



# Advancing Women in Leadership

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*Full Length Research Paper*

## **The Essential Leadership Skills for Women Leaders in the Age of Industry 4.0**

**Szufang Chuang & Barbara A. W. Eversole**

**Szufang Chuang**, Indiana State University, Associate Professor, [Szufang.Chuang@indstate.edu](mailto:Szufang.Chuang@indstate.edu)  
**Barbara A. W. Eversole**, Indiana State University, Professor, [Barbara.Eversole@indstate.edu](mailto:Barbara.Eversole@indstate.edu)

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**Abstract:** The researchers summarized and synthesized research evidence on different women's leadership characteristics and behaviors from men and identified essential women's leadership competencies that are necessary to address the new challenges of today's workplace and the paradigm shifts for women leaders to remain competitive in Industry 4.0. Recent neuroscience and social science research findings regarding women's leadership characteristics and behaviors were reviewed and discussed. Critical leadership traits, abilities, and skills for (international) business success were discussed. Six essential women's leadership skill sets for Industry 4.0 were proposed to provide human resource development practitioners a framework for women leadership development and promoting gender equality in workplace. Some unique women's traits such as sensing, listening, accepting, approaching, collaborating, supporting, and encouraging, can be women leaders' strengths in the tech-driven workplace. Finally, implications for human resource development and recommendations for future research were provided.

**Keywords:** Essential leadership skills, women's traits, women as leaders, women's leadership development, Industry 4.0. As our workforce demographic changes, there are challenges that come with organizational diversity and inclusion initiatives and technology innovation in the workplace. The large number of retiring mature workers, known as the silver tsunami, creates issues of talent shortages in the workplace; yet the other group of mature workers who prefer to work longer for self-actualization or financial reasons also creates challenges of a multi-generational workforce for managers and leaders (Tamburo, 2020). According to the U.S. Bureau of Labor Statistics (2021), the labor force of people ages 75 and older is projected to grow 96.5 percent by 2030. In addition, technological advancement increases opportunities and needs for high- and low-skilled jobs with none-routine and unpredictable pattern of tasks but replaces middle-skilled jobs using routine manual tasks – known as job polarization (Cirillo, 2018; Gallie, 2017). The current progression of Industry 4.0, also the 4th Industrial Revolution, drives companies to upgrade and fully automate their manufacturing systems and to upskill their employees and leaders (Kasapoğlu, 2018). These modern phenomena have reformed business models and produced an aging, diverse, machine-paced, and skill polarized workplace that may redefine and create different demands for essential leadership skills for managers and leaders. Leaders are facing challenges of preparing workers for new skills and job changes to align initiatives with new business models and organization's strategic direction. Also, to retain talent workers and ensure their productivity, developing and sustaining engagement of remote workers require advanced consulting and leadership skills from managers. After examining the effect of Industry 4.0 on employment, job outlook, work structure, and human resource development (HRD), Chuang and Graham (2018) noted combined challenges of a skill-polarized workplace, a tendency of technological unemployment for those positioned in middle-skill jobs, and an increased demand for employees with a higher level of human skills.

Given the challenges of the skill-polarized workplace, job changes, technology unemployment, and new meaning of work to lead in Industry 4.0, additional constraints make it harder for women to succeed in leadership positions. In 2019, about 41 percent of managers were women, a number that has remained relatively flat since 1990, who still remain underrepresented in management positions (U.S. Bureau of Labor Statistics, 2022). The number is even worse in the executive suite: only 5% of the global 500 is run by a woman (Hinchliffe, 2022). Although a sufficient number of women is highly educated and qualified to participate in global organizations, there are still barriers and challenges confronting women in leadership and management positions in business, government, and university sectors (Haile et al., 2016). There have been many efforts to promote gender equality in the workplace. Yet, research evidence has shown a long-term effect of underrepresentation of women (students) in STEM industries (Adams & Kirchmaier, 2016), and considerations of senior leader selection and development still vary by gender across the globe (Gipson et al., 2017; Cuadrado et al., 2015). For example, in China, Horak and Cui (2017) revealed significant evidence of better organizational

performance and competitiveness with women on corporate boards; however, gender inequity remained on the boards in the automotive industry. In 2020, only a third of worldwide corporate boards had at least three women members (Milhomem, 2020). Via a systematic literature review over 345 publications between 2000 and 2015, Kalaitzi et al. (2017) discovered that “leadership skills” is on the top 10 list of 26 identified women’s leadership barriers. Research has provided evidence of lacking development of leadership skills for college students and women faculty in leadership positions (Acker, 2010; Kodama & Dugan, 2013).

From an organizational development perspective, women’s continued development and participation in leadership positions can enhance diversity in the workplace and promote organizational success. As women’s leadership roles and responsibilities expand, their quality performance and efficiency will be more visible in highly competitive and rapidly changing workplaces (Coleman, 2010). It is critical to find out their needs, barriers, and unique qualities that differentiate them from men and make the differences beneficial to their organization and job performance. While Industry 4.0 reforms the business model, operation, system, and strategy globally, securing effective leadership skills for woman managers should be considered as a strategic HRD approach for organizational competitive advantages. After all, having diverse gender managers at the top level promotes organizational growth (Seo et al., 2017).

Because of the ongoing gender gap in top leadership positions, a new perspective of essential leadership skills from women’s perspective to cope with workplace changes by advanced technology is needed. This conceptual paper aims to provide new insights and perspectives on the woman leadership competence puzzle and identify essential women’s leadership skills for organizational success in Industry 4.0. The paper is expected to (a) provide evidence and practical information that will facilitate organizations helping women in developing essential leadership competencies for Industry 4.0 transformation, (b) contribute to the literature in gender, leadership, and organization development/culture change, and (c) explore whether and how women may well be uniquely positioned to lead in Industry 4.0. Therefore, the construction of this paper will first focus on the current understanding of women’s qualities and behaviors in leadership roles. Next, we will discuss the critical perspectives on leadership skills for success in Industry 4.0 transformation in general. Finally, based on the two phases, we will propose essential woman leadership competencies in industry 4.0.

### **Sex Differences: Women’s Qualities and Behaviors in Leadership Roles**

In this paper, leadership is “the behaviors and qualities of persons in formally designated leadership positions” (Powell, 2014, p. 249). This section focuses on the gendered nature of leadership and leadership qualities and behaviors of women based on significant findings from neuroscience and social science research.

### ***Gendered Nature of Leadership***

Clow and Ricciardelli (2011) noted the three theoretical lenses that pertain to gender inequality in leadership: social role theory (Eagly et al., 2000), stereotype content model (Fiske, et al., 2002), and ambivalent sexism (Glick & Fiske, 2001). Eagly and Koenig (2008) noted that role theory and stereotypes that women are interested in community and are empathetic conflicts with the role stereotypes prevalent in the world of management. Women are also more interpersonal, while men are more task-oriented (Eagly & Karau, 1991). Since more men than women are leaders, role incongruity theory explains why women are perceived as being less effective than men as leaders (Eagly & Koenig, 2008; Patterson et al., 2012). In fact, even when women leaders adopt the same behaviors as men, they are still viewed as ineffective, as they threaten gender stereotypes (Rudman & Fairchild, 2004; Mavin, et al., 2017). All this leads to discrimination against women leaders (Clow & Ricciardelli, 2011).

It is important to note that women’s barriers to reach their leadership potential are global. In South Africa, woman managers tend to deploy transformational, democratic, and people-oriented leadership styles and experience barriers related to gender stereotype, a lack of confidence to achieve success, family responsibilities, and a lack of networking skills (Maseko & Proches, 2013). In Spain, gender stereotypes was also found in a perceived expectation of exhibiting woman traits in women leadership (Cuadrado et al., 2015). In South Korea, Cho et al. (2016) discovered robust findings on women leaders’ work-life imbalance and barrier in leadership development because of a gendered workplace. Similar findings on women leadership barriers were supported by Kalaitzi et al.’s (2017) study in healthcare, academia, and business. These research findings indicate that women leaders tend to exhibit different leadership styles from men and generally experience barriers caused by gender stereotypes and roles.

### ***Women Lead Differently from but Effectively as Men***

Using measures of leadership effectiveness, such as the Multifactor Leadership Questionnaire (MLQ), studies have found no difference between genders (Yan et al., 2018; Stempel & Rigotti, 2018; Qiu & Dooley, 2018). There are more similarities in leadership behaviors than differences between men and women executives versus non-executives, such as decisiveness, assertiveness, and strategic thinking (Wille et al., 2018). However, Javidan et al. (2016) discovered different global leadership strengths between men (who demonstrated superior interpersonal impact, global business savvy and cosmopolitan outlook) and women (who excelled in diversity, diplomacy, and intercultural empathy). Shaked et al. (2019) concluded that women principals utilized an instructional leadership approach characterized by instructional expertise and attention to relationships more often than men. In another study, women leaders were found to favor clement leadership behaviors on an instrument – the Paternalistic Leadership Questionnaire (PALEQ) – while men favored authoritarian

behaviors (Zbihlejevia et al., 2018). Clement leadership behaviors included care for subordinates and their well-being, while authoritarian behaviors utilized power and control and required obedience. These results mirror those found by a meta-analysis done by Eagly et al. (2003) of 45 studies, which found that women were more effective than men on transformational measures of management. These scientific research findings confirm that, in general, genders lead differently.

### ***Women's Barriers in Leadership Role and Development***

A consistent finding on women's barriers in leadership is lack of confidence. Paustian-Underdahl et al. (2014) reported that women were rated as significantly more effective than men in leadership by others, but less effective than men in self-ratings. Sheppard (2018) and Koochang and Hatch (2017) also discovered that women scored significantly higher on leadership effectiveness but considered themselves to have less leadership ability than men and viewed themselves as less likely to become leaders. These findings reveal that women tend to suffer from a lack of confidence in their leadership effectiveness. This low self-assurance can affect women's performance evaluations and opportunities for promotion to higher level management positions (Harvey, 2015). Similar finding on the confidence gap between genders could also be found in other research in United Kingdom (Howe-Walsh & Turnbull, 2016), South Africa (Maseko & Proches, 2013), and United States (Sin, 2016) that often restricts women's opportunities for career advancement. The issue of low confidence among women is universal and should be addressed for their leadership career development. A notable exception to this is a specific gendered role model coined the "female hero" by Adamson and Kelan (2019). This role model has the "confidence to jump over gendered barriers" (Adamson & Kelan, 2019, p. 983).

Another common phenomenon impacting the leadership gap is the glass cliff – a result of hostile sexism (Acar & Sumer, 2018; Ryan et al., 2016). The glass cliff is the phenomenon where women are placed in risky top leadership positions more often than men. Harassment and social role conflict limits the number of women in top leadership positions (Hubbard, 2018). In a study using indirect questioning techniques, Hoffman and Musch (2019) found that both women and men were more prejudiced against women leaders than self-reports would indicate. Another experimental study on effective leadership between genders, women were rated less positively and rewarded less than leader of men (Grossman et al., 2019). Sexism has been and will continually affect women in their leadership role and advancement.

### ***Women's Brains Action Patterns***

Why women see and do things differently from men may be explained through a neuroscience lens. Neuroscientific studies demonstrated that one's emotion, thought processes, learning, memory, and moral decisions are affected by the biology of sex differences in cognitive function (Li, 2014; Ryan, 2017). Recent studies in cognitive neuroscience have examined gender

differences in brain activation patterns and concluded gender differences in justice evaluation (Dulebohn et al., 2016), attitudes about online advertising (Goodrich, 2014), responses to novel and valenced material (Andreano et al., 2014), ethical decision-making (Ryan, 2017), information processing (Bhaduri & Ha-Brookshire, 2015), and multitasking (Tschernegg et al., 2017). Even though recent empirical research discovered that genders are found to be less different in sequential (i.e., task switching) and concurrent (i.e., dual tasking) multitasking, the research finding was generated by controlling all possible gender differences in working memory, processing speed, spatial abilities, and fluid intelligence (Hirsch et al., 2019). Specifically, women have more persistent amygdala responses to familiar, negative material which leads to a potential vulnerability contributing to affective disorder and predicts self-reported anxiety and depression (Andreano et al., 2014). Generally, women perform better on object location or recognition and verbal memory tasks (Li, 2014). For example, women are generally better at remembering faces (Herlitz & Loven, 2013) and outperformed men on word attention and social cognition tests (Ingalhalikar et al., 2014). In more recent research, Tschernegg et al. (2017) assessed sex-related differences in brain function with multitasking and confirmed that women demonstrated increased activation in functional networks (the inferior frontal gyrus) for verbal dual-tasking. These findings are supported by Amen et al.'s (2017) discovery on how women's brains are significantly more active in the limbic (emotional areas) and the hippocampus (memory area), which may explain why women tend to exhibit more empathy, intuition, and collaboration. New research on facial recognition and processing facial expressions has shed light on why women's abilities surpass those of men; women are actually processing information on a subconscious, unattended level (Zhang et al., 2018).

### ***Women's Information Processing***

The literature shows that genders are different in information processing and evaluation, and the differences are influenced by both biological and socialization factors (Aragon-Mendoza et al., 2016; Bhaduri & Ha-Brookshire, 2015; Costa et al., 2001; Goodrich, 2014; Meyers-Levy, 1989). Women are comprehensive processors who are more likely to process information elaborately, seek association between their self-generated and outside information, and evaluate all available information before reaching a judgment (Bhaduri & Ha-Brookshire, 2015; Goodrich, 2014).

### ***Women's Problem Solving***

Problem solving is a method, a procedure, and an attempt to recognize, explain, assess, and resolve a gap between a pre-existing condition and a goal (Khan et al., 2016). Empirical research systematically reports gender differences in problem-solving process, style, and skill (Burnett et al, 2016; Ekici, 2016; Görücü & Cantav, 2017; Hardy & Gibson, 2015). Specifically, women were found exhibiting greater levels of creative problem-solving (Hardy & Gibson, 2015) and positive perceptions of the

general problem-solving process (Ekici, 2016). Both Hoogerheide et al.'s (2016) video modelling example and Sin's (2016) social media example indicated that women tend to have low self-efficacy, and their problem-solving methods are more likely to be affected by excessive information, conflicting information, and noncredible information. Hedjazi et al.'s (2012) conclusion on how intuitive individuals often view the environment as a whole aligns with Burkey and Miller's (2005) report on women being intuitive global thinkers and using an intuitive problem solving style in work settings. The finding was also confirmed in Khan et al.'s (2016) recent research on university students' problem solving style. Notice that, because many empirical research in problem-solving was conducted on students at high school (Ekici, 2016; Hoogerheide et al., 2016) and university levels (Görücü & Cantav, 2017; Keener & Strough, 2017; Khan et al., 2016), the application of these scientific findings on professional women workers in leadership positions may require further investigation. Women workers may have different leadership traits and behaviors from women students. Because problem solving has a significant effect on life satisfaction of individuals (Cenkseven-Önder, 2012), it is important to understand and further investigate on issues relating to women's problem solving.

### **Critical Perspectives on Leadership Skills in General**

For decades, scholars have been trying to define essential leadership skills for managers. Katz (1955) distinguished three developable leadership skill sets: technical skills (i.e., knowledge and proficiency in particular activities involving methods, processes, procedures, or techniques), human skills (i.e., self-awareness, sensitive to human relations, encouraging and motivating employees, communication, and active listening, which shows the ability to work with people and help people working cooperatively toward a common goal), and conceptual skills (i.e., vision, strategy, and putting goals into words which shows the ability to see the enterprise as a whole and work with ideas and concepts). Katz (1955) suggested that technical skills are more important at lower levels of administration; however, human skills are essential to managers at all levels. Differently, conceptual skills are the most important ability of administrators at the top/executive level. Katz's central idea of leadership skill has been well adopted and further developed in many studies (Kearns et al., 2015; Mumford et al., 2007; Zaccaro, 2001).

In 1980s, research on leadership skill began to involve more variables into investigation such as environmental dynamic. For example, Heimovics and Herman (1989) examined management skills and suggested that skills such as creative boundary spanning, strategic planning, human resource development, and service provision are needed for managers of non-profit organizations. Kearns et al. (2015) also examined lead skills of the chief executive officer (CEO) of non-profit organizations and identified a mix of technical, interpersonal, and conceptual skills in the executives' leadership tasks that are critical for organizational success. Communication and trust building are

identified as the most important interpersonal skills for CEOs (Kearns et al., 2015).

To better understand how leadership functions and the applicability of the identified leadership skills in an international context, Hurt and Homan (2008) used the U.S. Department of Labor's Occupational Information Network (O\*NET) to examine the components of effective leadership and identified four dimensions of universal leadership behaviors: visionary, consideration, task-orientation, and problem-solving. Jones et al. (2014) has also contributed to the literature on international leadership by attempting to develop a universal leadership model and proposing Four As – ability, adaptability, ambassadorship, and awareness – as the construct of universal leadership. Self-awareness is emphasized as a critical attribute in achieving and maintaining a successful leadership role (Jones et al., 2014).

However, given the contemporary changed leadership landscape, Marques (2015) suggested seven critical leadership behaviors: flexibility, care, a sense of community, creativity, inspiration, facilitation, and honesty. Similar result was found in Smalley et al.'s (2016) study on individual leadership perceptions, skills, and traits of agribusiness and industry professionals. Smalley et al. (2016) discovered that being accountable, taking responsibility, communicating, learning, and adapting to change are five most important leadership skills, and honesty, positive attitude, trustworthiness, self-confidence, and dependability are identified as the five most effective leadership traits. Also, twenty-one behaviors of effective leaders from the point of view of subordinates that Hamlin et al. (2016) enumerated in a derived etic comparative study are:

good planning, involves employees in decision-making, actively listens and seeks opinions of staff, actively supports training and/or career development of employees, constructive in providing feedback on performance, monitors and addresses poor performance and appraises employees, gives recognition or thanks, rewards employees, gives direction and guidance, informs staff by sharing information, shows interest in employee well-being, effective delegation and empowerment, sets goals and shares them with employees, supportive management/ leadership approach, lends employees a hand when necessary, stands by employees when under threat, encourages and/or motivates employee, helps employees learn from their mistakes, exhibits an open and approachable style of management and leadership, develops honest and trusting relationships with employees, and leads by example (p. 251).

In a more recent research, Tench et al. (2017) surveyed 2777 communication and public relations practitioners (62% were woman; 38% were men) in Europe to identify important characteristics or behaviors to be demonstrated by effective leaders. The identified top ten characteristics of an effective leadership are:

communicating in an open and transparent way, providing a clear overall, long-term vision, handling controversial issues or crises calmly and confidently, leading by example, aligning what is said and done, bringing out the best in others, admitting mistakes, telling a compelling, easily understandable story, making tough decisions, and showing respect for different cultures (Tench et al., 2017, p. 204).

Because of technological advancement, recent research began to consider technological dynamic in leadership behavior. The Industry 4.0 and Age of Automation has made leadership tougher. An enlightened and flexible leadership is required to keep pace with the rapidly changing industrial landscape and to lead businesses into the future (Herold, 2016). Some critical qualities of an effective leader include the ability to ensure the organization's sustainability and demonstrate their moral responsibilities to the communities such as treating technological displaced workers with respect (Binney, 2019). According to Herold (2016), top leaders in the digital age should hold the four skillsets: traditional leadership (leading, managing, and inspiring others effectively), diversity (welcoming and embracing different opinions and perspectives), agile leadership (innovating, performing, reflecting, risking, defending), and ethical responsibility (leveraging new technologies to protect humans). Harrison et al. (2018) examined and identified the critical entrepreneurial leadership skills for organizational success in a developing economy environment through qualitative research. Technical/business skills (i.e., technical expertise, business function skills, accounting and financial management, administration, marketing) were one of the four identified entrepreneurial leadership skill sets in the study.

Table 1 summarized the critical leadership traits, abilities, and skills found in the literature discussed above. The identified leadership skills may be adopted to facilitate women to achieve and maintain a successful leadership role during the Industry 4.0 transformation.

#### **Essential Women's Leadership Skills in the Age of Industry 4.0**

“Leadership is a matter of intelligence, trustworthiness, humanness, courage, and sternness.” – Sun Tzu (Cleary, 1988, p.6).

Industry 4.0 integrates advanced technology into every aspect of life and increases human dependency on technology. The need for human labor is declined from production to decision-making and business strategic plan and leadership are reformed (Herold, 2016). The profound impact of Industry 4.0 on social and human capital development should not be underestimated.

As discussed in the previous sections, the literature has provided sufficient evidence on gender differences in various ways. A gender impact on woman leadership identities, styles, and practices was confirmed (Wheat & Hill, 2016). Gender differences do matter in leadership and management performance. Perkov et al. (2016) indicated an ongoing tendency of women achieving top management positions through their

shared experience as women, rather than adopting a successful leadership style for men. More studies have examined women's traits and revealed the influence of women's social roles and personality (women's) traits on their behavior and performance in decision-making, conflict management, and problem-solving (Cenkseven-Önder, 2012; Keener & Strough, 2017). For example, Wheat and Hill (2016) identified a powerful influence of motherhood on the women's leadership styles and practices and how the skills learned from the motherhood could be transferred to the leadership roles. This may partially explain the phenomenon of gender differences in leadership. Similarly, Keener and Strough (2017) also identified a significant influence of women's personality traits on women's conflict management strategies. Specifically, women tend to use a communal strategy to manage conflicts with female friends but adopt an agentic strategy to address conflicts with a male friend or romantic partner (Keener & Strough, 2017). Common woman traits that were identified in leadership and management literature may include: sensitive to other people's needs and feelings, emotional, devoting self wholly to help others, building warm relationships with others, and using idealized attributes and inspirational motivation (Cuadrado et al., 2015; Martin, 2015; Tench et al., 2017). To help women reach higher-level of leadership positions in this competitive work environment, Cimirotić et al. (2017) discovered several individual enabling factors such as social/interpersonal skills, specialized knowledge, professionalism, ambition, hardworking, ability to assert oneself, and like their job. Thus, efforts to reshape women leaders into a male form are not needed, nor encouraged. Women may have different needs and concerns with leadership development, as well as strengths to lead employees and organizations through Industry 4.0 transformation. Successful leaders should not be gender-blind but treat gender differences as opportunities for better performance outcomes. The unique women's traits and strengths may be adopted in leadership practices to unleash women leaders' potential.

Because of the gender differences and rapidly changing work environment, we propose that women could apply some of the woman traits and strengths to cultivate their leadership qualities and skills that are needed for (international) business success in Industry 4.0 and to possibly complement and address issues caused by gender inequality in the workplace. For the purposes of this conceptual paper, we proposed the following six essential women's leadership skill sets for Industry 4.0 transformation.

#### ***Advanced Human/Interpersonal Skills – for Humanness***

Humanness is something cannot be replaced by machines or robots. Interpersonal skills and traditional women's behaviors are favored in new business management (Gaytán, 2014). Studies suggest that women tend to exhibit more empathy, intuition, and collaboration than men (Araújo et al., 2017).

Table I. A Summary of Critical Leadership Traits, Abilities, and Skills Identified in Literature

Skill Sets	Critical Leadership Traits, Abilities, and Skills	
Human/ Interpersonal Skills (All-Levels of Administration)	<ul style="list-style-type: none"> <li>· Awareness of self and others</li> <li>· Team-building</li> <li>· Ambassadorship</li> <li>· Adapting to change</li> <li>· Motivating self and others</li> <li>· Inspiring others</li> <li>· Welcoming and embracing different opinions and perspectives</li> <li>· Showing respect for different cultures</li> <li>· Managing &amp; developing people</li> <li>· Empowering employees</li> </ul>	<ul style="list-style-type: none"> <li>· Giving feedback &amp; recognition</li> <li>· Advanced communication</li> <li>· Sensitive to human relations</li> <li>· Showing care &amp; concern</li> <li>· Trustworthy</li> <li>· Collaborative</li> <li>· Supportive</li> <li>· Honest</li> <li>· Flexible</li> <li>· Empathic</li> <li>· Principled</li> </ul>
Conceptual Skills (Top Level of Administration)	<ul style="list-style-type: none"> <li>· Creating and selling vision</li> <li>· Analytical</li> <li>· Strategic planning</li> <li>· Idea generating</li> <li>· Problem-solving</li> <li>· Decision-making</li> </ul>	<ul style="list-style-type: none"> <li>· Taking ethical responsibility (having a sense of community)</li> <li>· Leveraging new technologies to protect humans</li> <li>· Holistic thinking</li> </ul>
Technical Skills (Lower-Level of Administration)	<ul style="list-style-type: none"> <li>· Knowledge and abilities in particular activities involving methods, processes, procedures, or techniques</li> <li>· Service provision</li> <li>· Task-orientation</li> <li>· Technical expertise</li> </ul>	<ul style="list-style-type: none"> <li>· Business function skills, accounting and financial management, administration, marketing</li> <li>· Planning</li> <li>· Giving direction &amp; guidance</li> </ul>
Entrepreneurial Skills	<ul style="list-style-type: none"> <li>· Opportunity identification skill</li> <li>· Opportunity exploitation skill</li> <li>· Risk management skill</li> <li>· Negotiation skill</li> <li>· Envisioning skill</li> <li>· Creativity &amp; innovation skill</li> <li>· Handling controversial issues or crises calmly and confidently</li> </ul>	

The use of empathy may help a woman leader to understand the needs and struggles of employees during the Industry 4.0 transformation. Generally, women are sensitive to people's needs and feelings and favour network and relationship building. Networking skills, particularly in certain membership, may increase opportunities for relationships, promotions, and professional recognition and credibility (Gipson et al., 2017). The woman's strength in relationship/team building may help collecting diverse opinions, promote innovation, and increase productivity. Thus, women may be more likely to arise as leaders and perform successfully when the positions involve advanced interpersonal and human skills. Strengthening women's human and interpersonal skills could also make them robot-proof and stay competitive in the job market. While many women may already have interpersonal skills, weaknesses such as indirect communication style or oversensitivity may constrain their optimal performance on advanced human/interpersonal skills. Women tend to use indirect communication to avoid tension or uncomfortable situation that sometimes may create confusion and misunderstanding on the message. Expressing a compelling story in clear and concise language are critical verbal communication skills a leader should have. Open and frank communications with inclusive language and network of support may advance women's human skills.

#### ***Heightened Awareness Skills – for Trustworthiness***

The abilities to recognize one's own bias, emotions, behaviors, beliefs, motivations, strengths and weaknesses are important to all leaders, particularly in virtual workplace. In order to create long-standing, trusting relationships with employees, women leaders should be truthful to their own bias, strengths, and weakness. As discussed earlier, women's brains are significantly more active in the limbic – emotional areas (Amen et al, 2017), so women leaders need to be aware of their anger and frustrations and heighten their emotional regulation skills. Such emotional self-regulation may help women advancing their emotional intelligence and trustworthiness. This suggests that a commitment to develop heightened awareness of self and others is a crucial step for women to be a trustworthy leader

#### ***Sharpened Technical Skills – for Intelligence***

During the Industry 4.0 transformation, successful women leaders should be equipped with practical knowledge and abilities that are needed to perform mechanical techniques, information technology tasks, and/or scientific methods professionally. Because women's brains tend to be more active in the hippocampus – memory area (Amen et al, 2017), they generally perform well on object location tasks and verbal memory tasks. Such intellectual functioning indicates how women's leadership effectiveness may be boosted via language-based interactions (involving encoded, stored, and retrieved information) with others. Women leaders' ability to think, reason, and use knowledge may predict their leadership performance, particularly in problem solving and conflict management. Thus, dedicating time to enhance their abilities to acquire and apply knowledge and skills through media and

technology could prepare them to respond to challenges of Industry 4.0 and be ready for higher managerial and leadership positions. A commitment to seek life-long learning on numerous fronts for continuous performance improvement and leadership development is vital for women to move up to higher-level leadership positions.

#### ***Robust Conceptual Skills – for Sternness***

Because women are multitasked comprehensive processors and intuitive global thinkers, women leaders tend to process information elaborately, seek association between information, and evaluate all information before making a decision. These characteristics may help women leaders developing a global vision and an ability to see the enterprise as a whole when working with ideas and concepts. Even though they may use an intuitive problem solving style in work settings, their problem-solving methods can be influenced by excessive information, conflicting information, and non-credible information. Detailed and completed information would enhance women leaders' conceptual skills and abilities to make effective decisions that align with organizational goals.

#### ***Greater Self-confidence Skills – for Courage***

As discussed previously, a tendency of low self-assurance among women may significantly affect their performance and chance of moving to top leadership positions. Knowledge decreases fears and builds self-confidence. It is important to not worry about failures but focus on how to succeed one step at a time. In addition, challenging oneself to lean into discomfort and acknowledging personal value system may also help increasing one's self-assurance. Together, knowledge and self-awareness can promote women leaders' confidence level. Positive thinking, confronting difficult questions, being courageous, taking a stand, learning, and practicing are other possible ways to promote greater self-confidence. To be effective over time, it is essential for women leaders to boost their self-confidence, an essential life skill, for themselves and for their team members (followers).

#### ***Strong Innovative Skills – for Creativity***

Innovation is an important leadership skill to explore new ideas/opportunities and solve problems. Innovation and creativity set human apart from animals and robots. Because women are intuitive global thinkers and tend to use intuitive problem solving style in work settings (Burkey & Miller, 2005), it would be helpful for women leaders to advance their innovative skills and develop creative intuitive skill and a growth mindset. Creative intuition is an ability to identify creative ideas freely and independently, without much thinking based on reason or logic (Spacey, 2017). Such ability may be enhanced by developing a growth mindset which seeks growth for themselves, the employees, and the company as a whole (Dweck, 2006). People with a growth mindset are interested in and thrive with challenge. They seek success in learning and improving with a focus on self-development, self-motivation, and responsibility (Dweck, 2006). A creative intuition skill may facilitate women leaders to quickly respond to the changes and



challenges caused by Industry 4.0 transformation, and a growth mindset would help them to transform the challenges to opportunities. Holding a strong innovative skill also helps women leading employees to coexist with machines and robots in the machine-paced and skill polarized workplace, as well as enhance their leadership behavior and take them to the top.

### Conclusion

The industry is changing and so is the workforce and leadership. Sex differences cause women to naturally lead in ways that we may need for Industry 4.0: more collaborative, more empathetic; more human-centered. Nevertheless, women still face significant barriers to entering top leadership positions, despite study after study showing that their ability is at least equal to that of leaders of men, if not better. A two-pronged approach is needed to make progress on this issue: we must prepare women leaders by building on their strengths, such as interpersonal skills and empathy, and developing some characteristics that hold them back, such as lack of self-confidence and assertiveness. We must use organization development to change workplace culture to remove the structural barriers and inequities that exist which keep women underrepresented in higher leadership ranks. Changing workplace culture is perhaps the most important strategy, as women are already ready for leadership roles. If we are to make any real progress in terms of the number of women in leadership roles, we need to make real changes in workplace structures and norms.

In this paper, we summarized and synthesized research evidence on different women's leadership characteristics and behaviors from men and identified essential women's leadership competencies that are necessary to address the new challenges of today's workplace and the paradigm shifts for women leaders to remain competitive in Industry 4.0. This paper provides HRD practitioners a strategic framework that will be necessary for women's leadership development and promote gender equality in the workplace. Some women's traits can be women's leadership superpowers such as more sensing, listening, accepting, approaching, collaborating, supporting, and encouraging skills. With this mindfulness women can increase their self-awareness and confidence level and embrace their strengths into leadership to work toward management effectiveness and organization success.

This paper has implications for practices in training and career development and organization development. With changing demographics and workforce requirements, HRD professionals can strategically help women to increase their competitiveness in the workplace and achieve parity in higher leadership ranks by building on their women's strengths that make them effective leaders, rather than fixing the women. Examples may include providing self-awareness training, growth mindset workshop, and creativity workshop that are needed for business success in Industry 4.0. Moreover, the professionals may also focus on organizational cultural change efforts, such as gender equity workshops and tying performance expectations to outcomes (Diehl & Dzubinski, 2016), to change male gendered norms in

workplace and prepare woman leaders to facilitate human-machine partnerships at work. HRD interventions to embed diversity inclusivity into the organization culture are also critical. As Cook and Glass (2014) asserted, diversity among decision makers could significantly increase women's ascension to top leadership positions and contribute to gender equality in work organizations. Furthermore, because of the fixed gendered social status of organizations, it is important to re-examine the existing HRD interventions for effective women's career development toward top management level with necessary skills to promptly respond to challenges and opportunities of Industry 4.0. Empirically testing the aforementioned recommendations with women's leadership development in organizations is recommended.

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