectations (Berkup, 2014; Dimock, 2018). While elder generations are offboarding, younger generation Y and generation Z are filling up the empties. Future researches should distinct these young but impactful cohorts from elder generations, thus mapping up correlations toward variety of important dependant variables.

Final Words

The key to a revolution is disruption in work, and every revolution bring about either the revolutionary methods or revolutionized workforce which nurtures new ways of work and life. In the fourth industrial revolution where economy of scale is breaking its boundaries to reach its next level, interactions among people and work is becoming more and more diverse and reliant on technology.

As organization success in this current revolution is only attainable if the organization indulge in the shift and transformation, the current workplace evolution has again urged the necessity of work redesign to cope with a whole new set of work requirements and expectations. Work motivation science, subsequently, has to revise its variables and models to continue providing organizations with important references.

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