

Fresh Evidence on Technology Leadership and Technology Transformation at Schools in Five Different Continents: Moderating Role of Supply Chain

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Abstract- This paper aims to summarize the knowledge and understanding of technology leadership in educational context, that is still scarce, and gather the empirical evidence on organizational change due to technology transformation at schools in five continents. Further aimed where information sharing wide supply chain management significantly and positively inserts moderating effects among the relationship between simplified organizational structure (SOS), collective decision making (CDM), adequate knowledge and skills (AKS), and organizational change (OC). The research revealed that simplified organizational structure, collective decision making and adequate knowledge and skills have positive association with organizational change, and supply chain positively moderate among the link between AKS and OC. The result also contribute to (1) a considerable variability of terms and definition of technology leadership in the era of industrial revolution 4.0 and (2) theoretical review on managerial practice for successful technology transformation. From the study, leaders, teachers, and staffs in higher education and all parties involved in the world of education today are able to recognize the importance of adapting to rapid changes, which occur exponentially in the world of education as a result of technology development.

Keywords; School principal, Technology leadership, Information sharing, Supply chain management, Technology transformation

1. Background

In recent years, communication and information technology have developed so rapidly and become important stuff in the lives of people all over the world. According to Rudito in early 2016, out of 7.39 billion world there were 3.42 billion internet users, 2.31 billion social media users, and 3.8 billion mobile phone users [24]. In first quarter of 2020, there are 4.57 billion internet users in the world today, with total number of internet users around the world grew by 301 million within one year – more than 800,000 new users each day [64]

In the context of education, the introduction and use of technology in schools have become a universal

phenomenon that occurs in both developed and developing countries [25]. One of the biggest change in schools today is that teachers are no longer the main source of knowledge for students because students can access any knowledge, from anywhere, and at convenience time they want, by using technology (26). The traditional student's assignments have now shifted to online discussion, project collaboration, making VLOG, online paper submissions, etc. [1]. Some examples can be seen from the changes that have occurred in the classroom: video streaming can be accessed from anywhere, stories can be read through e-books, online learning can be done via smartphones, lessons can be taught through distance learning, e-learning, video conference [2] [26].

Apart from that, information sharing wide supply chain management has become a considerable topic in the technology that is developing with rapid form. The important mode of information sharing wide supply chain management not only inserting a role among technology advancement but also helping the lives of people [3]. The role of information sharing wide supply chain management where significantly asserted in technology, and human lives also play a significant part in the organizations. Various factors that induce numerous elements influence the changes of an organization; therefore, the strong impact of information sharing wide supply chain management could assert [4].

Various capabilities prevail in the structure of an organization that consists of significant technology, although technology positively linked with the organizational structure, the eminence of information sharing wide supply chain management could not eliminate [5]. Leadership and transformation countered as dominant elements that contribute a significant portion among the organizational change; therefore, information sharing has a significant impact on the contribution towards the organization [6].

Technology and technology transformation in the context of education is important to study because (1) technological mastery is an important "life skill." Like literacy and numeracy, especially for the young generation (2) technological mastery is an opportunity for economic development and employability requirements. While UNESCO stated that the main task of 21st-century education is building 21st-century skills, the dimensions of which include communication, creativity, critical thinking, collaboration, ICT literacy, information, media literacy, and life skills, which all require technology-based capabilities and knowledge [25] (3) technology is a tool to assist school's operational management and improve teaching and learning process [8].

In line with these technological developments, at the same time, there were an expectation's changes from school stakeholders (government, parents, society). Where according to, these stakeholders expect schools to be able to maintain their excellence to foster student academic achievement, but also have the responsibility to prepare students to be able to adapt in a more complex and competitive global digital environment, even schools bear the responsibility of creating the next generation, namely ethical & responsible digital. This shift in the expectations of stakeholders has also forced a shift in the functioning of school educational institutions into a digital platform [9] [27]. The situation has been compounded by the fact that there is a global pandemic COVID19. All schools in five continents are pressure to do a dramatic shifting, and must rely heavily on technology for teaching learning process and its management operations.

In fact, technological development cannot be stopped nor delayed. In the context of technology education, there is no party assigned or to be responsible for educating users whom most of them are in the immature stage. This phenomenon has resulted in so many technological abuses among teenagers, ranging from friendship bullying, porn videos, hoax news, to various invitations to delinquency models, or making violence in online sites. Thus we need a conducive digital learning environment in schools, aimed to serve the educational market based on the latest technology. Therefore, to be able to survive and stay competitive, schools need to reform their organizations and improve the educational process through technological transformation [10].

Technology leadership is a new concept in school leadership, which its definition is still unclear [65]. While other researchers have agreed that studies on technology leaders in the context of education are still very rare [32]. An evident is taken from a literature review conducted by utilizing Google Scholar database from 1998 to 2008 [28]. The finding showed only ten articles of technology leadership themes that were successfully published within ten years [11].

Meanwhile, in reality, the implementation of technology in schools has begun since the creation of personal computers in the 1980-1990s in developed countries, and the 1990-2000s in developing countries. Technology aimed to fulfill the school's need to analyze data to make important decisions and improving teaching and learning processes. Another issue regarding technology in schools is the implementation has not yet optimal. Although schools in Australia, for instance, have adequate technology infrastructure, and although large investments have been made to integrate technology into classrooms, and put one personal computer in classrooms, technology has not yet been fully exploited by most teachers [29]. Educational investors in various countries expect the use of technology to improve educational outcomes and improve the quality and effectiveness of the learning process. Technology the implementation has not all gone as expected; it was considered less than optimal [12] [44].

From various reasons above, this article was written to present (1) the definition of technology leadership in the educational context in today digital era, (2) and to determine the key drivers and barrier factors of technology transformation at schools, by measuring the link between simplified organization structure, collective decision making and adequate knowledge and skills to organizational change, using role of supply chain as moderating variable (3) Highlight common managerial practices for ensuring successful technology transformation in schools.

2. Hypotheses development

Technology transformation in schools is actually proof of the process of change in school organizations. Changes that move from old conventional practices towards efficiency efforts, quality improvement, improvement to achieve, maintain excellence and competitiveness of school organizations. Organizations that are able to direct themselves to be more effective, organizations that can build communication systems to exchange information, understand each other, adapt to various external threats and challenges, and are able to make improvements, to achieve goals expected, through innovation, experimentation, flexibility, and others actually have empowered the advantages they have, which are also the advantages of internal resources. This is in line with the concept of absorptive capacity of, which states that organizations have the ability to understand new things that come from outside, then manage them based on their knowledge, experience, skills in such a way and apply them for commercial purposes. This is an important step in achieving innovative organizational capabilities [14]. The results of previous study indicate that school organizations have the capacity to learn, self-managed, repair themselves to survive, and survive amid changes in

the external environment, in this case, the rapid development of technology [15].

11 out of 40 articles (28%) mentioned changes in organizational structure to be simpler. This can be understood because complex structures can inhibit the learning community [30] and interfere with achieving consensus, while consensus is indispensable in the learning process. Therefore, reducing complexity is very important to increase school effectiveness [16]

Some forms of simplification of organizational structure include space, time, structure & curriculum that was redesigned [31]. Rearranging goals, Design a user-friendly curriculum, a non-rigid structure that supports collaborative activities (though only consists of seven people), designing relevant infrastructure [32]. Setting up infrastructure & building technology collaboration [33] [34] [62]. Setting up teacher learning networks and encoding responses [35]. Reverse the communication process to be simpler and design an information collection system [36]. Building a structure of sharing, preparing, and availability of IT infrastructure, and technical support teams [37]. Simplifying rules, technology tools design & collaboration processes [17] [38]

H1: Simplified organizational structure significantly contributes role of organizational change.

5 out of 40 articles (12.5%) mention the importance of mutually agreed decision making. Teachers contribute to the changes that must be made through influencing and participating in school decision making. Because the teacher's role is important, many things are done by teachers, ranging from representing schools at meetings held by the government, collaborating with fellow teachers at the same school, or between schools, bridges between schools and parents. In other words, without teacher participation in decision making at school, it is very difficult for schools to improve teaching and learning processes, form professional communities, high quality of pedagogy, maximum student learning outcomes. The teachers who collaborate with each other explore and solve various problems they experience a process of learning and self-development. These teachers certainly will tend to apply what they have learned in the classroom, so as to produce better instructional practices. [30]

Some examples of teacher involvement in the decision-making process include teachers using Web 2.0 for internal communication & decision making [34]. Encourage the active participation of teachers in meeting the demands of ICT teaching & learning. There is student involvement, a shared process - between leaders, teachers, and students [18] [38]

H2: Collective decision making positively influences organizational change.

13 out of 40 articles (32.5%) mention organizations need to build joint commitment and collaborative

activities. Organizational learning is influenced by each individual to add their collective knowledge, experience, and skills to the organization. Learning with social systems goes beyond individual learning [30]. Dialogue at the school organization level is very important. According to Crossan, Maurer & Whilte [39], through dialogue, a group can develop a new and deeper understanding together. In addition, the dialogue process also seeks to convey messages and meanings that are interrelated [17].

To be able to share knowledge at the organizational level (sharing knowledge across the organization) requires interrelated, integrated processes and deliberate efforts by members of the organization. A shared commitment will facilitate the integration process. Apart from that, the best way to learn within the scope of the organization is through the community. Where employees form identities, share meaning, and innovate. Likewise, when teachers share, discuss teaching objectives, and focus on student learning, they will tend to take collective responsibility for achieving school goals [15] [30].

Some collaboration and shared commitment activities are undertaken to develop a network system between staff/teachers, clients, parents [32], setting up online collaboration among teachers [33] [34]. Review teaching materials collaboratively & individually, discussing lessons for next week through the network [40]. Creating a student teaching center, a culture of experimentation, collaboration & communication building a teacher learning network called EnLIST [41]

12 out of 40 articles (30%) mention the importance of learning and relevant skills related to needs. Learning depends on the basic knowledge that was previously owned, then the individual is open to new ideas and finally acquires new knowledge. In school organizations, knowledge can come from several sources (1) organizational history, (2) knowledge imparted by schools from experts, (3) teachers and staff in schools acquire new knowledge when they successfully solve school problems. One way to achieve organizational innovation is to exploit organizational capabilities based on routines that enable organizations to improve, expand, and utilize the knowledge they have to create something new [15] [42].

Learning has more meaning than just a means for preparing and doing work alone, but learning is a way to solve problems that exist in work [30]. Organizational learning through collaborative activities is actually intended to integrate new knowledge into the organizational context, so that new skills and practices will be truly embedded in organizational members [11].

Things were done at school to ensure organizational members have adequate and relevant ICT skills and knowledge, including conducting e-competency training for teachers, students & parents [32], preparing e-learning-teaching, network knowledge, to enhance collaboration with external parties [32], learning management systems

of LMS become comprehensive-routine management systems [33] [34], teachers become facilitators of student learning centers, ICT supports instructor reform [40]. There is ongoing support for teachers in the classroom and a commitment to continue learning [41], building a culture of acquiring & sharing knowledge professionally [43], creating a culture of technology learning community [37], provide support & ongoing opportunities to explore & experiment with new technology [44].

H3: Adequate knowledge and skills significantly influence organizational change.

Today, the global world feels well acquainted with technological advancement, while information sharing wide supply chain management endorse dominant impact over the acquainted global world [19]. Studies used information sharing wide supply chain management, an important measure that endorses eminent impact over the relationship between various elements [20]. The moderating aspect of information sharing wide supply chain management is asserted in vast studies contributing to significant change towards organizational changes. Changes contribute not only to efficient efforts but also inclusive of quality achievements in organizations, while information sharing wide supply chain management put moderating effects among them [21]. The excellence of an organization is the path that every organization strives to achieve; therefore, certain achievements could hide if the efficient use of information sharing wide supply chain management not deployed in the path of excellence. The systems of communications are dominant elements between the organization and customers, which further considered as a backbone of an organization [22].

Information sharing wide supply chain management is the influencing factor among organizations and customers, while the aim of information sharing wide supply chain management differentiated in literature. Certain improvements in organizations due to variant changes in structures, skills, and knowledge eminently performed where the employment of information sharing wide supply chain management insert robust effects [23]. Studies widely mentioned dominance of organizational structure, which positively enumerates the significance in a competitive market, while the prevalence of information sharing wide supply chain management caught as an influencing element.

The prevailing element of information sharing wide supply chain management known between organizational change and simplified organizations. Some processes enacted by organizations to achieve the targeting situations; therefore, the role of information sharing wide supply chain management significantly influences the process. Literature mentioned information sharing wide supply chain management as an influencing means contributes positive and negative aspects toward the organization [?]. Whereas, the decision-making process

tends dominance over the information sharing wide supply chain management, while the robust impact of information sharing could enhance organizational changes [?]. The need for adequate skills and knowledge with the deployment of information sharing wide supply chain management enumerate better results in organizational change.

H4: Information sharing wide supply chain management inserts a moderating effect on the relationship between simplified organizational structure, organizational change.

8 out of 40 articles (20%) state the importance of feedback and accountability. Organizational learning is a process that allows organizations to move forward in a sustainable manner. The process of adaptation and change is continuous. In fact, no organizational problem has been solved for a long time because new problems will emerge. The inquiry process in organizational learning depends on regular feedback from stakeholders both inside and outside the organization [66], i.e., feedback that contributes to the latest solutions [12].

In practice, schools will send activity reports to the district office in each city or province. Reports based on standards related to established school performance, such as test scores of student achievement on standardized exams. In addition, establishing a performance based on certain standards is very useful. This will make it easier to assess the progress of the school, the school accountability system, and others. And facilitate the calculation of the quality of performance and its consequences in the form of rewards, gifts, incentives, or sanctions [15] [30].

In terms of accountability, several things have been done including using the school budget properly based on priorities & needs, developing strategies to secure additional funds to facilitate school functions & operations [43], setting appropriate institutional goals for implementing e-teaching & e-learning at school [32], creates several methods of monitoring teaching and learning processes (student outcomes, lesson plans, teacher notes, class sizes) [43], utilizing school budgets in using technology [31], evaluating learning [45], utilizing department meetings to get feedback (students, parents), developing peer observations, arranging the time for teacher reflection. Get feedback from colleagues, teachers, and students, establish policies, assessment systems, feedback that appears, awards and recognition [17] [38].

H5: Information sharing wide supply chain management inserts a moderating effect on the relationship between collective decision making, and organizational change.

13 out of 40 articles (32.5%) mentioned the importance of leading technology in schools that are undergoing a technological transformation. Principals, as technology leaders develop organizational capacity by fostering a culture of technology inquiry in school organizations [30]. Technology leaders, will focus on finding and solving

problems related to technology and people, and developing organizational learning patterns for find various ways to improve the effectiveness of organizations related to technology. The principal, as a technology leader, is a technology user, technology competent, as well as technology motivator for the organization he leads. Technology leaders who also act as role models that consistently invite and motivate members to utilize technology in every aspect of organizational life, and to build technology culture in the organization they lead [46].

Some examples of technology leadership practices found include e-leadership in implementing the VLE-Virtual Learning Environment [32], various leadership behaviors such as consulting, recognizing, supporting, motivating, empowering, good, humble, kind, open, easy approached, helpful [43], individual principal's ability to lead ICT integration, individual principal's efforts, inspiring & enabling teachers. Ttechnology leadership has a greater influence than infrastructure & technology expenditure [47]. Leadership for schools in poor community requires courage, empathy, commitment of flexibility, maintaining relative stability of staff, willingness to accommodate parents & community, desire to work outside of normal school schedules [48]. Other scholar present school principals as twitter users to expand and strengthen communication with the community local, and reach out to share resources digital competence (setting direction, developing people, developing organizations, developing teaching & learning, teacher personal development and independent leadership for digitalization [49]. Dimensions of technology Leadership include equality, provide support for changing technological settings , applying technology to use, increasing staff – teachers used technology, creating learning communities, creating innovations [37], In additiona, technology leadership in Australia stated principal's ICT competency such as using computers, using word processing, word advancing, internet & search engines, using digital cameras , scan photos to create files, edit digital images, use e-mail, receive e-mail at work and at home, PPT presentations, interpret databases, send attaches files, create and use databases [50].

H4: Information sharing wide supply chain management inserts a moderating effect on the relationship between adequate skills and knowledge, and organizational change.

14 out of 40 articles (35%) state the importance of sustainable individual development in schools that are transforming technology. The organizational absorptive capacity depends on the learning ability of each of its members. Therefore organizations need to build a prior investment for individual professional development [42]

Doing self-e-learning [32], teaching LMS to students [34] , teachers individually doing ICT daily practices , establishing research groups to help change in pedagogical

beliefs, learning more personal [40], offering training to teachers [62], continuous self-development [41], teachers assigned to work on innovative individual projects [35] , building CPD (Continuous Professional Development [51], joined the training for principals to become digital leaders [28] and training of potential staff who were prepared to be prospective leaders [31] , providing personal learning & development opportunities for students and researchers [36], improve staff & teacher skills [37] , offer ICT professional development long-term sustainable development, ICT workshops [44] .

3. Methodology

The quantitative method adopted by the study through which data were collected by using questionnaires. A total of 250 questionnaires were distributed out of them only 180 were returned that is represented 72.0 per cent response rate. The variables adopted by study has three predictors such as specified organizational structure (SOS) that has four items, collective decision making (CDM) that has three items, Adequate knowledge and skill (AKS) that has five items. In addition the moderating variables such as supply chain management (SCM) has five items while predictive variables such as organizational change (OC) has three items. These are shown in Figure 1.

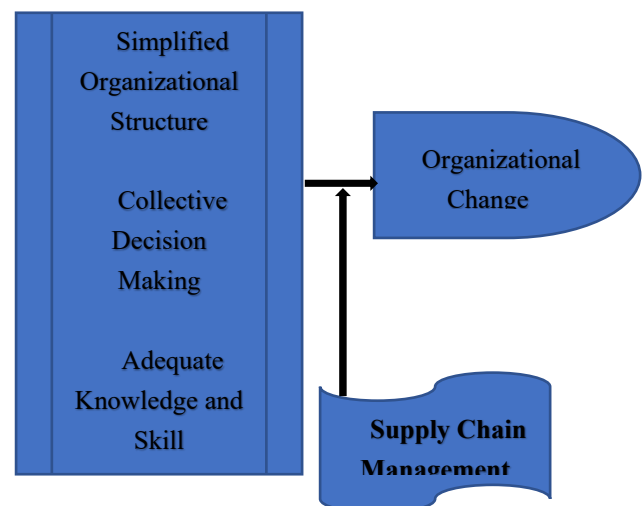


Figure 1. Theoretical model

4. Results

The convergent validity has been checked first and the results show that valid convergent validity because the values of Alpha and CR are more than 0.70 while AVE and loadings values are higher than 0.50. These values are shown in Table 1.

Table 1. Convergent validity

Items	Loadings	Alpha	CR	AVE
AKS1	0.860	0.905	0.929	0.725
AKS2	0.870			
AKS3	0.853			
AKS4	0.854			
AKS5	0.818			
CDM1	0.740	0.755	0.858	0.670
CDM2	0.805			
CDM3	0.902			
OC1	0.857	0.821	0.893	0.736
OC2	0.838			
OC3	0.879			
SCM1	0.715	0.865	0.881	0.598
SCM2	0.862			
SCM3	0.718			
SCM4	0.838			
SCM5	0.721			
SOS1	0.895	0.923	0.945	0.812
SOS2	0.906			
SOS3	0.905			
SOS4	0.898			

The discriminant validity has been checked second and the results show that valid discriminant validity because the values of Heterotrait Monotrait (HTMT) ratios are not greater than 0.90. These values are shown in Table 2.

Table 2. Discriminant validity

	AKS	CDM	OC	SCM	SOS
AKS					
CDM	0.401				
OC	0.472	0.782			
SCM	0.769	0.384	0.383		
SOS	0.430	0.452	0.537	0.427	

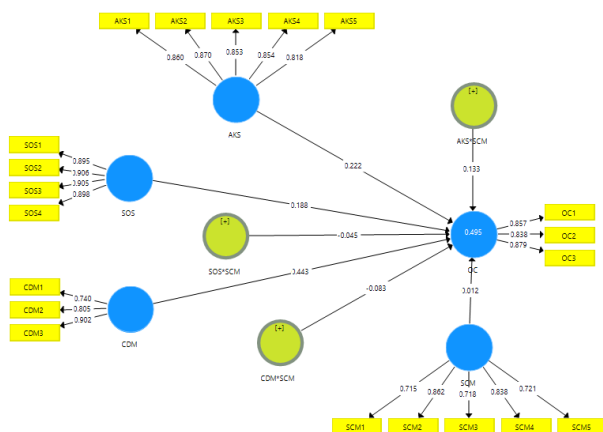


Figure 2. Measurement model assessment

The path analysis show that AKS, SOS, and CDM have positive association with organizational change and accept H1, H2 and H3. In addition, supply chain positively moderates among the links of AKS and organizational change and accept H6. However, supply chain insignificantly moderates among the links of CDM, SOS and organizational change and reject H4 and H5. These relationships are shown in Table 3.

Table 3. Path analysis

Relationships	Beta	S.D.	t-statistics	p-values
AKS -> OC	0.222	0.059	3.748	0.000
AKS*SCM -> OC	0.133	0.056	2.367	0.018
CDM -> OC	0.443	0.050	8.841	0.000
CDM*SCM -> OC	-0.083	0.057	1.452	0.147
SOS -> OC	0.188	0.057	3.281	0.001
SOS*SCM -> OC	-0.045	0.062	0.729	0.466

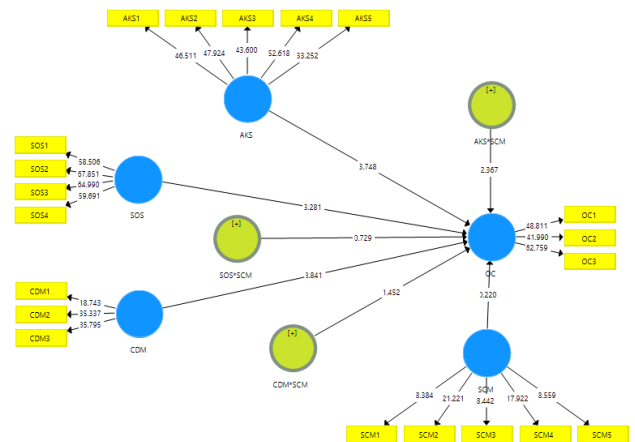


Figure 3. Structural model assessment

5. Discussion and conclusion

This article aimed to provide a background of technological leadership, which is seen as a new wave of a new model of leadership. The technology leadership model actually has a lot in common with other leadership models. The difference is that technology leadership focuses on leadership issues where the organization he leads is undergoing organizational change as a result of the influence of information and communication technology. In the past, leadership research did not focus on the problem of leadership in organizations where the work and responsibilities of leaders are related to information and communication technology [52]

In line with the fairly long evolution of the world of education, the role of a school principal becomes diverse. At present, the school principal's most recent role has emerged as a technology leader. The technology came first, followed by the urgency from the environment (global pandemic COVID19, stakeholder's expectations),

then principal as technology leader came later. A special challenge for principals in their role as technology leaders is to encourage teachers, students, and all school organizations to utilize technology with the aim of increasing the effectiveness of teaching and learning processes and school operational management. The problem is the readiness and experience of the principal to become a technology leader is often inadequate; even knowledge and skills about technology are obtained by learning by doing.

The principal's role as a technology leader includes the following tasks: (1). set the vision and goals of technology in schools. (2) Promote technology in schools (3) Being technology role models at schools (4) support the use of technology in schools. (5) engage in professional development activities that focus on technology integration in student learning activities (6) provide professional development opportunities for teachers and staff to master technology (7) secure resources to support technology use and integration in School (8) technology advocate (9) knowledgeable and supportive of national technology standards and prototype attainment of the standards in their schools (10) communicate the use and importance of technology in enhancing student learning experiences to the stockholders [53].

In this study, it is the main duty of school principals as technology leaders to establish SOS, and maintain DCM, AKS for creating successful technology transformation (OC). Result also concluded a dominant part of the information sharing wide supply chain management that prevails between the elements of technology leadership and technology transformation. Although information sharing wide supply chain management contributed a significant portion to the organization, information sharing wide supply chain management also endorses eminent impact over the elected factors of the study. A study concluding the moderating effect of information sharing wide supply chain management among the relationship between simplified organizational structure (SOS), collective decision making (DCM), adequate knowledge and skills (AKS), and organizational change (OC). The differentiation of variables renders compatibility following the study, while the information-sharing wide supply chain moderates among all elements that show relevance to the factors of leadership and transformation of technology.

Researchers have proven the principal's important function in making strategic choices, as well as to interpret, mediate, change and even influence the process of reform in organizations [54] [55]. The success of reform depends on the extent to which the principal accepts, rejects, or adjusts to the demands of reform. In other words, choices, decisions, and actions of school principals will influence educational reform in schools [25]

The principal is the most important factor in school organizations [56], which influences the effectiveness of the school in carrying out its main functions. Regarding technology, research revealed the importance of technological mastery in line with the development of technology itself [52]. E-leadership is the key to change. Leaders at all levels in all sectors (business, government, education) are expected to be competent in the use of information and communication technology today [57], and the expectation of mastery of this technology will continue to increase over time. Therefore, leaders should upgrade their abilities in terms of managing teams, by implementing e-teams, telework, e-meetings, online file sharing, virtual teaching/learning/supervision, e-teambuilding in their daily leadership practices.

In relation to technology transformation in schools, principals as technology leaders need to carefully consider the challenges to be faced, opportunities, responsibilities, and leadership strategies before implementing technology in schools. In leading technological transformation, the principal carries out the multi-role of a technology leader, namely a change leader, supports the professional development of teachers, and becomes a role model for the use of ICT in schools [58]. The success of technology leaders in implementing technology is not just about preparing infrastructure, equipment, or software, but the ability to influence and empower teachers. Technology leaders not only master new technologies but ensure and support teachers to engage continuously with students in their learning. Technology leader believes that changes in society, markets, and technology have forced many organizations today to develop new strategies and learn new ways. The most important task for leaders in dealing with these changes is to mobilize people in the organization to be adaptive [58]

Technology transformation in education takes place globally, both in developed and developing countries. The difference is that in developed countries such as America, countries in Europe and Australia, infrastructure factors are not too much of a problem because of government support and funding, as well as support and funding from external parties (parent committees, school partner companies, etc.). The availability of adequate bandwidth networks, the existence of a master plan for school digitalization down to the lower level (e.g., district, province, School), the availability of adequate training, trained teachers, and adequate support, have been the biggest support for school transformation

Authors contributed a technology factor that is eminent in organizations, but the element of information sharing wide supply chain management affects the technological variations in organizations. Studies mentioned a variety of components where information sharing wide supply chain management inserts influence while some studies render the contributing role of information sharing wide supply

chain management. For a change in an organization, various amendment contributes a significant role while the induction of information sharing wide supply chain management influences such amendments. Authors differentiate following their opinions regarding the implementation of strategies to bring organizational change; therefore, an element of information sharing wide supply chain management could not omit due to pertinence.

In less developed countries, however, such as India, Vietnam, Sri Lanka, and African countries, although government support has been declared, various problems related to networks and infrastructure still dominate. For example, poor internet connectivity and access, inadequate hardware and software devices, limited funds, and external support, limited IT and human resources training, teachers are usually only trained in basic literacy and computer software [25].

To sum up, from the study review, it comes up with four elements that offer critical success factors for the use of IT in the education system.

First, this includes ensuring the availability of certain minimum infrastructure requirements, such as electricity, telephone, internet lines, including models for efficient, affordable, and quality internet access for schools, school buildings, and a safe and protected environment for school IT use. Procurement and installation of hardware and software technology that is conducive to schools. This is a large investment, and for practical reasons, many countries have to do this in stages [25].

Second, Implementing IT in the education sector requires a large amount of money and skilled labor. Therefore, partnerships with government and the private sector, development agencies, school communities, and other professional communities are important. Full support from stakeholders (local government, alumni, parent committee, school partner companies), both material and non-material, can support the successful transformation of technology in schools. Government intervention and support are the main driving factors for the success of IT in education. The existence of regulations, central/regional government policies or IT master plan together with regional planning such as provinces, cities or initiatives at the school level will legitimize the adoption of technology in the school environment [25].

Third, Teachers to use IT training. Teachers need to understand how to implement IT that can support teaching and help with the administration process. Therefore, the policy made must be able to identify ways to improve the capacity of teachers in the use of IT and integrate IT into the curriculum, teaching system, and pedagogical models. The policy must also be able to identify the IT profile of the staff required to support technology implementation in schools. Schools and governments can collaborate to train

IT instructors, design teacher training models, evaluate teacher effectiveness, etc. This is done to ensure that teachers and members of school organizations have adequate knowledge and skill, relevant IT knowledge and continuous individual professional development.

Fourth, Effective technology leadership is a significant predictor of the use of technology by teachers and students in schools [29]. Strong technology leaders will produce coordinated use of technology to support teaching and learning. Planning and operationalizing the use of technology in the school environment effectively is the task of a technology leader, which in turn has an impact on the division of leadership responsibilities to ensure integrated success. Technology leadership includes technical expertise, communication development, coordination, and teamwork skills. Technology leadership with NETS-A standards that have been agreed internationally requires that technology leaders have a variety of knowledge and skills consisting of 5 dimensions (1) Visionary Leadership (2) Digital Age Learning Culture (3) Excellent in Professional Practice (4) Systematic Improvement (5) Digital Citizenship [59]

From the various definitions, in general, it can be said that technology leadership is a leader who is carrying out his role dealing with technological issues, leaders who dare to accept technological challenges, leaders who are willing to learn, accustomed to using and mastering technology in their daily roles (technology literate and technology competence). The principal's knowledge in understanding digitalization is a prerequisite in leading technological transformation. Principals need to know the strengths of each teacher so that they can delegate/assign relevant tasks according to the ability of teachers. This is useful so as not to waste time, effort, and talent of teachers. In addition, a technology leader is also brave to take risks and is enthusiastic leaders to transmit, socialize, and apply the use of technology to the organizations he leads to be more efficient. Despite many difficulties, technology leaders will be consistent in creating technology culture throughout the school organization (building a digital culture). The quality of technology leaders reflects the quality of one's leadership, in the sense that quality technology leaders are in line with quality school leadership. Technology leadership, not only dealing with technology alone but represents all technology-related activities in schools, including organizational decisions, policy rules, and various kinds of technology-related practices in the school environment.

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