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Establishing the Reliability &Validity of Scale for Smart Roads: Examining the Mediating-Moderating effects of government policies, management support, beliefs, attitude & behavior

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Abstract
Smart roads have transformed the conventional roads into more efficient and drivers friendly, however, the transition is not easy for both developed and developing nations. Therefore, the successful development of smart roads is possible if these countries adequately address the socio-political, psychological, organizational, cultural, financial, technological issues besides issues related to government policies, public-private partnership and support, the belief, attitude, and behavior. This study is an effort in the same line. Data was collected from Canada, France and Saudi Arabia. PLS-SEM was used for data analysis. Hierarchical multiple regression was run for moderation. The study found that innovative culture, public-private partnership, green energy, safety and security, economic sustainability, government policies, top management support, attitude and behavior are crucial for the development of smart roads. This study also suggeststhat cultural issues need to be addressed for the success of smart roads.
Key Words: Benefits and Challenges, Smart Roads, Govt policies, Top Management Support, Belief, Attitude, Behavior, Smart Cities.

Introduction

The industrial revolution introducedsmart cars and smart roads. It transformed small roads into highways and motorways, thus, high speed replaced the slower movement, shrink thedistances, and save time at one hand and increasing death because of collisions and accidents on others (Cyganski, Fraedrich, and Lenz, 2015).

Roads are the main source of communication and transportation not only for goods but alsofor commuters to travel within the city and beyond. The traditional roads are associated with congestions, delays, and accidents. Whereas some of the technologically advanced countries are

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moving ahead (Al-Naima and Hamd, 2012). They are investing huge amounts in research and development to find a solution to the problems of traditional roads. The digital revolution and Industrial revolution 4 together transformed the societies into 4.0 societies, driven by digital gadgets.The term smart road is used for the incorporation of technologies into roads to generate solar energy (Ranjan and Rajeev, 2015). Smart roads are meant for improving the operation of autonomous/ electric cars, lighting, and the application of digital media for the transformation of data and information. They also use global positioning system (GPS) (Viktor Berggren, Aneta Vulgarakis, Athanasios Karapantelakis, Elena Fersman, Keven Wang, Leonid Mokrushin, Nicolas Schrammar, and Rafia Inam, 2019)besides the concept of dividing road, and monitoring the condition of the road (Grand View Research, 2014). Initially, the smart road system was thought-out for cars onlyintendingto make a car more sustainable transportation by alleviating the issue of traffic congestion (Gereon Hinz, Josef Eichinger, Martin Buchel, and Alois Knoll, 2017).This concept not only worksin a particular way and condition, rather the purpose of the smart road is to use every single resource to get maximum results (Ansari, Akhdar, Mandoorah and Moutaery, 2000).

The heavy traffic on roads has created the issue of congestion and delay. Manoj and Narendra (2015) believe that smart roads are the only solution to overcome the issues through digital road signs to inform the traveler of congestion or slow traffic besides the delay time inter alia automated warnings for accidents. It alsosuggestsan alternate route by directly transmitting information to the driver dashboard, thereby drivers can adjustthe alternate route.

This study used SLRs and surveys. Data was collected fromdrivers, industry, and shareholders in three different countries Canada, Saudi Arabia, and Francefor two years to analyze and determine the predictors of the benefits of smart roads and challenges.Studies have indicated that people's beliefs, attitudes, and behavior determine the acceptance of new technologies (Ali Aba Hussein and El-Zobeir, 2007). Moreover, the right model, digital talent, and culture allow taking risks, continuous learning as key enablers of a successful digital journey besides, built-in professional eye on quality, sustainability, and cost-efficiency. With this background, thus the problem statement for this study was that how the contextual factors make or break the successful development and implementation of smart roads to improve traffic safety and comfort for commuters.

Literature Review

Every day, people around the globeare experiencing the disgusting strain on roads while traveling to the office, home, market, or even visiting other cities, for example, congestion on roads due to heavy traffic flow and unexpected delay. This not only disturbs the journey but also results in an apologetic attitude and behavior justifying and explaining the causes of delay than expected arrivals (Manoj and Narendra, 2015).

We are living in the age of technology, which is playing an instrumental role in shaping our societies and our lives. From the time we are born until we die, we are dependent on technology in

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one or another way. Yet, the computer, information technology, and now robots and drones have revolutionized the world by transforming it from conventional business to automation. Technology is linking almost every aspect of human life, for example, our cities, and our homes, and it connects people with people, therefore, it is no wonder that we should use it in our traveling since billions of people travel along roads every day. Though the concept of smart roads is in its infancy, which is like smart cities and smart homes, the purpose of smart roads is not only to help the commuters make their journey easy, pleasant, and safe but also much interactive experience too.

The idea is to transform our conventional roads as we see to develop and practice live feedback mechanisms for traffic, road conditions,and weather (Kshirsagar and Sutar 2013). Smart roads are expected to solve everyday problems through efficient use of electricity i.e. automated switch off-switch on during vehicle movement on one hand and other, solar energy will replace the existing power generation into environment-friendly green energy (Dylan Ryan, 2018; Ranjan and Rajeev, 2015). Surveillance of smart roads is done through drone cameras, which offer online information to road management authorities for quicker response, as well as helps in preventing and controlling accidents (Road Accident Report, 2015). Smart roads are cost-effective in the sense; theyminimize the use of human resources. It also makes it easy for highway departments to program the repair and maintenance system and emergency services like repair of vehicleson the road, emergency medical aid,and automated battery charging in electric cars.

Since smart roads make use of solar energy to light the way through automated systems besides helping in charging the autonomous cars, thus it further reducesthe loss of batteries (Ranjan and Rajeev, 2015). This aspect of green and renewable energy forced the people to find alternative means of transport yet, this idea will take time to materialize, right now, it is not always feasible for extensivetravels, and therefore, we have to see for the next few years' various cars on our roads producing carbon emissions. However, the use of green energy will reduce such emissions, since people are more inclined toward electric/ autonomous cars as smart roads offer them charging while driving thereby preserving our environment, the most debated topic and burring issue before the comity of nations (Kyriakidis, Happee,and de Winter, 2015).In contrast to developing countries, Scandinavian states have been fine-tuning their traffic safety policies for the last 50 years, while the underdeveloped and over-populated countries have been compelled to adopt a casualty "Triage" attitude to harm reduction(WHO, 2016). This approach is used in the background of rapid population growth, rapid motorization, and a protracted under-resourcing of health and transportarrangements(Elvik, et al., 2009 andBarrimah et al., 2012).

New Road, New Technologies

The shift from conventional roads to smart roads might not entirely get rid of the road damages, but make use of solar energy, which is less expensive, since it is very helpful to power the streetlights, road signs, and markings, thus, it reduces the amount of electricity required, produced

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through thermal or nuclear power stations (Luke Dormehl, 2016). European countries are taking lead, for example, Norway in installing fiber-optic beneath the surface of roads, which can record information about the traffic moving on it. It will generate and provide real-time online information and will keep on updating the drivers. Similarly, smart roads in Sweden are using charging strips that are assisted by the robotic arm and connect to the driving vehicles. Because of the guidance provided by this system, the driver can sit back and relax, yet despite these magical changes, drivers will be still responsible for steering. These smart roads in Sweden, however, will help them charge during long journeys without stopping thereby keep the car powered throughout traveling on road. Further, researchers are focusing on the idea of linking roads during traveling via the Internet of Things (IoT). Itwill make the traveling experience considerably more interactive.

The electric/ autonomous vehicles on smart roads would allow their driversextra comfortwhile on way to their workplace beside, helpful in fixing the environment, and more significantly, will even resolvethe issues of congestion (Lars Lischke, Sven Mayer, Andreas Preikschat, Markus Schweizer, Ba Vu, Paweł W WoZniak, and Niels Henze, 2018)).Several factors are impeding the growth and progress of smart roads, however, finding a suitable systemthat is beneficial both for drivers as well as for the planet Earth, could also be beneficial for the rest of the nation's development and adapt comparable technologies for their use. Canada, France, the USA, UK, Sweden, Norway, Saudi Arabia, Dubai, and China are the pioneer, once they find it successful, it will be easy for other nations to take a ride for the new journey.

Glow in the Dark

In the global competition and pressure on the economies, countries could not afford the luxury to spend budgets on the lighting of roads that span thousands of kilometers. The smart roadis based on the idea to use glow in night/ dark for road markings. These are currently available inthe Netherlands. Though this technology is in its infancy, very few of the highways are using glow in dark (Ahmad, Mustafa, Omar, Abubakr, Ahmed, Derbala, Essam Ahmed, and Bassem Mokhtar, 2017). However, under this feature, marking on roads is made by using paint with photo-luminescing powder, which charges up during the day and glows up to 8 hours in the night, thus, they are transforming the driving experience Tron-like (Michelle Starr, 2014).

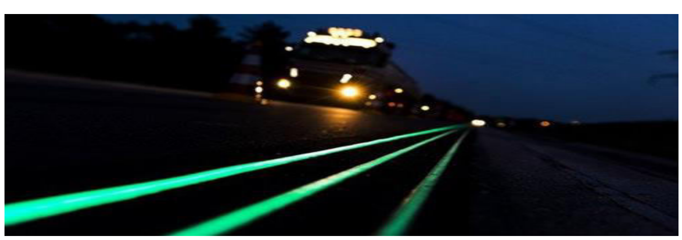

Figure-1

Experts are also working on the use of motion-sensor lights, these are interactive in the sense that when a vehicle approaches a particular point of the road, motion sensors will light only that part of

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the road, and lights will slow down upon passing of vehicles and bright on approaching of the vehicle (Lyndsey Gilpin, 2014).

Figure-2

Wind-Powered Lights

Contrastingto interactive lights, another idea is the use of wind power lights that will power up themselves. These will make use of pinwheels to generate power/ electricity. This willconvert the wind breezesfrom passing vehicles into electricity, which will light up the lights on the pinwheels or road paths. Further, since these will use wind for power-up, therefore, these will light up as and when vehicles pass by that section of the road (El Faouzi, Leung, and Kurian, 2011).

Figure-3

The Electric Priority Lane

One of the wonderful proposals is the provision of electric priority lanes where only electric vehicles could be able to keep on charging during traveling by justkeeping their vehicles in the right lane (El Faouzi, Leung, and Kurian, 2011).It will use embedded magnetic fields to charge up vehicles. Thus, it will eliminate the charging stations alongside roads.

Figure-4

Solar Roadways

Solar Roadways is an idea to install solar panels on glass roads with LEDs and microprocessors(Dylan Ryan, 2018). Since glass is renewable and environment friendly. The surface of these panels could be designed for vehicles to stop safely even if they are travelingata speed of 80 miles per hour (Lyndsey Gilpin, 2014). These roads will also be capable of meltdown snow in the winter season too, and solar energy could be used to cater to other needs.

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Figure-5

Smart Road Nations

The danger of climate change is forcing the nations to put their heads together and to invest more in how to save mother earth and make it a better place to live in. Under the umbrella of the United Nations, we could find several nations who are committed to this cause. They are striving hard to work on, develop, and finally taking initiatives of smart roads in their countries. The USA is working on smart America, and it has introduced the electric vehicle Tesla. More recently, Sweden has also introduced a smart road, and charge electric vehicles while driving. Similarly,the United Kingdom has also initiated a smart road program in 2015 and initially introduced charging while driving to help the long commute issue. Yet, it appears that China will be leading as it is working on products for first-generation smart roads such as solar energy generating panels.

Smart Roads in Canada

General Motors Canada's president urges that industry and government must go hand in hand to build smart roads for smart cars. It is planned to build a smart road first from Toronto to Waterloo (Dana Flavelle, 2015). The major challenge today Canada is facing is the growth of industry inter alia expansion of urban cities is badly affecting the climate with ever-increasing pollution (Lyndsey Gilpin, 2014). The smart grid of solar roads in Canadamight help reduce pollution. Besides,it will further strengthen the economy of the country too. The solar and wind power produced on smart roads will have the capacity to produce electricity more thanused by the US. Inthe south Canadian border, in Sandpoint, Idaho, all the asphalt roadways are using solar panels;that has considerably reduced the greenhouse gas emissions by generating clean and renewable energy. Likewise, a couple namely Scott and Julie Brusaw in their private capacity has developed solar roadways using a modular pavement system with 18.5% efficiency and cost of 250,000 pounds (Lyndsey Gilpin, 2014). The Canadian smart roads are capable of the last 20 years. These roads are also capable of melting snow and ice on contact with built-in LED lights. Further, the sensor system of smart roads in Canada could also issues warning ahead of danger or unexpected debris or trafficcongestions, etc. Similarly, under thesolar roadways indiego campaign, a $1.9 million project was launched to create awareness for the use of electric and autonomous cars, which last for 15 days (Manoj and Narendra, 2015). The campaign was successful on YouTube as more than 13 million Canadians viewed it, said Alexis Blais the public relations manager of Indiegogo (Lyndsey Gilpin, 2014). More recently, Jessica Vomiero (2017) has reported that three Canadian cities Toronto, Mississauga, and Kitchener took lead to benefit from the digital revolution thus, plans have been underway towards smart cities through infrastructural development for smart roads.

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Smart Roads in France

The government of France together with the European Union is much concerned about climate change; therefore, it is planning for bringing vehicles with no human on its roads by early next year with the investment of Delphi under the project titled "Delphi and French transport company Transdev Plan". It is planned to introduceautonomous taxis and shuttle vans for passengers in France.Transdev is already operating trains, buses, ferries, and other transportation services in some 19 countries. The Renault Zoe is also going to launch autonomous taxis, which is expected to initiate in Rouen, Normandy inter alia shuttle van service that will ply between rail station and campus university district of Paris-Saclay (PASA Group, April 2018). To realize the dream of smart roads and autonomous drive, the government of France is going to establish proper and adequate legislation, which will allow autonomous cars on public roads and streetsby early 2021 (AP Auto Writers, 2017), already been announced by President Emmanuel Macron.With the legislative framework, the scope of geographical experimentation is likely to be expanded and therefore will be likely to present increasingly varied driving situations, which is key in development.President has said that by 2022, France will be having a regulatory mechanism for such a purpose (PASA Group, April 2018). Although, until now France is lagging in developing self-driving vehicles as compared to Sweden, Norway, and Denmark. The French minister for ecology has officially inaugurated 1 KM pilot solar road in Tourouvre, in northwestern France with $5.22 million investment, and 30,139 sq.ft. of Watt way solar road tiles were installed expected to generate 280,000 kWh (roughly 800 kWh per day) electricity sufficient public lighting of a town of 5,000 residents. It will also meltdown snow during winter (Smart Roads, 2016).

Saudi Initiatives for Smart City and Smart Roads

The Kingdom of Saudi Arabia is one of the oil-rich and prosperous countries in the Gulf region. Due to a lack of public transport system, people prefer to use their cars (Barrimah et al., 2012). The youngster with less traffic sense and behavior, drive more hastily without bothering the others (Ouimet, Brown, Guo, Klauer, Simons-Morton, and Fang, 2014; TRL, 2005). Road traffic accidents are the major health hazard with 19 killed daily, and 4 injured every hour in KSA (Mansuri, Al-Zalabani, Zalat, and Qabshawi, 2015; Ansari et al., 2000; Hevelkeand Nida-Rumelin, 2015). The Kingdom of Saudi Arabia is second among the Arab countries and 23rd globally in terms of deaths due to road accidents, according to a World Health Organization (WHO, 2016) report. The statistics reveal that a car accident occurs every second (Road Accident Report, 2015; Arab News, December 20, 2015; Saudi Gazette, 2013; Saad et al., 2002; Ali Aba Hussein & El-Zobeir, 2007; Barrimah et al., 2012).

Neom city, underway as cross border city in the Saudi province Tabuk will incorporate smart city technologies. It is located near the Red Sea adjacent to the borders of Egypt and Jordan covering a total area of 26,500 km^2. The first section will complete by 2025 with an estimated cost of $500 billion. The announcement of NEOM was made by Saudi Crown Prince Mohammad Bin Salman during the Future Investment Initiative conference on October 24, 2017, in Riyadh(Business Insider, February 22, 2018).Likewise, the newly constructed roads around

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Riyadh Air Base (RAB) are using an integrated state-of-the-art traffic system, named "smart roads."(DNTS, 2011).Centralized control management to ensure the highest safety standards runs it (Riyadh Municipality, 2008). The Saudi smart roads are capable of accommodating electronic traffic applications, which provide automatic guidance to users for traffic congestion in case of accidents inter alia adverse road conditions through multiple electronic boards. These are equipped with 22 variable guiding panels, 161 directory boards, and 120 track-controlling panels inside the tunnels. Saudi smart roads are also equipped with 260 and 34 fixed and axial surveillance cameras. The roads have incorporated advanced security and safety systems, emergency call centers, alarm bells, exit gates, radio message exchange services on FM, firefighting, lighting, and ventilation systems, in addition to flood disposal pumps, humidity, and rain meters (Riyadh Municipality, 2008). Although the benefits of smart roads promise great potential in the future yet, there are some challenges faced by both developed and developing countries during the due course of digital transformation.

Benefits of Smart Roads

The benefits of smart infrastructure are multifarious for example, in the case of the driver using his/her phone for navigational information, information can be provided to the driveri.e. warnings of dangerous traffic situations or route information can also be transmitted. The driver of a semi-autonomous car can be warned of different traffic scenarios that can be classified by the information provided by the sensor system (Koo, Kwac, Ju, Steinert, Leifer, and Nass, 2015). In case there is a standing vehicle, which might go off driving on the road, other drivers traveling on the road will be informed accordingly. Likewise, the sensor system will detect a driver if by mistake he enters in a wrong way, then it will issue a warning to the rest for the ghost driver (Romero, Prabuwono and Hasniaty, 2011). Repositioning on the road could become possible for a driver in case of bad weather. The smart roads will be capable to inform driversof the possible accidents or dangers on the route (El Faouzi, Leung, and Kurian, 2011). It will also provide an optimized traffic flow to the driver to improve their driving plan. The smart roads will also enable traffic flow management through online prediction in respect of trajectories and behavior of vehicles on road through the supply of accurate data on average speed and traffic density to control the traffic flow automatically (Howard, Jean-Michael Georg, Johannes Feiler, Frank Diermeyer, and Markus Lienkamp, 2018).The smart roads are fundamentally user-oriented; they are designed specifically for reliability, safety, security, comfort, and modernity, etc. Likewise, the use of new technologies has transformed the old road system into more environment-friendly, energy conservation, improved service quality, economic sustainability, improved safety, coverage of externalities, assurance of regional cohesion, adaptability of service offered, social commitment, economic consideration, technology and innovation (Pindarwati, and Wijayanto, 2015).

Major Challenges in Transition to Smart Roads

Transformation is not an easy rather herculean task. The transition from traditional roads to smart roads is thus facing several challenges, at present, there are a very limited number of people who

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owe their cars to avail of this benefit. Due to a smaller number of vehicles, governments always feel reluctant to implement smart roads, as it will be an unwise investment. Second, electric cars are not yet available a commercial scale, thus the cost associated with such transformation would not be justified. Though self-driving is very attractive, however, still there are doubts about their safety (El Faouzi, Leung, and Kurian, 2011). The increasing number of deaths due to road traffic accidents reminds us that despitethe use of technology, the driverless future is still a dream.

The roads are now no longer the only means to travel, rather they could be used to charge electric cars and get solar energy since they have the largest exposed surface area to the sun (Ranjan and Rajeev, 2015). Technology is available to keep the section of road well light up through the use of energy-efficient, cost-effective, and environment-friendly contraptions systems (Mate Boban, Apostolos Kousaridas, Konstantinos Manolakis, Josef Eichinger, and Wen Xu., 2018). The work on the smart road is going on; new emerging technologies will make roads smarter and safer for traveling in the future (Maurer, Gerdes, Lenz, and Winner, 2016).Although, smart roads promise benefits, however,researchers must also address the issues to reap their benefits. Several challenges and issues include, for example, planners and designers of smart roads should not underestimate the ever-increasing number, size, and weight of vehicles, which result in early wear and tear on one hand, and congestion on the other(Schrank et al. 2012). The major challenges identified by researchers are, socio-political and psychological, organizational, financial, technological, and that related to government policies.

1. **Social and Psychological:**Social and psychological factors are critical to transforming conventional roads into smart roads (Dotzauer, De Waard, Caljouw, Pohler,and Brouwer, 2015). Today people are lucky to have personal cars, yet most of the young do not bother to observe traffic rules (Pettigrew, Fritschi and Norman, 2018), therefore, it has been found that deaths due to crashes are very high. Smart roads demand social and psychological shifts in driving behavior.
2. **Organizational, Cultural, andFinancial:** The organizations responsible for the installation, maintenance of smart roads also lacks the potentials to meet the requirements of smart roads. Smart roads depend on the smart organization and smart officials. Studies showmost organizations lack the capacity as well as facing the shortage of required qualified workforce (De Souza, Brennand, Yokoyama, Donato, Madeira, and Villas, 2017). Likewise, finance is also a big issue, asthe shift towards smart vehicles will affect the financial position of the countries as well in the future. Moreover, breaking cognitive maps, changing the old mindset is possible through effective education and training programs (Dotzauer, De Waard, Caljouw, Pohler and Brouwer, 2015). Further, it has been reported in studies that the availability of funding to support the systems and research as a continuous process for improvement is also a prerequisite for the success of smart roads(Pindarwati, and Wijayanto, 2015).

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3. **Technological:** This includes both machines, equipment,and professionals, the ability to develop and maintain smart systems dependson the planners, architects, engineers, IT professionals and administrative machinery, end-users inter alia availability, installation, repair, and maintenance of the smart technologies(Kundi and Shah, 2010). Studies recommendthat a state-of-the-art road system is essential for smart cars and automobiles on the roads.
4. **Government Policies:** Studies widely reported the administrative and management systemsas key to success. The policies of the government and top-down support of administrative machinery have been considered critical that may lead toward the successful execution of the projects including projects of smart roads in Europe, China, and America. Though governments have specialized departments and effective control mechanisms for the execution of such projects, yet lack of understanding, delayed decisions, lack of enthusiasm on part of human factors might be one of the issues that need to be streamlined(Pettigrew, Fritschi and Norman, 2018). The policy formulation, evaluation, and implementation depend on knowledge, administrative and decision-making skills, and more significantly the will to put in place(De Souza, Brennand, Yokoyama, Donato, Madeira, and Villas, 2017).
5. **Public-Private Participation & Support**: Smart road projects need a complete change of the road infrastructure. Therefore, fromthe western perspective, the dream was materialized through effective involvement of the private sector, however, in countries like Saudi Arabia, the public-private partnership is yet new to the psyche, and therefore, investors are reluctant to participate. Under Saudi vision 2030, the government is encouraging the participation of the private sector to share the burden of the government concerning investment in various sectors including transportation. Further, the success of smart roads depends on the support of the public in the form of cooperation and practicing smart road behaviors. This need could be catered through education and awareness i.e. seminars, workshops & billboards.Thus, mutual understanding and cooperation of public and private individuals need to sort-out.
6. **Beliefs, attitude, and Behavior:** Digital transformation introduced autonomous vehicles resulted in a complete shiftintransportation. Several researchers predictedthat autonomous vehicles would further pave the way for social, cultural, andeconomic changes (Pettigrew, Fritschi,and Norman, 2018). The positive outcome of new systems will reduce accidents, and solve the issue of traffic congestion, more fuelefficiency, convenience in movement, and a revival ofsharing economy (Dotzauer, De Waard, Caljouw, Pohler and Brouwer, 2015). Contrary to this notion, however, experts have reservations (De Souza, Brennand, Yokoyama, Donato, Madeira, and Villas, 2017). They state thatsmart roads with autonomous cars could meet resistance due to issues of safety, reliability of technology, ethics, and inadequatelegislation. Therefore, studies have reported that beliefs, attitudes, and behavioral changes must take place for the successful installation of smart technologies.

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Demographic Variables

The characteristics of the samples i.e.,age, gender, socioeconomic, education, etc. are widely recognized and used by researchers in such studies as the one in hand (Dijksterhuis&Bargh, 2001). Age and gender might have a significant influence in predicting the criterion variables (Saad et al., 2002). Younger people are eager to adopt more than older digital gadgets (Ouimet et al., 2014). Though gender is an inconsistent predictor, however, some studies identified males tend to be more prone to driving and violation of road safety systems than females (Elshinnawey et al., 2008). The level of education and literacy have also a significant impact on safe road behavior. Studies point out that people with higher levels of education have socially maturedroad behavior (Saad et al., 2002; Dijksterhuis&Bargh, 2001). Likewise, one of the main determinants is the relationship between drivers' attitudes and socioeconomic status, which is also widely explored by the researchers (Ouimet et al., 2014). People from rural backgroundswith low income respect the traffic rules, yet, in contrast, people with higher social backgroundshave low respect for the law (John &Surv, 2008). The below table illustrates the description of demographic variables of the study along with assigned coding:

Table-1: List of the Demographic Variables

Variable	Description	Code
Age	10-20, 20-30, 30-40, 40-50, above 60	AGE
Gender	Male and Female	GND
Education	Literate and Illiterate	EDU
Social Background	Rural-Urban	SBD
Economic Background	Low-income-High-income	EBD
Traveling Nature	Short, Long Distance	SLD

Theoretical Framework of the Study

The below figure explicates the schematic diagram of the theoretical model of the study which is based on the research variables of the study at hand. This model explains the association/relationship among the independent variables (IVs) and a dependent variable (DV) (Correlation analysis) and also explain the impact of the independent variables and demographic characteristics of the respondents along with the role of mediating variables (MVs) and moderating variables on the dependent variable.

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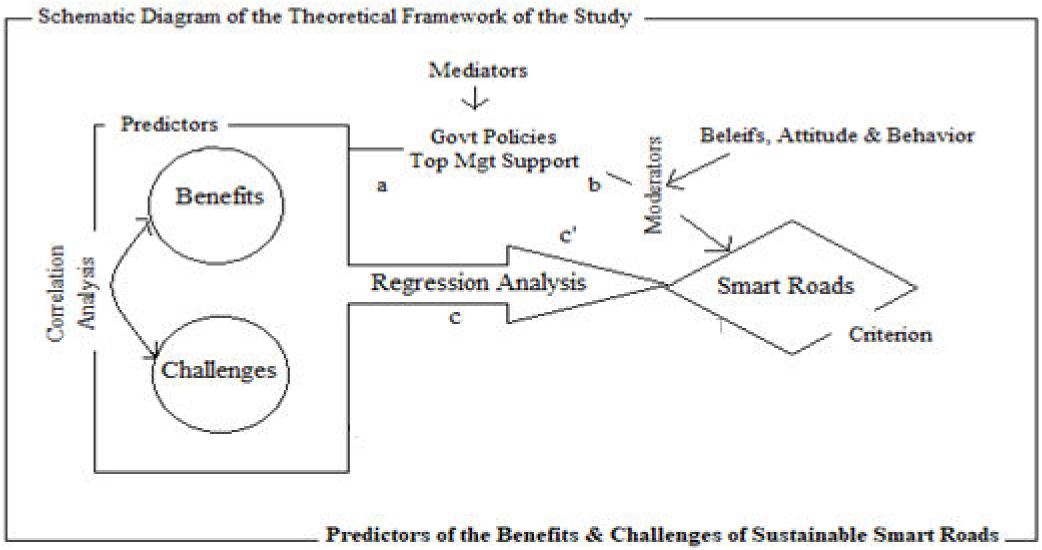

Figure-6: Schematic Diagram of Theoretical Framework developed from the Review of Literature.

Based on the review of the previous studies, and the theoretical model of the study, the below hypotheses, were proposed:

H_1: All IVs, MVs, and DV are mutually correlated.
H_2: Predictors positivelysignificantly predict the criterion variables.
H_3: Government policies and top management support have indirect effects on IVs and DV.
H_4:Beliefs, attitude, and behavior have moderating effects on IVs, MVs, and DV.

Methodology of the Study

This paper used both extensive review as well as primary data. To understand the benefits and challenges of smart roads, the SLRs method was employed for a review of the previous studies and connecting new studies with them. Second, a 5-point Likert instrument was administered to get opinions of the respondents in three different counties i.e., Canada, Saudi Arabia, and France.The SLRs method used by Massaro et al. (2016a) is a method to study existing studies to develop an understanding, significant and critical reflections, and paths for future research and the research questions to develop knowledge, connecting current study with that of earlier studies. Light and Pillemer (1984, p. 169) assert that a new study could be significant if it could assimilate the studies already done. Bernard of Chartres and Isaac Newtonstated that we could innovate by standing on the shoulders of giants, further support this view. Thus, the SLRs approach helps develop the new paths and questions for research study based on previous findings. Inthe early 1900, published studies were scarce, and only a few selected researchers could have access. However, fortunately, the world is different today, where we can find and access a huge amount of information using information and communication technologies to develop new knowledge. Thus, today a researcher's task is easy, he just needs to ask the right questions. Yet, Dumay and Cai. (2014, p. 1261) have observed that generally some of the researchers abstain to use leading-edge

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technologies, as a result, they are limiting the scope of their review of the literature. On the other hand, Petticrew and Roberts (2008) criticized the customary review of literature, stating it much subjective. To address this criticism, the SLRs approach integrates the advanced research technologies for doing a review of the literature; it complements the traditional literature reviews since this method is fruitful to produce diverse results that one can defend.

A survey was conducted once the researcher has exhausted the possible secondary sources. Based on the principle of operationalization (mutually exclusive and collectively exhaustive), a questionnaire on a 7-point Likert scale recommended by Ridings, Gefen and Arinz, (2002) and Mayer and Davis (1999) ranging from 1. Strongly Disagree, 2. Moderately Disagree, 3. Slightly Disagree, 4. Neutral, 5. Slightly Agree, 6. Moderately Disagree, and 7. Strongly Disagree was developed and administered. Data was collected in France, Canada, and Saudi Arabia. As the population of the study was infinite, so the sample size was determined through a statistical formula of (Daniel, 1999: 141-142).

$$n = N*X / (X + N - 1), \text{where,}$$
$$X = Z\alpha/22 *p*(1-p) / MOE2,$$

and $Z\alpha/2$ is the critical value ofNormal distribution at $\alpha/2$, MOE is the margin of error, and p is the sample proportion, whereas N is the population size, similarly, correction for a sample size of the finite population has been adjusted in the formula.To check the psychometric properties (Nunnaly, 1978) and the reliability of the scale was measured through Cronbach alpha (Cronbach, 1951).Approval for the study wassought from the relevant ethical and administrative institutions. However, beforethe survey, a pre-survey and pilot test were undertaken,Data was collected in Canadian cities Toronto, Scarborough, Kitchener, Guelph, Brampton, and Hamilton from July 03, to August 17, 2018. In Saudi Arabia,the survey was carried outin December 2018 and January 2019 in Dammam, Khobar, Riyadh, and Buraydah, while in France,data was collected in July 2018 in Paris, Marseille, and Aix en Provence areas.

Data Analysis and Major Findings

Table 1: Reliability Analysis

S#	Country	Variable	No of Items	Alpha
1	Canada	Innovative Culture	3	0.917
2		Public-Private Partnership	3	0.882
3		Green Energy	3	0.884
4		Eco-Sustainability	3	0.897
5		Safety & Security	3	0.820
6		Attitude and Behavior	3	0.803
7		Govt Policies & TMS	2	0.666
8		Smart Roads	3	0.798
9		Innovative Culture	3	0.821

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10	France	Public-Private Partnership	4	0.813
11		Green Energy	4	0.876
12		Eco-Sustainability	3	0.826
13		Safety & Security	3	0.821
14		Attitude and Behavior	4	0.849
15		Govt Policies	4	0.669
16		Top Management Support	3	0.857
17		Smart Roads	3	0.736
18	Saudi Arabia	Innovative Culture	5	0.751
19		Public-Private Partnership	5	0.743
20		Green Energy	4	0.795
21		Eco-Sustainability	4	0.887
22		Safety & Security	4	0.887
23		Attitude and Behavior	3	0.767
24		Belief	5	0.771
25		Govt Policies	4	0.791
26		Top Management Support	2	0.624
27		Smart Roads	3	0.924

Since the whole building of research depends on the reliability of the instruments; therefore,the researcher has to ensure the acceptable internal consistency and reliability of all items used in the instrument. Due to cultural differences in the West and the Middle East, it was essential to validate the instrument from both the western and eastern perspectives. For that reason, the researcher has collected data from Canada, France, and Saudi Arabia. The internal reliabilities of all items were tested by using item-total correlation i.e. ITC values. According to Field (2013), ITC values for all items must be equal to or greater than 0.40; otherwise, those items having ITC values less than 0.40 be excluded from the analysis. The minimum acceptable level of Cronbach alpha is 0.70, or >0.70 (Field, 2013). However, in some cases, 0.60 is acceptable (Price & Muller, 1986). There wasa total of 33 variables, 27 independent variables (IVs), 2 mediators, 2 moderators, and one dependent variable (DV). Out of 27 IVs 22 IVs have S.D <0.40, ITC <0.40, alpha value less than 0.70 and factor loadings of all items for 22 variables were less than 0.40. Based onthe above criteria, those variables and their items were excluded from the study. Only five variables i.e., culture, public-private partnership, green energy, economic sustainability, safety, and security were retained since they fulfilled the criteria. Results of reliability analyses for variables and their instruments used in Canada, France, and Saudi Arabia are given in table 1. There were ten variables such as culture, public-private partnership, economic sustainability, green energy, safety and security, attitude and behavior, belief, smart roads, top management support, and government policies.

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Study 1 Canada

Data was collected in three stages, in the first stage, data was collected in Canada, results of the instrument's reliability are presented in table 1. For innovative culture, public-private partnership, green energy, economic sustainability, safety, security, attitude, and behavior, two items from each variable were found problematic as their ITC values were less than 0.40, therefore, these items were excluded from further analysis. One complete variable i.e., belief was completely deleted from the analysis because of less ITC value for all items, further for government policies and top management support, only two items were found reliable,and the remaining items were excluded. Eighty questionnaires were distributed in Canada, but 60 respondents filled the questionnaires and returned them to researchers. These 60 responses were used in the analysis yielding a response rate of 75%. For innovative culture (Item4, & 5) were found problematic and three items were found reliable.Cronbach's alpha value for three items was 0.917 is considered excellent (Hair et al., 2017; Field, 2013). Further, analysis of results for public-private partnership revealed that two problematic items (items 1 & 3) were excluded from the analysis. After deleting two items,Cronbach's alpha for the remaining three items was 0.882. In same way green energy (item 2 & 5), for economic sustainability (item 3 & 4) for safety and security (item 1 & 2) and for attitude and behavior (item 2 & 4) were deleted. Cronbach alpha for green energy was 0.884, for economic sustainability it was 0.897, for safety and security 0.820, for attitude and behavior 0.803 respectively. On the contrary, the belief variable was excluded from the analysis because of low ITC values. Whereas, top management support and government policies have only two items reliable and their alpha value was 0.666 was consistent with Price and Muller (1986). This means that government and top management support is considered one variable fromthe western perspective i.e. Canada and both government and top management are found on one page. Thus, out of ten, eight variables were retained in the Canadian perspective, validating the instruments on 23 items on a seven-point Likert scale: three items for each variable, only two items for government policies and top management support.

Study 2 France

In the second stage, data was collected from France. The same instrument was distributed in France, which was used in Canada. A total of 75 questionnaires were distributed in France out of 75 only 50 filled questionnaires were returned showing a 66.6% response rate. Analysis of results reveals that for innovative culture only three items were found reliable, and two items were deleted because of low ITC values and three items Cronbach alpha is 0.821. Likewise, for public-private partnerships, only one item was found problematic, and four items were found reliable showing an alpha value of 0.813. Similarly, for green energy, one item was excluded, and four items were retained showing 0.876 alpha value, for economic sustainability and safety & security two items were excluded from each variable due to low ITC values and three items were found reliable showing 0.826 and 0.821 alpha values, respectively. Subsequently, the attitude and behavior alpha valuesare 0.849, so four items were retained. However, government policies and top management support were considered as separate variables in the French perspective, one item

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was excluded from government policies, after deleting one item,the alpha value for government policies is 0.669 while two items were deleted from top management support showing alpha 0.857 value, respectively. Whereasbelief variable was completely deleted from the analysis. Likewise, three items were found reliable for the smart roads variable and its alpha value is 0.736.

Study 3 Saudi Arabia

In the third and final stage, data was collected in Saudi Arabia. It was essential to validate the instruments in the eastern perspective. For that purpose, 100 questionnaires were distributed, and 70 filled questionnaires were received, that were used in analysis yielding a 70% response rate. Analysis of results revealed that there was no problematic item in an innovative culture and public-private partnership,thus, all items were retained for analysis showing 0.751 and 0.743 Cronbach alpha values, respectively. More importantly, for green energy, economic sustainability, safety, and security, one item from each variable was found problematic hence deleted from analysis, alpha values for green energy, economic sustainability and safety and security 0.795, 0.880, 0.887 respectively. Furthermore, three items were retained for attitude and behavior showing 0.767. On the contrary, the belief variable and all items were found reliable in the Saudi perspective showing a 0.771 Cronbach alpha value. Similarly, for government policies after deleting one item alpha value was 0.791, for top management support after deleting three items 0.624 alpha value was reported and for smart roads after deleting two items alpha value of 0.924 is reported, thus, validating all the variables in Saudi perspective for smart roads.

Table 2: Demographic Information country wise

Country	Variable	Characteristics	N	%
Canada	Cities	Scarborough	24	20.0
		Hamilton	07	5.8
		Toronto	13	10.8
		Guelph	45	37.5
		Brampton	24	20.0
		Niagara	06	5.0
		Kitchener	01	0.8
	Gender	Male	88	73.3
		Female	32	26.7
	Age	21-30	50	41.7
		31-40	52	43.3
		41-50	11	9.2
		51-60	06	5.0
		60-70	01	0.8
France	Cities	Paris	170	53.96
		Aix-en-Provence,	145	46.03

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		Marseille		
	Gender	Male	214	67.9
		Female	101	32.06
	Age	21-30	03	1.0
		31-40	34	10.8
		41-50	58	18.4
		51-60	122	38.7
		60-70	98	31.1
Saudi Arabia	**Cities**	Riyadh	11	5.6
		Buraydah	15	7.7
		Damam	145	74.0
		Khobar	25	12.8
	Gender	Male	163	83.2
		Female	33	16.8
	Age	18-26 years	37	18.9
		27-35 years	106	54.1
		36-45 years	24	12.2
		above 45 years	29	14.8

Table-2 shows the personal information of the respondents from Canada, France, and Saudi Arabia.

In the first stage, data was collected from Canada. A total of 120 participants took part in the study. The majority of respondents belonged to Guelphi.e., 45 (37.5%), followed by Brampton 24 and Scarboroughi.e., 24 (20%) each respectively, 13 respondents from Toronto, 7 from Hamilton, 6 from Niagara, and only 1 respondent from Kitchener participated in the study. Further, analysis reveals that the majority of the respondents were men 88 (73.3%) while 32 (26.7%) were females. Likewise, most of the respondents belong to the age group of 31-40 years i.e., 52 (43.3%) followed by 21-30 age group 50 (41.7%), and only 1 respondent was a senior citizen who belonged to the age of 60-70 years.

In the second stage, data was collected from France. 315 respondents filled and returned the questionnaires. 170 (53.96%) respondents belonged to Paris and 145 (46.03%) belonged to Marseille and Aix-en province areas. Subsequently, 214 respondents were men i.e. (67.9%) and 101 (32.06%) were females. Another important point, most of the participants belong to 51-60 years of age followed by the 60-70 years age group i.e., 98 only three participants belong to the 21-30 years of age group.

In the thirdstage, data was collected from the kingdom of Saudi Arabia. A total of 196 informants have filled and returned the questionnaires. Data was collected from Riyadh, Dammam, Khobar, and Buraydah. 145 respondents belonged to Dammam, 25 from Khobar, 15 Buraydah, and 11

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from Riyadh. Furthermore, 163 informants were male and 33 were females. More importantly ,the majority of informants belong to the 27-35 years of age group, 37 belong to 18-26 years while 29 were above 45 years of age and 24 from 35-44 years of age group.

Figure 7: Demographic Information of respondents from Canada, France and KSA

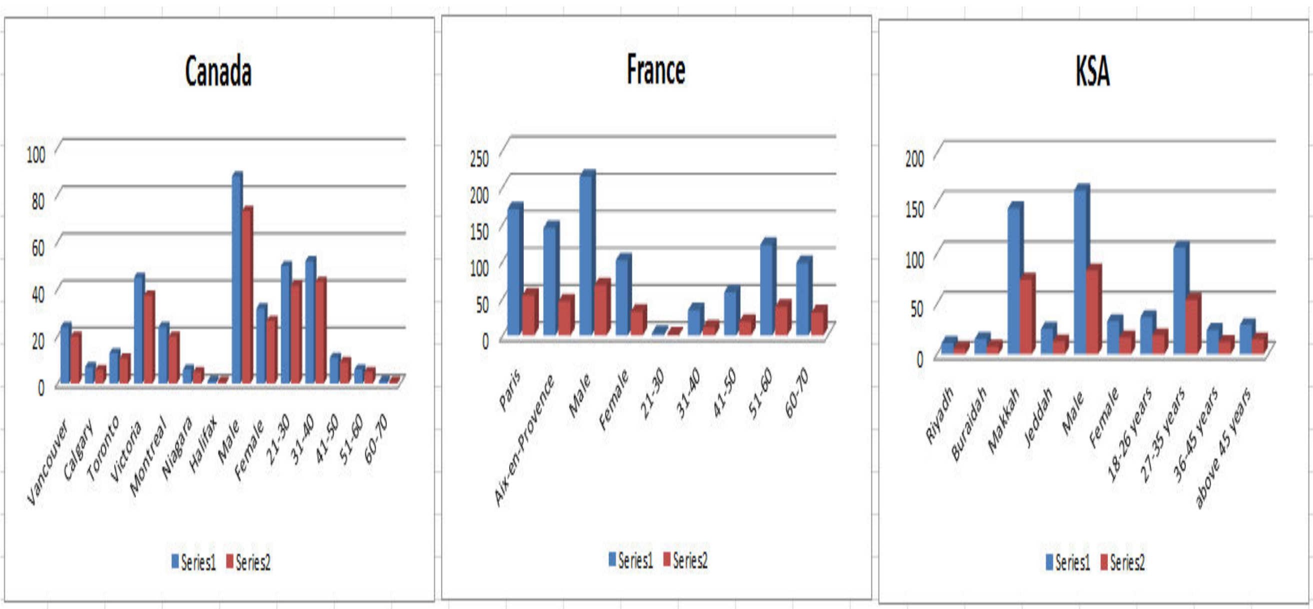

Table 3: Validities of Data

Country	Variables	Items	Mean	S.D	α	KMO	BTS	Loadings	AVE	CR
Canada (n=120)	Culture	3	3.5889	2.249	0.928	0.737	303.201	0.905-0.955	0.876	0.955
	PPP	3	3.4917	1.849	0.859	0.736	161.34	0.883-0.885	0.781	0.915
	Green Energy	3	3.4611	1.909	0.882	0.715	203.52	0.855-0.928	0.808	0.927
	Economic Sustainability	3	3.1556	1.616	0.819	0.716	124.81	0.840-0.869	0.735	0.893
	Safety & Security	3	3.2139	1.625	0.832	0.724	134.22	0.859-0.874	0.749	0.899
	Attitude & Behavior	3	3.2444	1.682	0.756	0.581	114.98	0.669-0.912	0.672	0.858
	GPTM, Top MGT	2	3.1167	1.759	0.646	0.500	33.52	0.866-0.867	0.760	0.863
	Smart Roads	3	3.4952	1.928	0.758	0.791	305.21	0.842-0.876	0.730	0.890
France	Culture	3	4.0582	.7731	0.773	0.688	278.8	0.809-	0.701	0.876

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(n=315)								0.874		
	PPP	4-1	3.6286	.6420	0.732	0.641	231.13	0.849-0.856	0.727	0.842
	Green Energy	4-1	3.7881	.5852	0.812	0.717	319.04	0.844-0.862	0.724	0.887
	Economic Sustainability	3	4.0222	.7791	0.778	0.689	289.05	0.808-0.876	0.706	0.878
	Safety & Security	3-1	3.7778	.5936	0.769	0.513	4.64	0.716-0.717	0.513	0.678
	Attitude & Behavior	4	5.2937	.9745	0.895	0.783	837.27	0.826-0.917	0.764	0.928
	Govt Policies	4	5.2183	1.068	0.805	0.704	757.27	0.555-0.922	0.636	0.871
	Top MGT	3	5.4212	.9891	0.735	0.687	231.01	0.789-0.841	0.673	0.861
	Smart Roads	3-1	5.1862	.9517	0.790	0.559	220.21	0.598-0.893	0.620	0.827
Saudi Arabia (n=196)	Culture	5	3.5429	.84198	0.759	0.755	241.905	0.639-0.781	0.516	0.841
	PPP	5	3.2194	.77805	0.715	0.713	189.370	0.561-0.778	0.489	0.825
	Green Energy	4	2.8661	.71762	0.774	0.639	118.42	0.760-0.977	0.908	0.713
	Economic Sustainability	4	3.1327	.75295	0.871	0.618	279.84	0.752-0.997	0.942	0.805
	Safety & Security	4	3.3099	.86635	0.879	0.738	321.98	0.894-0.900	0.803	0.925
	Attitude & Behavior	3	2.9269	.86448	0.760	0.503	145.49	0.921-0.926	0.853	0.921
	Belief	5	3.2714	.74600	0.777	0.740	308.88	0.580-0.810	0.533	0.849
	Govt Policies,	4	3.5523	.75626	0.764	0.523	153.95	0.551-0.768	0.473	0.780
	Top Management	2	3.334	0.8781	0.624	0.721	72.82	0.850-0.83	0.727	0.842
	Smart Roads	2	3.3342	.87811	0.924	0.728	472.39	0.913-0.958	0.870	0.953

It is imperative to report reliable and valid instruments (Creswell, 2009). For this purpose, mean, standard deviation, and exploratory factor analysis were used. The researcher retained items witha

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standard deviation >0.40. Table-3 shows the mean, standard deviation of culture, public-private partnership, economic sustainability, safety and security, attitude and behavior, government policies and top management support, and smart roads. The table shows that mean values of all the variables is greater than 3 and standard deviations are>0.40, whereas highest mean is scored by culture i.e. M_c= 3.5889, $S.D_M$= 2.249, followed by smart roads M_{SR}= 3.4952, $S.D_{SR}$= 1.928, public-private partnership M_{ppp}=3.491, $S.D_{ppp}$=1.849, and green energy M_{GE}=3.4611, $S.D_{GE}$=1.909. However, the lowest mean value is scored by government policies and top management support i.e. M_{GPTMS}=3.1167. $S.D_{GPTMS}$=1.75. This implies that culture, public-private partnership, smart roads, and green energy are the most crucial variables in the model while less support is scored as evidence for government policies and top management support. The results thus suggest that the Canadian government must focus more on its policies and top management. Furthermore, reliabilityis checked through Cronbach's alpha. The acceptable value is 0.7 (Field, 2013) while in few circumstances value of 0.6 is also acceptable (Price & Mueller, 1986). Table-3 shows alpha values of variables, the highest alpha value is shown for culture i.e., 0.928, followed by a public-private partnership, green energy, economic sustainability, and safety and security has alpha higher than 0.80. Yet, attitude, behavior, and smart road reliability are 0.756 and 0.758, respectively. On the other hand, government policies and top management support have 0.646, which is also acceptable though it is the lowest value as compared to other variables according to Price and Mueller (1986), it is acceptable. Hence, the instrument is consistent, reliable, and valid for study 1, thus, retaining three items for each variable. Only two items for government policies and top management support were validated out of 23 items. In the second step, validity was checked by exploratory factor analysis (EFA). In EFA, there are certain criteria, to be fulfilled by data. The first rule of thumb is to check sampling adequacy i.e. Kaiser Mayer Olkin KMO, it must be >0.50, second, Bartlett's Test of Sphericity (BTS) must be significant, third, factor loadings, these loadings must be greater than 0.40 (Field, 2013). For study-1 Canada, all the variables show an acceptable level of KMO>0.50 and BTS values for all the variables are significant $p<0.05$, factor loadings of all the items of all variables are also higher than 0.40 as given by Field (2013). Furthermore, average variance extracted, and construct reliabilities were calculated. According to Hair et al., (2017) AVE must be >0.5 and CR must be higher than 0.7 then the instrument is considered valid. All AVEs and CRs for all variables are above standard criteria but the highest AVE is scored by culture i.e. 0.876 and CR=0.955 and lowest AVE=0.672 for attitude and behavior. Thus, our scales are reliable and valid.

The same criteria were set for data collected from France and its analysis. Table-3 shows mean scores and S.D of items for culture, public-private partnership (PPP), green energy, economic sustainability, safety and security, attitude and behavior, government policies, top management support, and smart roads. In the same way, those items having S.D less than 0.40 and item-total correlation (ITC) values <0.40 were excluded from the analysis. Highest mean score was found by top management support in France i.e. M_{TMS} = 5.42, $S.D_{TMS}$=0.989, followed by attitude and behavior M_{AB}=5.29, $S.D_{AB}$=0.974, and M_{GP}= 5.2, $S.D_{GP}$=1.02 respectively. On the other hand,

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PPP has the lowest mean value $M_{PPP=}$ 3.62, $S.D_{PPP=}$1.62 respectively. Cronbach alpha values were checked, alpha values for all variables are higher than 0.7.Moreover, attitude and behavior havethe highest value of alpha 0.895 while, PPP has the lowest alpha score 0.732 except, one item from PPP, one from green energy, and one item from safety and security, smart roads were deleted due to low ITC value. EFA was run to identify the validity of the instruments used in data collection in France. KMO, BTS, and factor loadings criteria were set as it was set for Canada. All KMO, BTS values were found satisfactory and in the specified range. Factor loadings of all items were higher than 0.4, AVE and CR were calculated manually. Highest AVE =0.764, CR=0.928 for attitude and behavior while all other values are also in the accepted range. Therefore,the instrument of France is also reliable and valid. In the French study, government policies and top management support are validated as separate variables.

Study-3 was conducted in the Kingdom of Saudi Arabia. The same questionnaire was distributed in KSA. In the first stage of analysis,the reliability and validity of instruments were checked. In comparison to Canada and France, all five items of an innovative culture and public-private partnership (PPP) are retained. All items of innovative culture and PPP met set standard criteria. Mean score of innovative culture is M_{ic}= 3.54, $S.D_{ic}$=0.841.Similarly,the mean score of PPP was M_{ppp}=3.21, $S.D_{ppp}$= 0.778, the highest mean value is scored by government policies, one item was excluded from the analysis of this variable because of low S.D<0.40. four items scored a mean value of M_{GP}=3.5523, $S.D_{GP\ =}$ 0.756, followed by a culture which is discussed above, and top management support M_{TMS}=3.334, $S.D_{TMS=}$0.878, three items were deleted from top management support, and two items were retained for smart roads $M_{SR=}$3.334, $S.D_{SR}$=0.878. Remaining variables such as economic sustainability, safety & security, belief mean values were higher than 3 but attitude and behavior mean value was less than 3 and the lowest mean score was scored by green energy $M_{GE=}$ 2.86, S.D=0.717. For the reliability of instruments in study-3, Cronbach alpha was checked. The same criteria were used as in study-1 and study-2 i.e., Canada and France. Cronbach's alpha value for all items in the instrument scored alpha values higher than 0.70. The highest alpha value is found for smart roads i.e., 0.924, followed by safety and security and economic sustainability i.e., 0.879, 0.871 respectively, however,the lowest alpha value is scored by top management support i.e., 0.624, we accepted it as suggested by (Price and Muller, 1980). Likewise, EFA was run. Sampling adequacy was checked through KMO and BST, while factors were retained based on Eigenvalues. Principal component analysis was used for reducing the number of items, oblique rotation Promax was used for rotation. Factor loadings less than 0.40, suggested by (Field, 2013) were excluded from the analysis. It can be seen in table-3that all variables and their respective KMO, BTS, Factor loadings are greater than the threshold values. More importantly, the average variance extracted, and construct reliability (CR) criteria were set as 0.50 and 0.70. Table-3illustrates that all variables have standard AVE and CR values, except PPP and government policies, whose AVE is less than 0.5 but CR values are greater than 0.70 so, there is no issue of AVE. Based on the above results,it is considered reliable and valid in the Saudi context.

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Table 5: Government Policies and Top Management Support as Mediators Study-1 Canada

D.V	**I.V**	**R**	**R^2**	**F**	**β**	**p**
Model 1						
GP_TMS	**Constant**	0.7701	0.5930	171.144		0.000
	Culture (a)				0.7701	0.000
Smart Roads	Constant	0.9624	0.9261	733.44		0.000
	GP_TMS (b)				0.8069	0.000
	Culture(c')				0.1273	0.0016
Smart Roads	Constant	0.9589	0.9195	1348.4		0.000
	Culture (c)				0.958	0.000
Model 2						
GP_TMS	**Constant**	0.748	0.5600	150.16		0.000
	PPP (a)				0.748	0.000
Smart Roads	Constant	0.959	0.920	675.00		0.000
	GP_TMS (b)				0.176	0.000
	PPP(c')				0.819	0.000
Smart Roads	Constant	0.952	0.906	1143.91		0.000
	PPP (c)				0.952	0.000
Model 3						
GP_TMS	**Constant**	0.773	0.598	175.5		0.000
	GE (a)				0.7733	0.000
Smart Roads	Constant	0.9018	0.813	254.7		0.000
	GP_TMS (b)				0.2604	0.000
	GE(c')				0.685	0.001
Smart Roads	Constant	0.8866	0.786	433.39		0.000
	GE (c)				0.8866	0.000
Model 4						
GP_TMS	**Constant**	0.7311	0.534	135.4		0.000
	S&S (a)				0.7311	0.000
Smart Roads	Constant	0.8177	0.668	118.06		0.000
	GP_TMS (b)				0.561	0.000

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	S&S(c')				0.308	0.001
Smart Roads	Constant	0.7211	0.5200	127.84		0.000
	S&S (c)				0.7211	0.000
Model 5						
GP_TMS	**Constant**	0.741	0.549	143.6		0.000
	ECO-SUS (a)				0.741	0.000
Smart Roads	Constant	0.825	0.681	124.94		0.000
	GP_TMS (b)				0.527	0.000
	ECO-SUS(c')				0.354	0.000
Smart Roads	Constant	0.745	0.555	147.4		0.000
	ECO-SUS(c)				0.745	0.000

The process file introduced by Hayes for mediation was used for mediation analysis (see table 5). Government policies and top management support were taken as mediating variables in the model. According to Barron and Kenny (1986) and Hayes (2007), for mediation, four steps needto be followed. The path a, b, c, and c prime. In the first model, government policies and top management support (GPTMS) were used as mediators between innovative culture and smart roads. In path c Coefficient of determination R^2 = 0.9589 meaning that innovative culture shows 95.89% variance upon smart roads. Similarly,the beta value is β=0.958, p<0.01, which means a one percent change in innovative culture would bring a 95.8% increase in the successful execution of smart roads in Canada. In path a, R^2= 0.593, β=0.7701explains that innovative culture shows variance upon GPTMS 59.3% while a one percent change in culture would get top management support by 77.01%. Further,results revealed path b and c prime, when innovative culture and GPTMS were added in the regression model together then R^2=0.92, β for culture is β=0.1273. And for GPTMS β=0.8069, thus, one percent change in innovative culture would bring 12.73% change in the execution of smart roads while the one-unit change in government policies and top management support would bring an 80.69% increase in the use of smart roads. Beta value in path c is reduced in path c prime this explains that government policies and top management support are acting their role as a partial mediator between innovative culture and smart roads. Likewise, GPTMS was used mediator between public-private partnerships and smart roads. All four model paths a, b, c, and c' were checked. The decision was made based on paths i.e., beta value (β) and its significance value i.e., p. In path a β=0.748, p<0.01, likewise, in path c β=0.952, p<0.01, in path b β=0.176, path c prime β=0.819, p<0.01. It could be noted from the above results that the beta value of path c is 0.952, which then reduced to 0.819 by adding mediator GPTMS i.e., 0.176, it means that government policies and top management support havea significant role in implementing the smart roads, although the role of public-private partnership is dominant i.e., 81.9%. But GPTMS also acts as a partial mediator between PPP and smart road development.In

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model 3, government policies and top management support were added between green energy and smart roads. It was found that path a β=0.773, p<0.01, similarly, for path c β=0.8866, p<0.01, while path b β=0.2604, path c prime β=0.685, p<0.01. Result explains that with the inclusion of GPTMS between green energy and smart roads beta values decreased from 0.8866 to 0.685, which implies that GPTMS also played a significant role i.e., 26.04% but the most dominant role is reported for green energy. It means there is a partial mediating role of GPTMS identified between green energy and smart roads. This illuminates that if the government of Canada introduces favorable policies for green energy and smart roads with the support of top management, this will result in the success of smart roads. In model 4 and model 5, government policies and top management support also act as partial mediators. But in models 4 & 5 β value of path b showsthe highest beta value for GPTMS as compared to safety and security and economic sustainability i.e., β=0.561, p<0.01 and β=0.527, p<0.01. This suggests that security, safety, and economic sustainabilityplay a greater role. Therefore, our hypothesis is substantiated.

Table 6: Government Policies, Top Management support (Mediators) Study-2 France, Study-3 Saudi Arabia

D.V	**I.V**	**Study-2 France**		**Study-3 Saudi Arabia**		**D.V**	**I.V**	**Study-2 France**		**Study-3 Saudi Arabia**	
		β	**p**	**β**	**p**			**β**	**p**	**β**	**p**
GP	**Constant**	5.86	0.000	2.86	0.000	TMS	**Constant**	5.67	0.000	3.19	0.000
	Culture (a)	0.11	0.004	0.21	0.000		**Culture (a)**	0.49	0.000	0.378	0.000
Smart Roads	Constant	3.13	0.000	2.19	0.000	Smart Roads	Constant	1.57	0.000	1.89	0.001
	GP (b)	0.312	0.000	0.23	0.003		TMS (b)	0.61	0.000	0.18	0.000
	Culture(c')	**0.080**	**0.10**	**0.38**	**0.000**		Culture(c')	**0.53**	**0.000**	**0.29**	**0.000**
Smart Roads	Constant	4.91	0.000	1.03	0.005	Smart Roads	Constant	4.91	0.000	1.03	0.005
	Culture (c)	0.56	0.030	0.41	0.000		Culture (c)	0.83	0.000	0.38	0.000
GP	**Constant**	5.78	0.000	3.05	0.000	TMS	**Constant**	5.82	0.000	3.00	0.000
	PPP (a)	0.89	0.000	0.74	0.000		**PPP (a)**	0.722	0.000	0.91	0.000
Smart Roads	Constant	3.21	0.000	3.32	0.000	Smart Roads	Constant	1.50	0.001	3.11	0.000

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	GP (b)	0.30	0.000	0.19	0.018		TMS (b)	0.61	0.000	0.18	0.008
	PPP(c’)	**0.43**	**0.000**	**0.15**	**0.032**		PPP(c’)	**0.43**	**0.000**	**0.15**	**0.016**
Smart Roads	Constant	4.95	0.000	2.30	0.000	Smart Roads	Constant	4.95	0.000	2.30	0.000
	PPP (c)	0.70	0.000	0.16	0.006		PPP (c)	0.87	0.000	0.25	0.032
GP	**Constant**	5.95	0.000	2.50	0.000	TMS	**Constant**	5.93	0.000	2.97	0.000
	GE (a)	0.20	0.000	0.26	0.002		GE **(a)**	0.81	0.000	0.16	0.000
Smart Roads	Constant	3.22	0.000	4.05	0.000	Smart Roads	Constant	1.50	0.001	3.97	0.000
	GP (b)	0.30	0.000	0.18	0.017		TMS (b)	0.61	0.000	0.169	0.01
	GE(c’)	**0.05**	**0.270**	**0.25**	**0.02**		GE(c’)	**0.027**	**0.064**	**0.0066**	**0.926**
Smart Roads	Constant	5.01	0.000	3.23	0.000	Smart Roads	Constant	5.01	0.000	3.23	0.000
	GE (c)	0.29	0.013	0.36	0.003		GE (c)	0.77	0.000	0.24	0.000
GP	**Constant**	2.52	0.000	3.40	0.000	TMS	**Constant**	3.26	0.000	3.11	0.000
	S&S (a)	0.44	0.000	0.46	0.000		**S&S (a)**	0.34	0.000	0.662	0.000
Smart Roads	Constant	3.55	0.000	1.52	0.001	Smart Roads	Constant	2.29	0.000	1.52	0.002
	GP (b)	0.29	0.000	0.15	0.009		TMS (b)	0.63	0.000	0.20	0.008
	S&S(c’)	**0.018**	**0.763**	**0.050**	**0.356**		S&S(c’)	**0.067**	**0.162**	**0.51**	**0.000**
Smart Roads	Constant	4.28	0.000	0.60	0.054	Smart Roads	Constant	4.28	0.000	0.60	0.05
	S&S (c)	0.149	0.008	0.51	0.000		S&S (c)	0.14	0.008	0.42	0.000
GP	**Constant**	5.73	0.000	2.28	0.000	TMS	**Constant**	5.65	0.000	2.51	0.000
	ECO-SUS (a)	0.88	0.000	0.31	0.000		**ECO-SUS (a)**	0.45	0.000	0.224	0.001

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Smart Roads	Constant	3.06	0.000	3.39	0.000	Smart Roads	Constant	1.46	0.000	3.18	0.000
	GP (b)	0.311	0.000	0.13	0.000		TMS (b)	0.61	0.000	0.21	0.003
	ECO-SUS(c')	**0.20**	**0.000**	**0.21**	**0.004**		ECO-SUS(c')	**0.0774**	**0.1074**	**0.132**	**0.012**
Smart Roads	Constant	4.80	0.000	2.1427	0.000	Smart Roads	Constant	4.80	0.000	2.41	0.000
	ECO-SUS(c)	0.77	0.000	0.24	0.000		ECO-SUS(c)	0.15	0.000	0.17	0.002

Table-6 shows mediation results for study-2 and study-3 conducted in France and Saudi Arabia, respectively. Government policies and top management support were taken as mediators between predictors and criterion. The decision about full mediation and partial mediation is taken based on c prime β value and its significant "p" value. From table 6, we can see that government policies act as full mediators between innovative culture and smart roads in France while it was identified as a partial mediator in Saudi Arabia i.e. (β_{FR}=0.080, p>0.05; β_{SA}=0.38, p<0.01). Moreover, government policies are identified as partial mediators between public-private partnerships and smart roads in France as well as Saudi Arabia i.e. (β_{FR}=0.43, p<0.01; β_{SA}=0.15, p<0.05). However, government policies act as full mediating variables for green energy in France while partial mediation was found for Saudi Arabia (β_{FR}=0.05, p>0.05; β_{SA}=0.25, p<0.05). More significantly, government policies mediate for France and Saudi Arabia as well between safety & security and smart roads (β_{FR}=0.018, p>0.05; β_{SA}=0.050, p>0.05).

It could be noticed that government policies have partial mediating effects on economic sustainability and smart roads (β_{FR}=0.20, p<0.05; β_{SA}= 0.21, p<0.05). Table-6 also highlights mediation results for top management support (TMS) in France and Saudi Arabia. It is evident that top management support plays partial role as mediator between innovative culture, public-private partnership, and smart roads (β_{FR}=0.53, p<0.05; β_{SA}= 0.29, p<0.05) and (β_{FR}= 0.43, p<0.05; β_{SA}=0.15, p<0.05). Further, analysis of results demonstrates that top management support acts as a full mediator between green energy and smart roads (β_{FR}=0.027, p>0.05; β_{SA}= 0.0066, p>0.05), similarly, TMS is reported as a full mediator between safety and security in France but partial mediator in Saudi Arabia (β_{FR}= 0.067, p>0.05; β_{SA}=0.51, p<0.05). In the same way, TMS fully mediates between economic sustainability and smart roads in France, while partial mediation is found for Saudi Arabia (β_{FR}= 0.0774, p>0.05; β_{SA}=0.132, p<0.05).

Table 7: Moderation results in Attitude and Behavior

	Canada		**France**		**Saudi Arabia**		**Saudi Arabia**	
	Model 1β	**Model 2β**	**Model 1β**	**Model 2β**	**Model 1β**	**Model 2β**		**Model β**
Culture	0.25	0.22	0.84	0.71	0.193	0.204	Culture	0.5293

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A_B	0.26	0.276	0.613	0.613	0.312	0.313	Belief	- 0.4635
interaction		0.358		0.87		0.26	interaction	- 0.2301
R^2	0.14		0.378		0.210		R^2	0.2292
ΔR^2	0.19		0.385		0.25		ΔR^2	0.0236
PPP	0.36	0.88	0.88	0.76	0.27	0.28	PPP	0.2102
A_B	0.62	0.12	0.615	0.609	0.443	0.443	Belief	-0.458
Interaction		0.17		0.91		0.30	interaction	-0.515
R2	0.20		0.378		0.188		R^2	0.122
Δ R2	0.29		0.386		0.192		ΔR^2	0.0619
GEGY	0.28	0.31	0.78	0.65	0.20	0.34	GEGY	0.0294
A_B	0.11	0.21	0.615	0.611	0.432	0.425	Belief	- 0.4011
Interaction		0.50		0.79		0.48	Interaction	- 0.2491
R2	0.38		0.377		0.187		R^2	0.0470
Δ R2	0.63		0.383		0.190		ΔR^2	0.0131
SS	0.52	0.56	0.67	0.69	0.400	0.410	SS	0.7419
A_B	0.34	0.26	0.632	0.640	0.235	0.271	Belief	- 0.2890
Interaction		0.23		0.57		0.98	Interaction	-0.483
R2	0.47		0.375		0.308		R^2	0.2919
Δ R2	0.52		0.378		0.315		ΔR^2	0.590
Eco _ Sus	0.37	0.43	0.105	0.97	0.69	0.85	Eco _ Sus	0.2799
A_B	0.25	0.32	0.614	0.612	0.422	0.460	Belief	- 0.6102
Interaction		0.38		0.79		0.96	Interaction	- 0.4646
R2	0.55		0.382		0.192		R^2	0.1314
Δ R2	0.41		0.388		0.199		ΔR^2	0.0577

Table-7 shows the moderation results of three studies conducted in Canada, France, and Saudi Arabia. The above of moderation shows attitude and behavior as moderators of this study. Process of Moderation given by Aiken & West (1991), later on, adopted by Hayes (2007) and Field (2013) was used in this study. The purpose of moderation is to strengthen the relationships between predictors and criterion while in some cases moderator changes the direction of the relationship. In the moderation process, mean-centered predictors are used, mean-centered means standardized variables i.e., mean of the variable is deducted from the variable itself, then its mean becomes zero and standard deviation becomes one. All this is done to reduce the problem of multicollinearity.

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When IVs are highly correlated, they create collinearity issues and affect beta values. Second, the product term i.e., interaction term is also created in moderation. This term is created by multiplying independent variables and moderators. The interaction term aims to provide a boost or statistical power. The moderation decision is madebased onthe change in R^2 and, interaction term significance value i.e., "p". Ifthe p-value is significant and R^2 is changed, this explainsthe role of the moderator. To have a clear understanding of moderation, moderation graphs are plotted one standard deviation above the mean and one standard deviation below the mean. Attitude and behavior were used as a moderator between innovative culture and smart roads. It can be seen in table-7 and figure-9 that in Canada $\Delta R^2=0.19$, and interaction term $\beta=0.358$, $p<0.05$, similarly, in France $\Delta R^2=0.358$, $\beta=0.87$, likewise in Saudi Arabia $\Delta R^2=0.25$, $\beta=0.26$, $p<0.05$. This explains that attitude and behavior are the potential moderators in three countries i.e., Canada, France, and Saudi Arabia.

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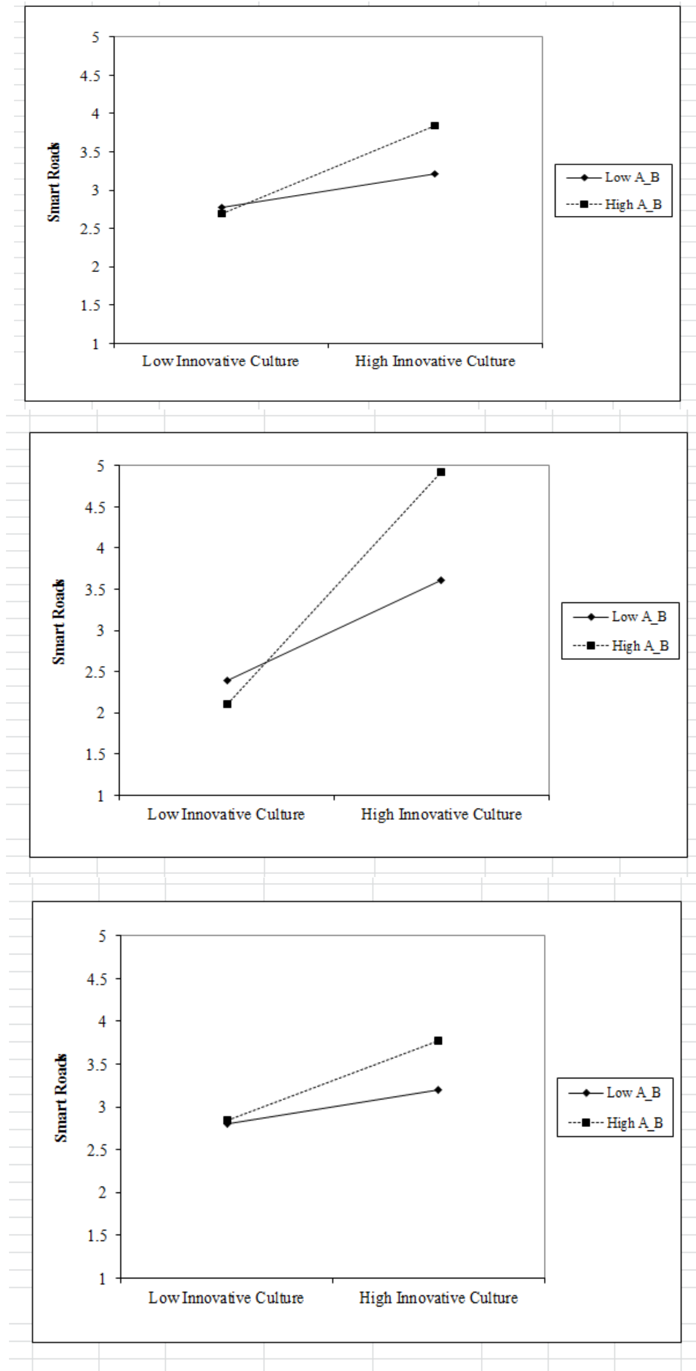

Figure 8: Attitude and Behavior as Moderator between Culture and Smart Roads in Canada, France, and Saudi Arabia

The table-7 and figure 10 show the results of study-1, 2, and 3 conducted in Canada, France, and Saudi Arabia respectively. Results demonstrate that there is the change in Δ R^2 and interaction term is significant too i.e. (Δ R^2=0.29, β=0.17, $p<0.05$), a significant change in Δ R^2 and beta value

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of interaction term is noted in French and Saudi Arabianstudies (ΔR^{2}=0.386, β=0.91, p<0.05; ΔR^{2}=0.192, β=0.30, p<0.05).

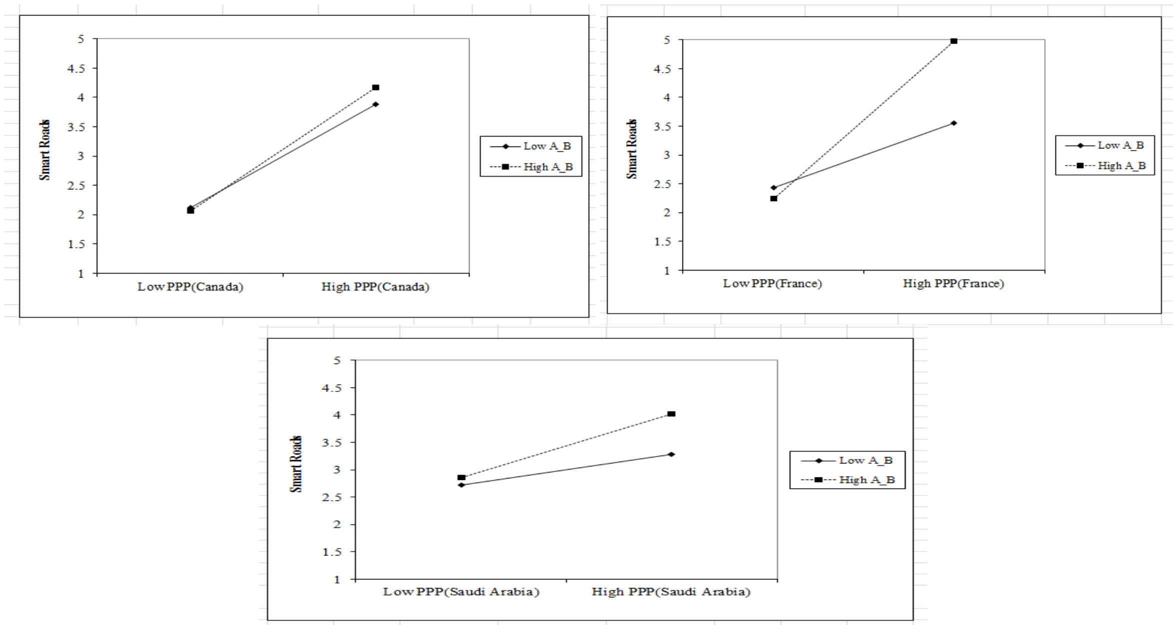

Figure 9: Attitude and Behavior as Moderator between PPP and Smart Roads in Canada, France, and Saudi Arabia

Table-7 and figure 11 highlights that attitude and behavior significantly interact between green energy and smart roads as results demonstrate the significant change in r square (ΔR^{2}=0.63, β=0.50, p<0.05), in Canada, France (ΔR^{2}=0.383, β=0.79, p<0.05), and Saudi Arabia (ΔR^{2}=0.190, β=0.48, p<0.05), respectively.

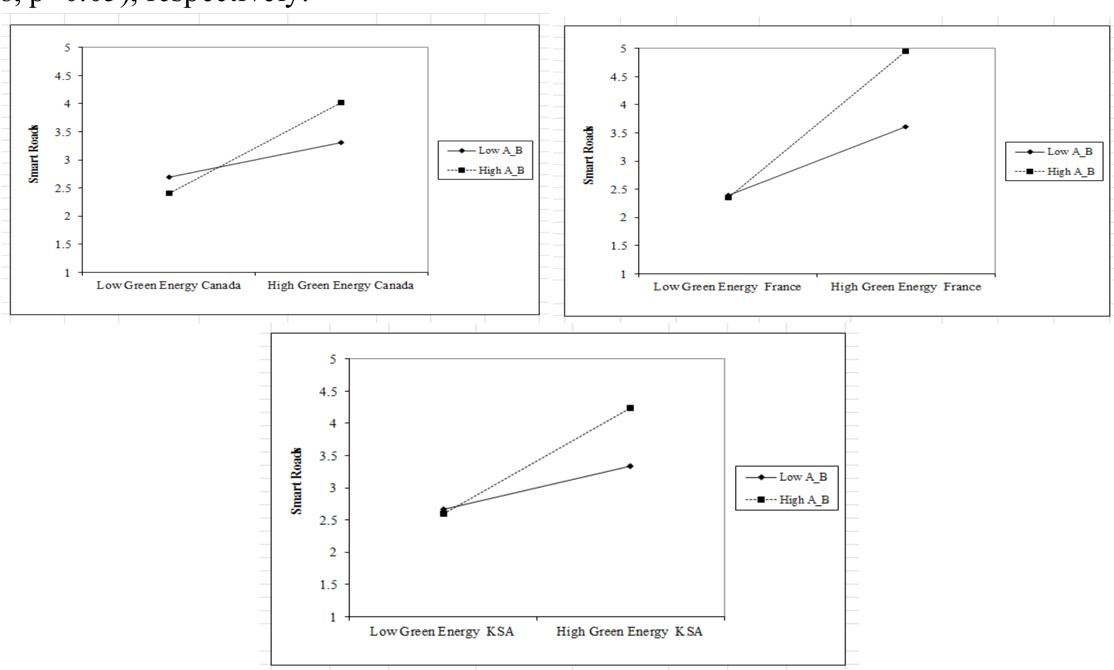

Figure 10: Attitude and Behavior as Moderator between Green Energy and Smart Roads in Canada, France, and Saudi Arabia

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Attitude and behavior were used as moderators between safety and security and smart roads. We can see from table-7 and figure 12 that attitude and behavior significantly act as moderators between safety and security. Study-1 Canada results explained significant moderation (ΔR^2=0.52, β=0.23, $p<0.05$), France (ΔR^2=0.37, β=0.57, $p<0.05$), and Saudi Arabia (ΔR^2=0.31, β=0. 98, $p<0.05$), respectively.

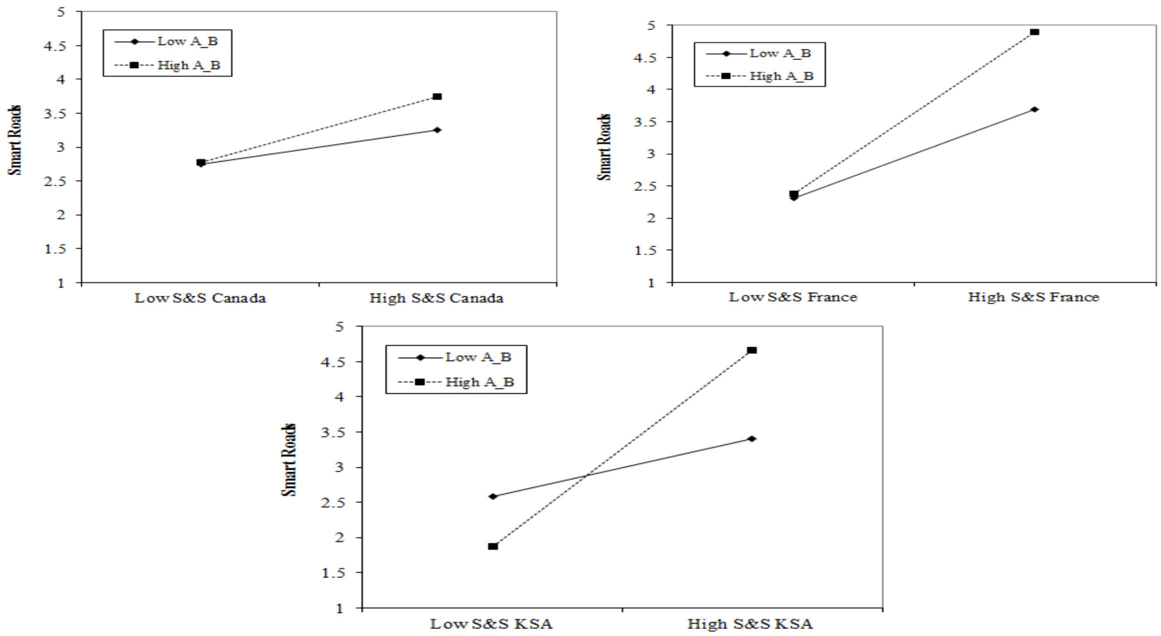

Figure 11: Attitude and Behavior as Moderator between Safety & Security and Smart Roads in Canada, France, and Saudi Arabiainthe last step, economic sustainability and smart roads were moderated by attitude and behavior. Results in table 7 shows significant moderation for study-1 Canada (ΔR^2=0.41, β=0.38, $p<0.05$), study-2 France (ΔR^2=0.38, β=0.79, $p<0.05$) and study-3 Saudi Arabia (ΔR^2=0.19, β=0.96, $p<0.05$).

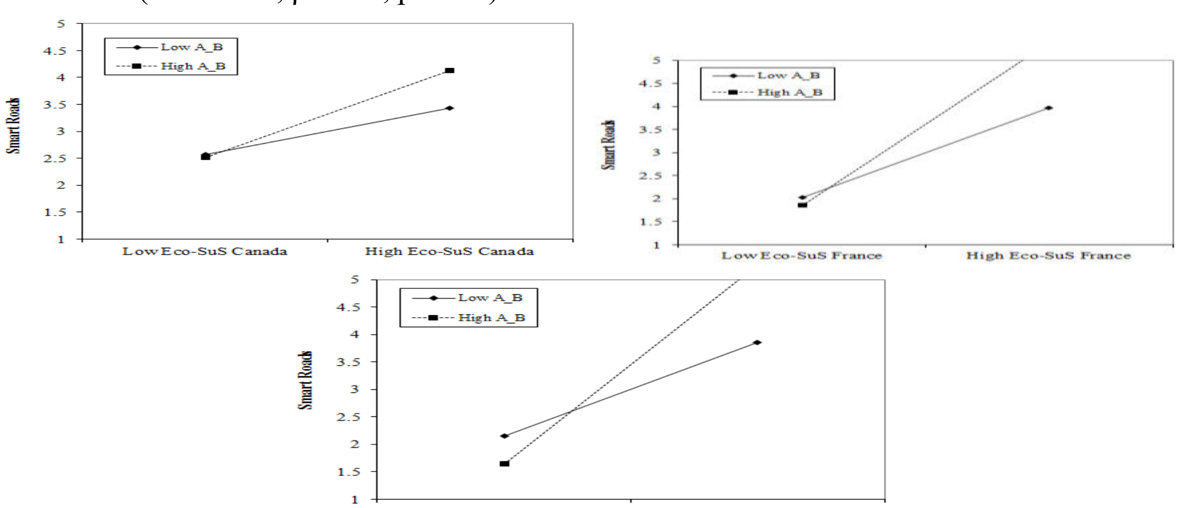

Figure 12: Attitude and Behavior as Moderator between Eco-Sustainability and Smart Roads in Canada, France, and Saudi Arabia.

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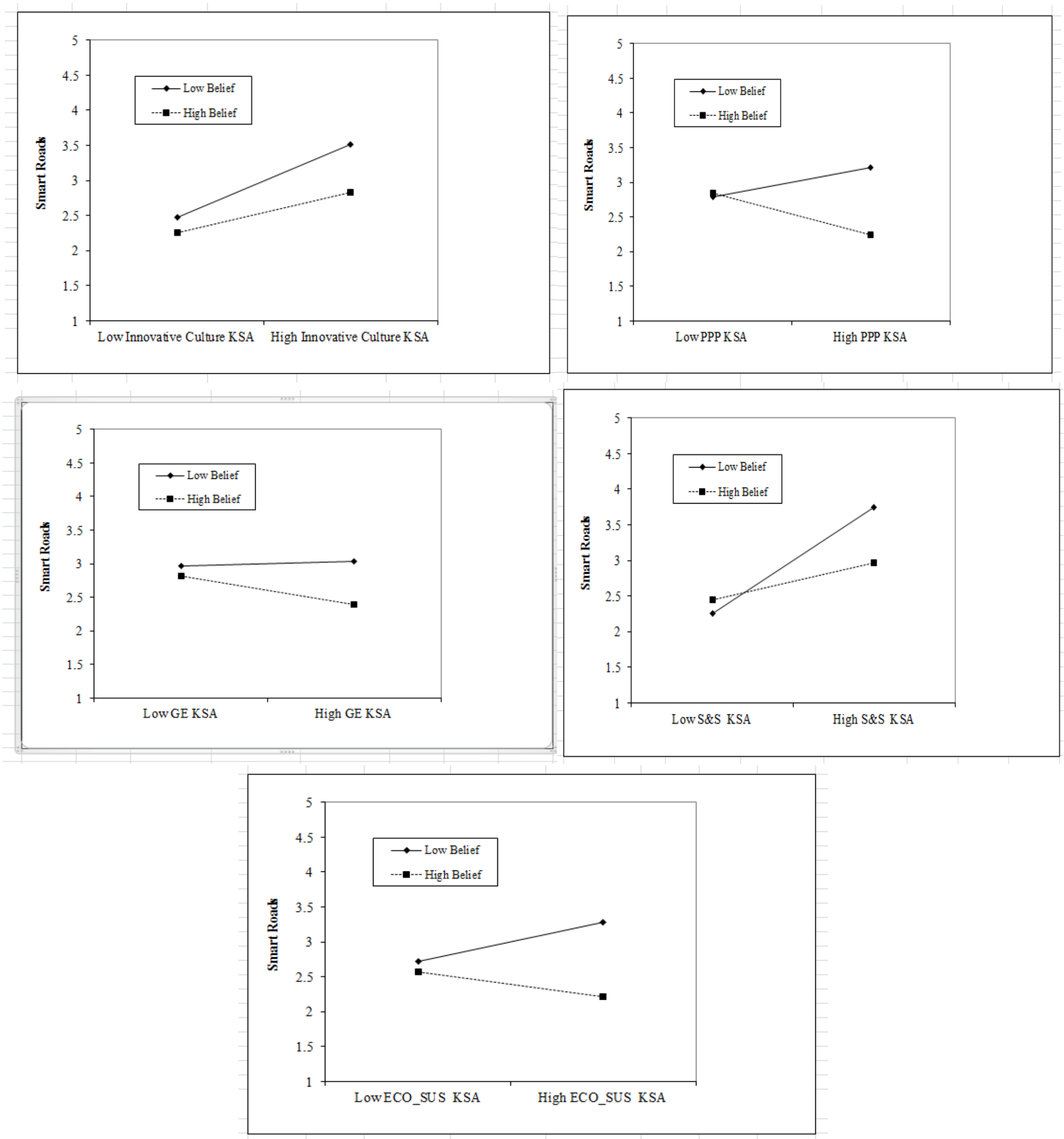

Figure 13: Belief as Moderator between Predictors and Criterion in Saudi Arabia

The belief was taken as moderator, yet it was excluded in Canadian and French studies due to low item-total correlation, low value of Cronbach alpha, and low factor loadings. However, it was retained and used as a moderatorin the Saudi Arabian study. Belief is found as interacting variables with buffering effects between innovative culture, public-private partnership, green energy, safety and security, and economic sustainability (see table 7). Furthermore, moderation graphs Figure-14 were also created one S.D above the mean and below the mean. All the moderation graphs showa clear moderation and interaction role of belief in Saudi Arabia.

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Discussion on Reliabilities and Validities of the Scale

Given the relevance and usefulness of smart roads for countries and economies, we had two objectives in this study. The first objective was to develop and validate the instruments for smart roads,their benefits, and challenges, second, we have to test the newly developed instrument in western (North America, Canada) Europe (France), and the Middle East (Kingdom of Saudi Arabia) countries. An extensive literature reviewgave us twenty-seven new variables on benefits, challenges for smart roads while two variables were identified as mediators i.e., government policies, and top management support, and two were identified as moderators'attitude, behavior, and belief Figure-1. In the first stage,the researcher has developed a psychometrically sound and reliable instrument. Initially, 175 pools of items were generated. After that, these items were given to five experts using the Delphi technique. Experts identified a few items as replication, so these items were deleted from the pool. Respondents must understand items/questions easily, then those items were rephrased through language experts and some of the items were excluded. A total of 165 items after deleting 10 items were used in the questionnaires.

There were twenty-sevenvariables, which were identified as benefits and challenges (IVs) for smart roads (DV) in the model. Then, out of twenty-sevenvariables, 19 variables were excluded in study-1 conducted in Canada. Further, those variables and their respective items were deleted because the items did not fulfill the reliability and validity criteria. Also, their Item total correlation was less than 0.4 besides their factor loadings were also less than 0.40 so all those items were excluded and only eight variables i.e. Innovative culture, public-private partnership, green energy, economic sustainability, safety and security, attitude and behavior, government policies and top management support and smart roads were retained in the analysis. More importantly for Study-2 conducted in France, results show that there are nine variables, which fulfill the reliability, and validity criteria and were retained. The rest of the items and variables, which did not fulfill the criteria, were not included in further analysis. Equally important in Study-3 in Saudi Arabia, ten variables were retained. In the same way, the same criteria were set for the third study. Mean standard deviation, Cronbach alpha, item-total correlation, KMO, BTS. Factor loadings, average variance extracted, and construct reliabilities were checked in all three studies. A criterion for standard deviation (SD) was set at 0.40. Items having SD>0.40 were retained, andthe remaining items were excluded. Similarly,the same criteria were set for reliability analysis and Cronbach alpha. Again, item-total correlation i.e. ITC>0.40 is considered reliable. ITC<0.40 was considered problematic and excluded. Alpha values suggested by Field (2013) >0.70 are considered as acceptable. For validity, exploratory factor analysis EFA was run. The rule of thumbgiven by Field (2013) and Tabachnik and Fidell (2007) for EFA was employed. The KMO value range between 0-1, KMO>0.50 is acceptable, BTS value range is 0-∞, it must be significant, Eigenvalue >1 is valid for retaining factors, and in the same way, principal component analysis (PCA) is used for reducing the number of items. Oblique rotation method and Promax are used for rotating factors, thus, those items having factor loadings greater than 0.40 are retained and the remaining are to be excluded from the analysis. This criterion was set for all three studies.

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Similarly, the average variance extracted AVE must be 0.50 or high, and construct reliability CR must be greater than 0.70 (Hair et al., 2017). From the results of all three studies, it is concluded that all the instruments were found reliable, valid, and psychometrically sound. Based on the above discussion, it is concluded that all instruments are found valid, and the first objective is achieved.

Discussion on Mediators

Government policies and top management support were taken as mediators in three studies. Barron and Kenny (1986) and Hayes (2007)suggested four assumptions i.e., path for mediation analysis. The path a, b, and c should be significant and path c prime if insignificant it is considered as full mediation if c prime is significant it is considered as partial mediation.

Results of study-1 Canada show that government policies and top management support partially mediates between innovative culture, public-private partnership, green energy, safety, security, and economic sustainability. This means that in Canada, government policies, which are formulated and implemented by top management in their respective cities, are playing a significant role in bringing innovative culture for the development of smart roads. Moreover, people are literate enough and aware ofthe benefits of smart roads, that is why they are flexible in adapting to new culture and values; in this regard, government and top management are also supporting their citizens by developing flexible policies. Likewise, government policies and top management support created an attraction for the development of smart roads through public-private partnerships (PPP) as the private sector is always welcomed in Canada for playing their significant role. That is why partial mediation is observed in the analysis. PPP brings quality and fewer burdens on government departments. Furthermore, it has been investigated that government policies and top management support act as partial mediators among green energy, safety and security, and economic sustainability. This explains that by introducing smart roads, the government wants efficient use of energy resources. It could reduce cost, timesaving, energy-saving and could help in preserving natural resources. Moreover, safety and security are top priorities of the Canadian government. Since no project could be successful until and unless the issue of security is resolved so that a safe and secure country may attract the private sector, this security was found a strength to attract investment in Canada for use of smart roads technology, further, new technology and smart roads bring economic sustainability.Study-2 was conducted in France. It was noted that in France, government policies fully support the innovative culture, but the public-private partnership is partially supported by the government. The reason behind this is that due to location change, the values, culture, and demographics are also changed in Europe as compared to Canada. The government is competent enough to support new developments, especially smart roads. As France is a more developed country that is why PPP is not encouraged. More importantly, the government in France is fully supporting green energy, safety, and security. Moreover, full mediation was found for government policies. This means that the efficient use of energy resources; law and order are fully controlled by the French government. On the other hand,

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the economic sustainability of smart roads was partially mediated by the government. The reason is that there is more sustainability in France, so respondents did not consider it critical. Similarly, top management partially supports innovative culture and PPP while top management for green energy, safety, and economic sustainability has observed full support. Study-3 was conducted in the Kingdom of Saudi Arabia. The results bring to fore that Government policies partially support the innovative culture, public-private partnership, green energy, economic sustainability while the government for safety and security gives full support. On the other hand, the study shows that top management support partially mediates between innovative culture, PPP, safety and security, and economic sustainability while fully mediate between green energy.

Discussion on Moderators

Hierarchical multiple regression was used for moderation suggested by Aiken and West (1991), and Field (2013). All predictors and moderators were mean-centered and interaction terms were created for each IV and moderators. Attitude and behavior were taken as moderators. The decision about significant moderation was made on the p-value of the interaction term. To have a better understanding of moderation, the moderation plots were created in excel. The formula for plots was given by Aiken and West (1991) i.e.,one standard deviation above and below the mean. Attitude and behavior were used as a moderator between innovative culture and smart roads in Canada, France, and KSA respectively. Moderation graph Figure II shows a high level of attitude and low level of attitude and behavior interact with a low level of innovative culture and smart roads. Also, in all three plots,a high level of attitude and behavior has high interaction. Further, moderators were used between PPP and smart roads. It shows that in Canada, high and low levels of attitude interact at a low level of PPP, but in France,a high level of attitude and behavior has high interaction than a low level, but high attitude interactswith PPP at a low level. However, in KSA,a high level does not clearly show interaction for PPP (see Figure-III). Similarly, moderation with green energy and smart roads in Canada was found significant as there is clear interaction shown in plots while in France and KSA, interaction for green energy is significant but at a low level (see figure Figure-IV). If we look into Figure-V and Figure-VI, clear interaction can be seen in KSA, it means that the attitude of the Saudi government towards security and safety, and economic sustainability is high as compared to Canada and France. The moderating role of belief was also investigated in Saudi Arabia (see Figure-14). Results indicate that belief playsa significant role in KSA.

Conclusion

An instrument developed for benefits and challenges for smart roads is a valuable instrument. The unique contribution of this research lies in the refinement of instruments for the benefits and challenges of smart roads. The second contribution of this study is the development and validations of the instruments in three countries of three different continents; equally important is that this study covered both western and eastern perspectives. Moreover, the results of pilot tests have been reported along with the results of a full-scale study by reporting the role of moderators

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and mediators. Eight variables were retained for Canada, nine for France, and 10 variables for Saudi Arabia. The excluded variable in Canada and France is belief. It means that this aspect is given full attention by the public and government department that is why there is no need to focus on these variables furthermore; the belief was retained in the Saudi context,as there is a need for the said variable. The studyconcludes that innovative culture, public-private partnership, green energy, safety and security, economic sustainability, government policies, top management support attitude, and behavior are crucial for the development of smart roads. This also explains that for smart roads, culture plays an important role. Culture varies from country to country, and nation to nation. In Canada and France, people are more flexible to adopt new and innovative cultures. Canadian and French nationals believe in change because multicultural people live there that is why they are habitual of adopting new policies, and new technologies introduced by the government from time to time. Next, public-private partnership is encouraged by the governments. By doing this new expertise, a new skilled workforce with their new experience invests in the country, and in development projects for the public, this increases economic sustainability, and efficient use of energy resources. For public-private partnerships, governments ensured safety and security. To attract foreign investors safety is the top priority of Canadian French and Saudi governments. For the development of smart roads, culture and public-private partnerships play an important role while it brings economic sustainability, enhances energy efficiency i.e., green energy, and smart roads help reduce road accidents especially in Saudi Arabia where the accident ratio is high. Smart roads might help governments to reduce accidents. Besides, the findings of this research are in line with the findings of Barrimah et al (2012). In the same way, this study got support from Lyndsey Gilpin, (2014) findings.

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