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Study on the Feasibility of Cross Sector Cooperation Approach towards Road Traffic Safety

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Abstract: Recently, the number of vulnerable road user fatalities has risen while many low and middle income countries are experiencing high road traffic fatalities. Such situations indicate that road safety is not only a technical problem but has become a serious social problem too. This has prompted stakeholders to re-think road traffic safety strategies. This paper aims at demonstrating the feasibility of the cross sector cooperation approach towards road safety. The first part gives a brief description of the proposed cross sector cooperation approach while the second part expounds on the applicability and merits of this approach using two selected case studies in Japan. The Theory of Change is also utilized to explain the success of the cross sector cooperation strategies, thereby re-echoing the importance of using non-traditional methods to tackle road safety issues.

Keywords: Road Traffic Safety, Cross-sector, Vulnerable road users, Theory of Change

1. INTRODUCTION

The World Health Organization (WHO) Global status report on road safety 2018, states that "Road traffic injury is the 8th leading cause of death for all age group surpassing HIV/AIDs, tuberculosis and diarrhoeal diseases." In comparison, the global status report 2015 stated that road traffic accidents would become the 7th leading cause of death if appropriate measures were not implemented. It is unfortunate to see this is slowly becoming a reality.

WHO further stated that 1.35million people die as a result of road accidents while between 20 and 50million are severely injured annually. In recent years, vulnerable road users such as bicyclists, pedestrians, elderly persons make up more than 50% of road accident causalities. The urgency to solve this situation is not just a technical issue but a worldwide

social concern too. Furthermore, many developed countries are faced with an aging society that has caused a tremendous change in accident risks and patterns, where by persons over the age of 65 are the most affected age group. Speculations are that by 2050, this age group will make up about 21% of the world's populations. This further agitates the prevailing road safety situation in the world.

According to the 2018 Japan police report on Traffic accidents, the elderly (over 65years) persons' fatalities are about twice that of other age groups. In addition, persons aged 5-9 years and those over 65years make up the biggest portion of injured pedestrians. In 2016, the number of fatalities per 100,000 persons of children below 15years, was distinctively high. With 44.6% of these fatalities occurring while walking and 23% occurring while riding a bicycle. Furthermore, the statistics bureau in Japan reported that the current population growth rate is estimated at about -0.18%, while the current population make up of Japan is such that persons above 65years are 27.8% and those below the age of 15years make up 12.3% of the total Japanese population. Such worrying statistics inform us that the safety of these age groups is of high priority.

Since Japan enacted its first road safety policy in 1971, subsequent policies have had to change implementation viewpoints to match the prevailing road safety situation. According to the 2017 "Special feature: Progress and Future prospects regarding traffic safety measure", from 1950 to 1979, the police focused on enforcement, improving traffic safety facilities and education. While from 1980 to 2007, the police leaned towards improving driver education and driver's license system, mitigating traffic accident damage and tackling illegal parking of vehicles and bicycles. In the period after 2008, the focus shifted to promoting measures for elderly drivers, drivers with illness exhibiting certain symptoms, traffic enforcement/speed regulation targeting safety on school roads and preventing traffic accidents.

Based on the current direction of policy, some academicians have become involved in creating various concepts to promote safety on school roads and in school zones. From these efforts, the International Association of Traffic and Safety Sciences (IATSS) published a guideline in March 2018 for the integrated safety management of school roads and zones, with an aim of reducing road accidents of school going children to zero.

Using an area where this guideline was tested and another where a similar procedure was used, this paper seeks to illustrate the feasibility of the cross sector cooperation approach in road safety.

1.1 Literature Review

The current wave of complete streets in the United States of America has shown that holistic road safety can be achieved when different stakeholders agree on a common goal and come together as a team to influence the political and technical atmosphere in road re-design and

re-construction (McCann, 2013).

Rahman *et al.* (2015) made a public survey about resident's acceptance of traffic calming prioritization process. The authors noted that the public not only consented to the street priority process but also made realistic contributions towards what they thought would be more successful road safety measures, in addition to what was already proposed.

Wegman (2004) noted that the Netherlands' journey towards attaining sustainable road safety, was as a result of the 1989 road safety plan which emphasized that local and provincial authorities and other stakeholders had to take part in policy processes.

Sunagawa *et al.* (2015) proposed a holistic framework on improving road crossing facilities based on the concept of social usability. The researchers moved towards resolving road safety problems from the final user's perspective rather than the technical approach of solving road safety issues for final users without the users' input.

Nakagawa *et al.* (2013) evaluated the role of various stakeholders in the development of Rakunan express bus operation scheme in Kyoto. They concluded that cooperation among the various stakeholders, from the planning stages to service introduction, was a key factor in the project's success.

Jones (2012) stated that one of the ways of developing sustainable transport is to identify cross-sector or socio-technical groups that can work together to influence a new breed of sustainable travel patterns.

Doi *et al.* (2016) emphasized that in light of the aging society, it is becoming imperative to have "co-creative thinking and community rooted approaches" in order to deal with the current road safety situation.

In recent years, various organizations such as Department for International Development (DFID, 2012) have utilized the "Theory of Change" (TOC) as a planning and management tool to determine community change efforts. TOC has been beneficial in the fields of education, poverty alleviation and agriculture, but is yet to be utilized in road traffic safety.

In addition, TOC has been used as an evidence based methodology in connection with social impact analysis. The HCT group in the UK has utilized TOC to show how their training and transportation services have impacted the lives of the communities they serve. Over the years, TOC has enabled HCT group to effectively utilize their resources in order to improve their service delivery and ultimately increase the impact on the communities.

Therefore, this paper seeks to show the feasibility of the proposed cross sector cooperation approach towards road safety using the "Theory of Change". This is illustrated by communities who have embraced different forms of cross sector cooperation strategies to address the high fatalities of school going children and bicyclists in Japan.

1.2 Description of the Cross Sector Cooperation Approach towards Road Safety

1.2.1 The components of cross sector cooperation approach towards road safety

This approach is rooted in the relationship, between the 3Es approach and PSC principle, which was suggested by Mwebesa *et al.* (2018). The 3Es is a technical approach that stands for Engineering (Eng), Education (Edu) and Enforcement (Enf) solution towards road safety. While the PSC principle stands for Prioritizing (P) a particular traffic participant in the road space, for example providing bicycle lanes on roads. S stands for Speed management in the road space while C stands for either Compactness (Cct) in the road space or Compression (Cr) of traffic rules and regulations by road users.

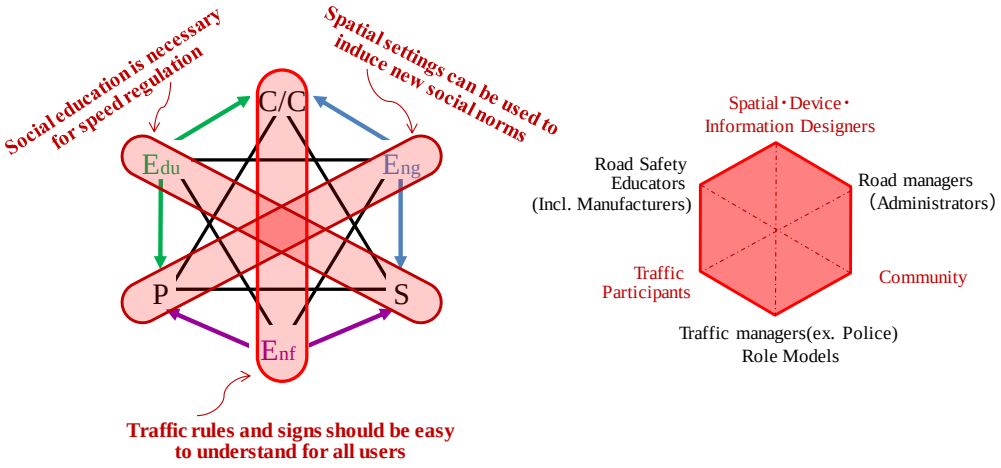

Figure 1. Desired cross sector cooperation and the main road safety key players

This cross sector cooperation approach towards road safety revolves around two main pillars. The first pillar is the key players (stakeholders) that are vital during road safety discussion. The right hand side of figure 1 suggests the six (6) broad categories of these key players. While the left hand side of figure 1 above represents the second pillar which is the classification of the causes of road accidents and their respective solutions. These solutions are represented by the widely known 3Es principle which has been adapted across the world for many years.

A definitive taxonomy of road accidents types has been developed over the years, while that for the causes of road accidents is yet to be agreed upon. Many a times, causes of road accidents are merely listed but figure 1 above suggests a classification of these incidences.

From this perspective, it is thought that accidents can be caused due to either a lack of clear hierarchy of road users (P) or a lack of speed regulation (S) or a lack in comprehension (C) of traffic rules and regulations.

Accidents resulting as a lack of speed (S) regulation are rather straightforward. On the other hand, road accidents caused as a lack of clear hierarchy of road users can be explained

by the definition of priority (P) in the PSC principle. When road users do not understand who is to be given priority in different traffic scenarios then the risk of accidents greatly increases. Drawing from one of the case studies, in Takamatsu city it is reported that the one of the main causes of accidents involving bicyclists is that drivers do not yield to bicyclists at intersections. Yet legally, pedestrians and bicyclists have a right of way at both signalized and un-signalized intersections in Japan. The same can be said for the priority given to through passing cars in relation to right turning cars at intersections in "keep-left" countries. When such priorities are not understood, there is an increased risk of having head-on collision or side collision.

Accidents caused due to a lack in comprehension (C) of traffic rules, regulations, signs and symbols is evident among foreign drivers in countries that have different characters other than the alphabet or those that have a totally different set of rules embedded in the norms of their societies. For example, it has been noted by Yoh *et al* (2017) that South East Asian drivers face problems while driving in Japan because they do not understand the Japanese traffic rules and road signs while East Asian drivers especially Chinese do not always face this problem because of similarity in characters with Japan. In addition, for federal states such as Germany or the USA, the basic traffic rules are usually the same but there are some extreme variations depending on state. With such examples in mind, a deeper understanding of the causes of accidents from the perspective of the PSC principle is an important step in formulating appropriate road safety solutions.

1.2.2 The holistic overview of the cross sector cooperation approach towards road safety

Figure 1 above represents the ideal overview of what holistic road safety should entail. The three highlighted elements are aspects of road safety that we need to further emphasis especially following the fast ageing societies and the imminent introduction of autonomous vehicles. These are likely to lead to obscure road safety challenges in the foreseeable future.

These three (3) aspects are; a) the need to change social education so as to address speed related problems, b) making traffic signs, symbols and regulations easy for all road users (including the physically challenged road users) to understand and c) the need to use spatial designs to induce new social norms among communities.

Dangers of over speeding have been among the largest content of many traffic safety campaigns all over the world. But what needs to be looked into is speed as part of a community's culture. Yoh *et al* (2017) briefly touched upon this issue in the research aimed at showing which accidents foreign drivers in Japan were prone to cause and which traffic regulations they tended to violate. It was concluded that among all foreign drivers in Japan, North and South Americans tended to violate speed related rules. Such regional differences

are an indicator that the nature of traffic safety education needs to be reviewed to suit a community's culture.

Uniformity of traffic signs and symbols is a sure way of improving road safety. The implementation of the Vienna Convention on road signs and signals in 1978 saw many European Union (EU) member countries utilizing a standard set of signs and symbols. Other regions of the world, such as Asia and Africa, have not implemented such standardized regional road signs and symbols and this to some extent may have contributed to the relatively higher road accident rates in these regions when compared to Europe.

On the other hand, engineers play a big role in forming the safety norms of a community. Countries such as the Netherlands and Germany have been successful in this regard. For many years now, the inclusion of bicycle lanes and other provisions in the road space have led to the high number of bicycle trips in both nations. These trips are not only for commuting to and fro school or work but also for activities such as recreation, shopping etc. Such engineering innovations that positively influence people's life styles are still lacking in many regions of the world. Therefore, a lot has to be done in order to realize the benefits of these three non-traditional aspects highlighted in figure 1 above.

2. METHODOLOGY

Two distinctive cases studies were chosen for this study. In these case studies, a form of cross sector cooperation strategy was applied to tackle the road safety issues in their respective areas. Documentation pertaining to various aspects of the road safety situation of these two areas was reviewed by the authors to ascertain if the two aforementioned pillars of cross sector cooperation approach were reflected in the road safety discussions held.

First, the authors sought to ascertain whether the stakeholders suggested in figure 1 were sufficient enough to cater for the various key players that took part in the road safety discussions. This was done by cross checking the job descriptions for the roles and responsibilities of each participant at the discussions. Based on this the participants were classified under a befitting category of key players from figure 1.

Secondly, the authors sought to classify the causes of accidents and their respective solutions based on the explanation given in section 1.2 above. This was done by using a simple quantitative method that gave us the percentages of each cause of accident under the P, S and C categories and the percentages of the solutions under the Eng, Enf and Edu categories. For example, the causes of accidents due to speed were totaled, thereafter a percentage of these to the total of all causes of accidents was got. The same was done for priority and comprehension while for the road safety solutions, each percentage was of a total of the 3Es. From this analysis, it was possible to ascertain which aspects of the cross sector cooperation

model were reflected, hence informing us whether the proposed model is applicable or not.

In order to understand the feasibility of the cross sector cooperation approach, the Theory of Change (TOC) was used to illustrate how cross sector cooperation efforts in the case study areas brought about change in the road safety discussions. For each case study, a TOC model was produced to highlight the underlying events or conditions that resulted in the outcomes.

2.1 The Theory of Change (TOC)

Mayne (2015) defines the Theory of Change as models of how change is expected to happen (based on forecasts) or how change has happened (based on results). Berry Organizational and Leadership Development, LLC states that the difference between a TOC and a logic model is that the "TOC links outcomes and activities to explain how and why the desired change has occurred". These links are the underlying factors or events that have to be present in order to foster change. Figure 2 below is a representation of a basic TOC model.

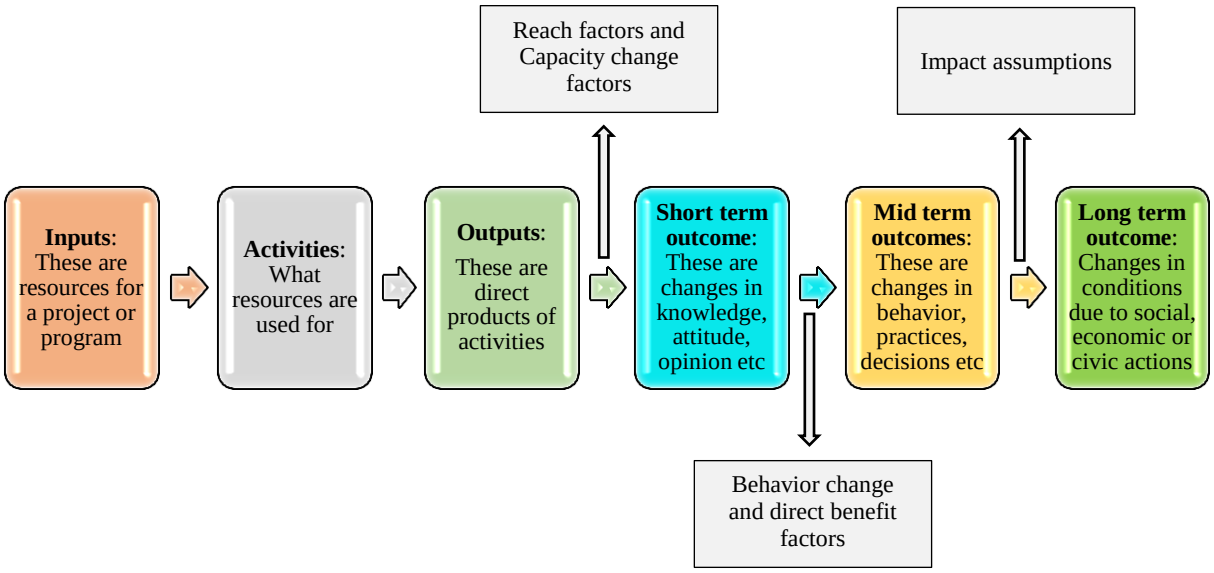

Figure 2. A basic Theory of Change model

The definitions in figure 2 above are adapted from the aforementioned organization while the assumptions are based on the definitions by Mayne (2015). In the same reference, items such as reach "factors" are termed as reach "assumptions". The authors chose to use the term "factor" because the events described in this study have already happened. The word assumptions were retained for impact assumptions because these are yet to be realized.

Therefore, reach factors are events or conditions that had to be present if the outputs were to be positively received by the stakeholders. Capacity factors are events that had to be

present and conditions that had to change so that the outputs would bring about a change in attitude, knowledge, opinions etc. Behavior factors are events or conditions whose presence led to change in practice and decisions of the stakeholders. Finally impact assumption are events and conditions whose presence will enable practice changes to be realized as direct benefits and these will manifest into long term outcomes.

3. RESULTS AND ANALYSIS

3.1 A Brief Background on the Selected Case Studies

The selected case studies were Takamatsu city in Kagawa prefecture and Niigata city in Niigata prefecture. The reasons for selecting these areas include;

- Both areas are highly motorized cities of Japan (see table 1 adapted from reference 13)
- Both these areas have consistently had road accidents rates higher than the national average (see table 2 below adapted from reference 11)
- Both areas embraced a cross sector cooperation strategy to tackle road safety issues involving a vulnerable road user
- IATSS has a keen road safety interest in these areas.

The norm in Japan is that a transportation safety plan is produced every 5 years by the designated MLIT and cabinet members. This is used as a guide for every local government to implement road safety guidelines in the way they see fit depending on the prevailing road safety situation in the localities. In addition, bodies such as the police, local governments and the Ministry of Land, Infrastructure Transport and Tourism (MLIT) have clearly defined roles and responsibilities when it comes to road safety. Most times, each authority carries out their respective duties without much consultation from other authorities despite the fact that their overall goal is to improve road safety either through education, engineering or enforcement measures.

Such divisions among the authorities, that are collectively responsible for road safety, creates an intangible problem. Furthermore, the community is rarely involved in discussions that relate to their own road safety, apart from when it comes to implement an educational road safety measure. However, Takamatsu city and Niigata city utilized strategies that brought together all these stakeholders (see table 3) to discuss the causes of accidents and their appropriate solutions. Table 3 reveals that the categories of key players proposed in figure 1 are sufficient enough to cater for various road safety stakeholders in different localities.

Table 1. Road accident statistics for Kagawa prefecture and Niigata prefecture

	Road accident deaths (no.)			**Road accident deaths (per 100,000 population)**		
	2015	**2016**	**2017**	**2015**	**2016**	**2017**
Japan (as a whole)	4117	3904	3694	3.24	3.07	2.91
Kagawa Prefecture	52	61	48	5.3	6.25	4.94
Niigata Prefecture	97	107	85	4.19	4.64	3.72

Table 2. Transportation mode split for people over 15 years of age

	Use of one transport mode (%)					**Use of 2 modes (%)**		**>3 modes (%)**
	Walking	Rail/Train	Bus	Car	Bike/ Bicycle	Rail/Train/ Bus	Rail/Train/ Bike/Bicycle	
Japan	7.1	16.1	2.5	46.5	14.6	3.8	3.4	1.1
Kagawa Prefecture	5.3	3.9	0.6	65.2	4.9	0.2	1.9	0.4
Niigata Prefecture	6.9	3.5	2.9	72.0	8.2	0.6	1.1	0.5

Table 3. Participants at the town meeting and workshops

Proposed Category	**Takamatsu city town meeting participants**	**Niigata city workshop participants (about 70 people)**
Road safety educators	• Police • Mothers' association for traffic safety	• Police • Hiyoriyama safety staff
Traffic participant	• Elementary school students • Residents	• Students • Residents
Traffic managers	• Kagawa prefectural police	• Niigata prefectural police
Community	• PTA • Community associations	• PTA • Association for traffic safety promotion
Road manager	• Takamatsu City maintenance department	• MLIT representatives
Spatial/Device/Information designers	• Prefectural Civil engineering department • Consultancy firm • Prefectural police	• Prefectural police • IATSS • Saitama University • Seiryou University

3.2 Case Study 1: Takamatsu City, Kagawa Prefecture

3.2.1 The road safety situation in Takamatsu city

Kagawa prefecture is an important entry point to Shikoku region and is also the location of both national and international trade points such as Takamatsu, Sakaide etc. Takamatsu city, its capital, houses many regional branches of Japan's biggest corporations.

As a prefecture, Kagawa is known to have the highest road accident deaths per 100,000 populations in Japan (see table 1 above). Takamatsu city's road safety situation is not very different from that of the rest of Japan, because majority of accidents occur at intersections and in residential areas and many involve bicycles.

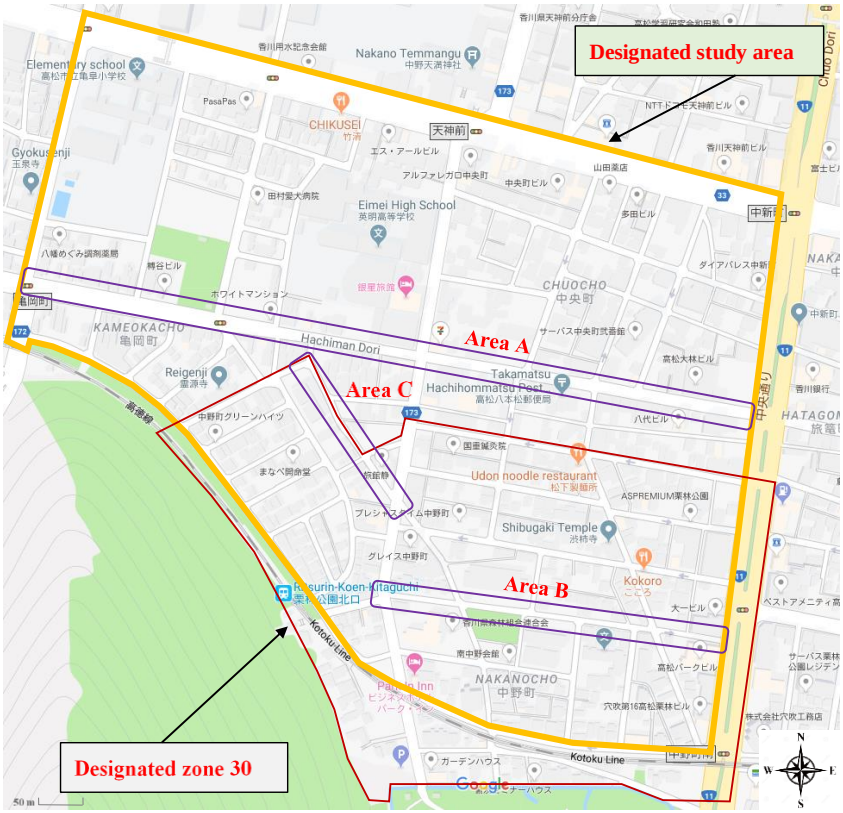

Figure 3. Area designated for intervention in Nakanochou, Takamatsu City

In 2016, probe data, video surveillance and surveys were carried out to ascertain the real causes of these numerous accidents involving bicycles. Three representative areas in Nakanochou area in Takamatsu city were selected. These are denoted by area A, B and C in figure 3 above, which is adapted from reference 15. Thereafter a town meeting was held in November 2017. It was attended by various participants from the community and various

relevant authorities (refer to table 3). The town meeting was kicked off by a field visit led by residents who explained their grievances to other members. That same day, the town meeting commenced in which an in-depth exchange of ideas and opinions took place.

Another meeting was held in January 2018, to forge a way forward based on the studies done in 2016 and information gathered from the town meeting in 2017. Based on the publication from the Kagawa prefecture committee responsible for road safety of Takamatsu city (July 2018), implementation of the various measures was still underway.

3.2.2 Merits of cross sector cooperation: Takamatsu city

During the discussion, it was agreed by all that over speeding was the riskiest behavior among the drivers. Therefore, ETC 2.0 was used to pinpoint the locations where this frequently happened. It was discovered that many drivers seemed to prefer using route B (see figure 4), the community agreed, arguing that route B was faster than route A. On the contrary, the results from the ETC 2.0 probe data showed that despite having traffic lights, route A was shorter and faster than route B. It was therefore collectively agreed that providing the community with such information would be vital to curb the risk of over speeding in this area.

It is through such interactions that other causes of accidents and their respective solutions were discussed. This further cements the fact that cross sector cooperation strategies such as this town meeting are fruitful in forging customized solutions to improve overall road safety. Figure 4 below exemplifies how various stakeholders within their dockets came together to contribute towards the discussion about speeding.

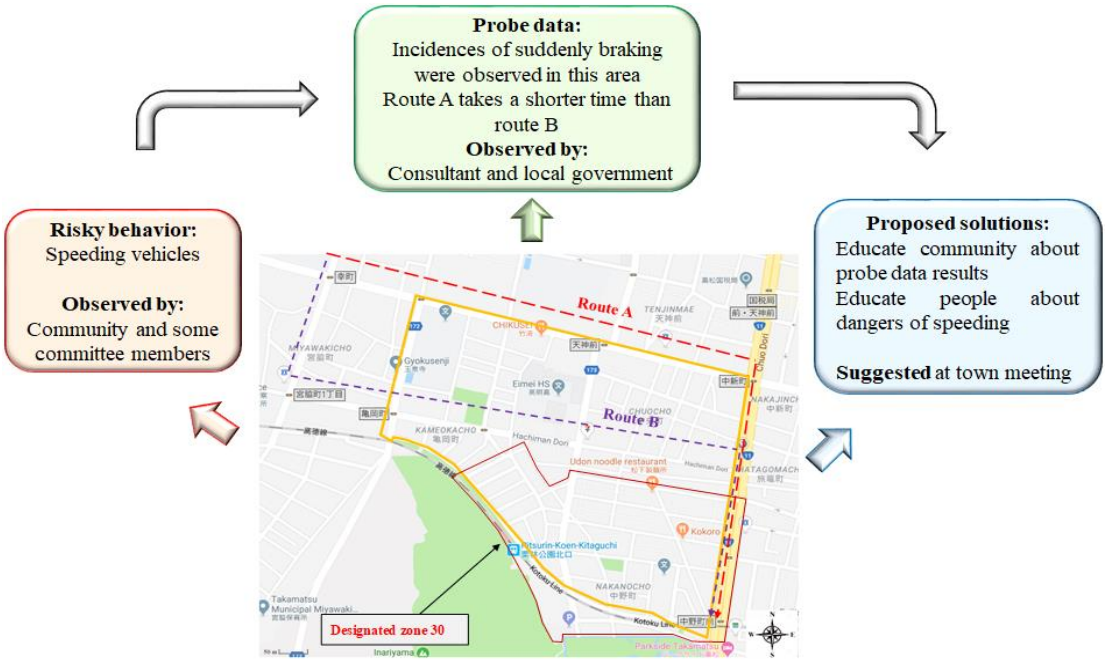

Figure 4. An example of decision making involving various stakeholders at town meeting

3.3 Case Study 2: Niigata City, Niigata Prefecture

3.3.1 The road safety situation in Niigata city

Japan is currently facing a problem of low birth rate that has led to many elementary schools closing. In addition, the number of fatal accidents involving elementary school children suddenly spiked from 3 deaths per 100,000 persons in 2009 to about 10 deaths per 100,000 persons in 2011. Niigata city has been affected by both these issues and it is one of the reasons why IATSS selected it as a case study during the formation of the guideline for improving safety of school routes.

In the academic year ending in March 2017, 3 elementary schools were scheduled to close and all the students were expected to join Hiyoriyama elementary school. The only challenge was that Hiyoriyama elementary school is located near a busy road leading to the port tunnel (refer to figure 5 below). This therefore posed a threat to the students who would have to mix with speeding drivers on the highway. In order to find solutions to this problem, three workshops were held to discuss ways on ensuring the safe commute of these students. Various participants were invited to discuss this issue (refer to table 3).

Figure 5. Map showing location of Hiyoriyama elementary school and the other schools that were closed

The first workshop (WS1) was held in July 2016 to discuss the general road safety situation that included the traffic data that had been collected prior. Two months later, another workshop (WS2) was held to discuss the probable solutions and to also avail the local government with information that could be used to estimate the cost of implementation and the manpower required. During the last workshop (WS3) in November 2016, both short and long term measures were decided upon.

3.3.2 Merits of cross sector cooperation: Hiyoriyama elementary school

Over speeding was still noted as one of the riskiest behaviors within the Hiyoriyama elementary school neighborhood. During the discussions, it was suggested that the school neighborhood be designated as a zone 30 area. Other proposed supplementary measures included installation of rising bollards, zone 30 indicative road furniture and green belts meant for cyclists.

The above example will be used to expound on the merits of such cross sector cooperation strategies. Demarcating an area as a zone 30 is an enforcement measure that only local government and police can undertake but it is also important to note that the residents' consent on where to place the rising bollards is also vital. The workshops provided an opportune setting where relevant stakeholders could make conscious decisions without so much resistance towards each other. Figure 6 below illustrates this point further.

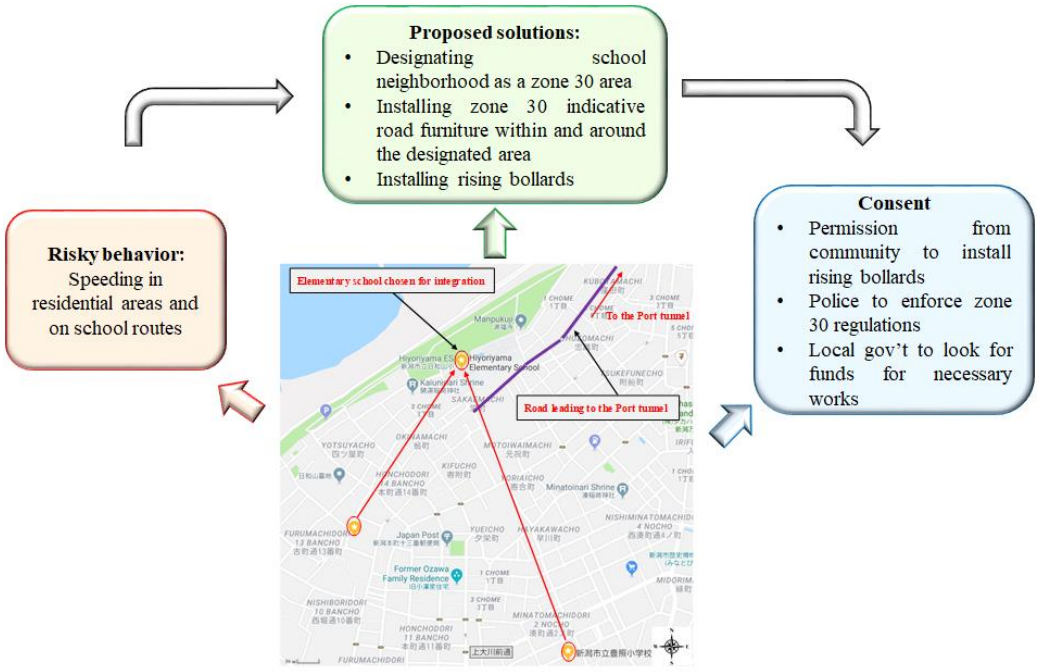

Figure 6. A representation of how cross sector cooperation strategies quicken problem identification and solution building

4.1 Discussion

In recent years, the 3Es have adopted another E which stands for Evaluation. It is no doubt that evaluation of any road safety measure is vital to establish its overall pros and cons. Although some measures have been implemented in both Takamatsu city and Niigata city as of February 2019, this paper does not seek to evaluate their effect. But rather the simple evaluation in this section seeks to compare the perspective of each city in terms of causes of accidents and the solutions suggested at the respective gatherings.

Figure 7 and 8 are a representation of the percentage proportion of accident causes and solutions based on the PSC-3Es relationship described in section 1.2. It is clear to see that cross sector cooperation strategies such as town meetings or workshops give us a better understanding of the root cause of road accidents because the affected party (the community) is given a platform to express their challenges from their perspective as opposed to authorities such as police or engineers simply implementing road safety measures from their professional perspectives only.

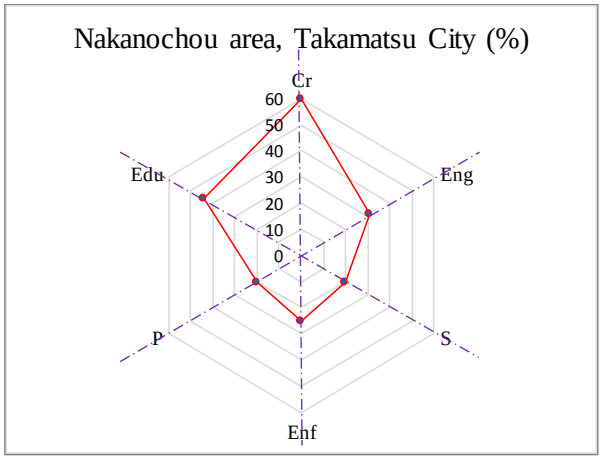

Figure 7. Results of the discussion at Takamatsu city

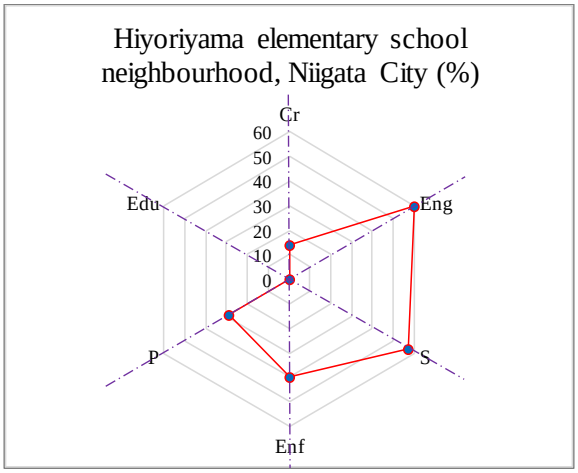

Figure 8. Results of the discussion at Niigata city

At the time the town meeting was held, Takamatsu had started designating bicycle lanes among other engineering related measures. But the results of the meeting, leaned towards Education related measures because it was identified that bicyclists and drivers were not conversant with traffic rules and regulations.

While in Niigata city, the designation of a zone 30 area is the main reason that dictated the change in the road environment hence the focus on engineering measures. Though one would argue that, now that school going children have to make longer commutes, ensuring that all road users understand the traffic rules and regulations would become paramount. However, this was not the case, because education measures work best if a particular target

group has been identified. In the case of Niigata city, a target group had not yet been identified.

All in all, this does not mean that all road users in Niigata city fully comprehend traffic rules and regulations or that enforcement by the police is flawless nor does it mean that the road environment in Takamatsu city is impeccably engineered or that enforcement is performing at 100%. But rather, these representatives felt that these solutions would help them overcome the current road safety issues within their respective area.

For now, a balance among the highlighted features in figure 1 is not the ultimate goal but rather acknowledging that there are challenges to be addressed and that steps are being taken. Takamatsu and Niigata cities made significant steps in the direction of the highlighted features. It is from this perspective that we feel that an organic combination of the efforts of these two cities can bring us a step closer to motivating those concerned to embrace cross sector cooperation towards road safety. First, identification of the factors that led to the success of these cross sector cooperation strategies is an important step. Section 3.5 further expounds on these factors.

4.2 Theory of Change Models for Takamatsu city and Niigata city

This section elaborates on the factors whose presence enabled the various stakeholders to come to a consensus regarding a way forward towards road safety. In order to understand these underlying factors, the theory of change model based on figure 2 has been created for each case study.

The items enclosed in rectangles are the underlying factors whose presence enabled participants to make use of the results from the activities so as to have an informed discussion that led to the outcomes. We feel that without these factors, the outputs or outcomes may have been different because the town meeting and the workshops are a first of their own kind in Japan. Two other elements that may have contributed to the discussion are; that both the town meeting and workshops were well organized to create a conducive atmosphere for open discussion. The other factor is that the activities chosen to identify the problem in these areas were appropriate. Without proper identification of the core problem, the discussions would have led to a different set of outcomes. Figure 9 represents the TOC model for Takamatsu city while figure 10 represents the TOC model for Niigata city.

These two cities had similar underlying factors though a few were very distinct to each city. These identified factors can be manipulated to suit another setting that may lead to a similar or different set of desired outcomes. In so doing we can predict the feasibility of a project once we know the factors that can foster change in one or more dimensions. This is the main merit of using TOC in this study.

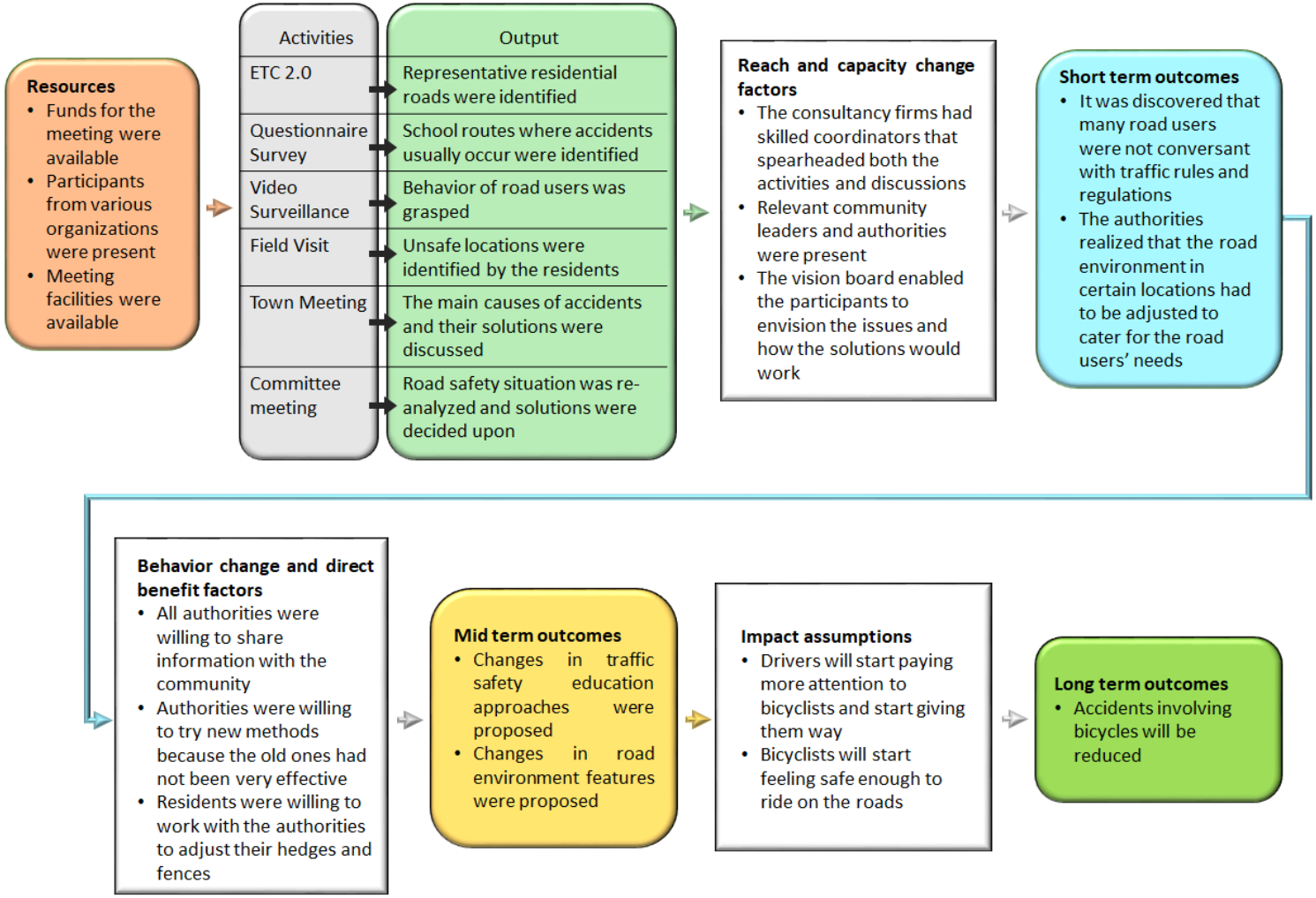

Figure 9. A representation of the Theory of Change model for Takamatsu city

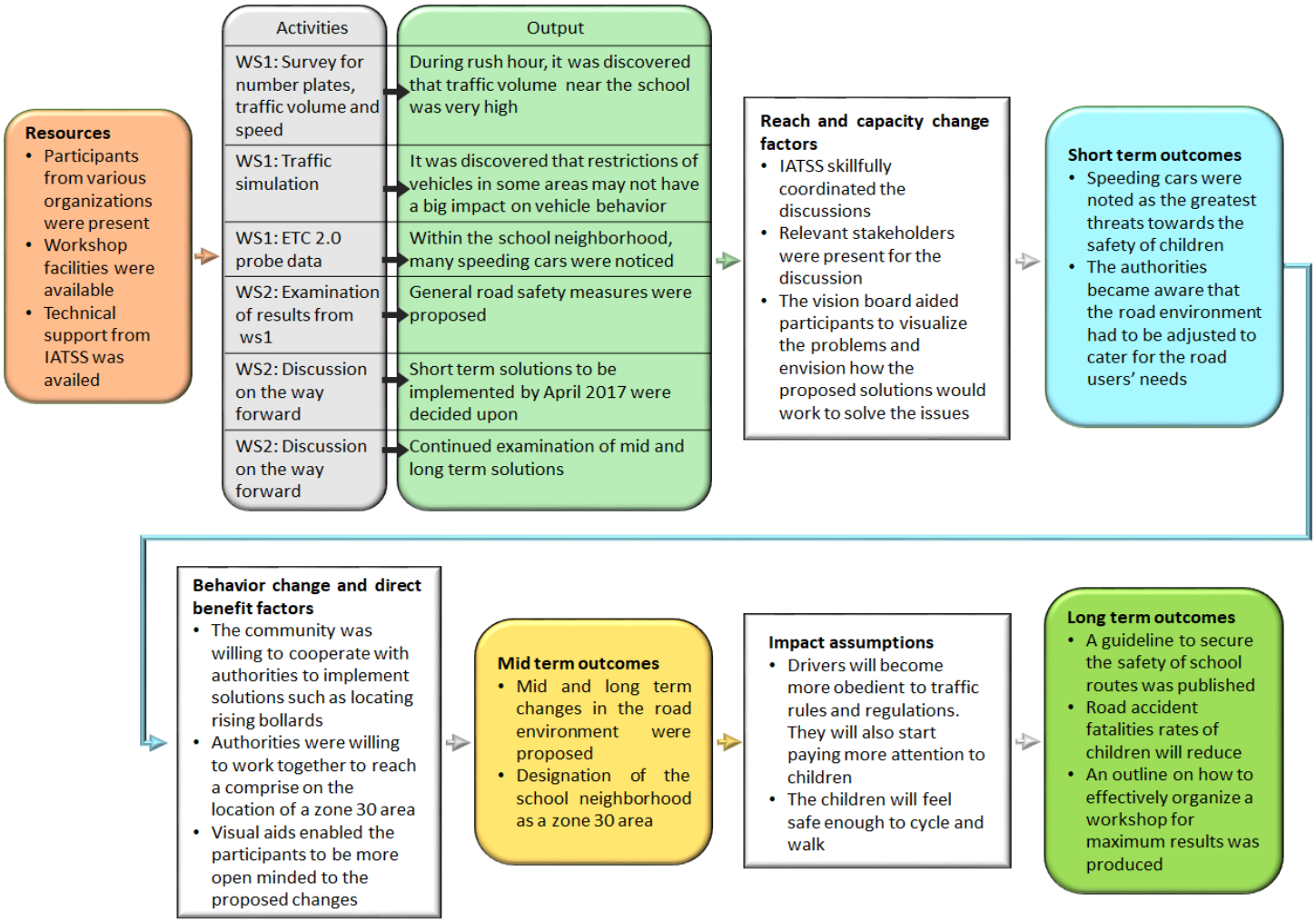

Figure 10. A representation of the Theory of Change model for Niigata city

5. CONCLUSION

Now more than ever stakeholders have to customize road safety goals and measures in order to combat the current social situation. In view of this, this paper has looked into expanding the meaning of cross sector cooperation towards road safety by broadening the traditional approach of the 3Es to include the concept of PSC.

This combined mechanism (refer to section 1.2) not only suggests broader categories of relevant stakeholders vital for co-creation in road safety discussions but also suggests a broader perceptive of looking at the causes of accidents and their respective measures. This approach changes the road safety over view by promoting techniques that bring the community to the road safety discussion table. Figure 1 also highlights the three road safety aspects that have been previously neglected but need to be looked into as we head towards the introduction of autonomous vehicles and the fast ageing societies as is the case in some developed countries.

The 2017 town meeting in Takamatsu city and the 2016 workshops in Niigata city are examples of cross sector cooperation strategies. The purpose of using these two case studies was to investigate whether the three highlighted aspects had been realized. From the study, we learnt that it is difficult to realize all three aspects at the same time.

Takamatsu city was successful in implementing social education measures that encouraged its residents to reduce the speed of their bicycles and vehicles. While Niigata city registered success in proposing various engineering measures that would prioritize the safety of school going children. They were also able to agree on installation of road furniture that would enable road users to better understand some traffic rules and regulations, for example zone 30 indicative signs were to be installed around the school neighborhood in addition to having police patrols.

Furthermore, despite cross sector cooperation approach being a new idea, it was possible to show that the stakeholders proposed by this approach cater for various key players in the road safety sector (refer to table 3). The authors were also able to demonstrate that the causes of accidents can be categorized based on the PSC principle. Figures 7 and 8 under section 3.4 illustrate this further. It is also important to note that various benefits were accrued from the meeting and the workshops as is depicted in sections 3.2.2 and 3.3.2.

Getting various parties to embrace this cross sector cooperation approach is quite challenging because ideally, the ultimate goal is to have a balance among the three highlighted aspects. Making these parties realize the inherent effect inputs and activities have on an outcome maybe one way to foster this. Therefore, the Theory of Change (TOC) was used in this study to give a holistic picture of what happens when different parties work together, and to show the latent impact of each party's input towards the outcome. In so doing, the authors hope to show the necessity and effectiveness of cross sector cooperation approach towards road safety

by only identifying the underlying factors that led to the success of the discussions in Takamatsu city and Niigata city.

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