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Trust in driverless cars: Investigating key factors influencing the adoption of driverless cars

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ABSTRACT

Driverless cars are seen as one of the key disruptors in the next technology revolution. However, the main barrier to adoption is the lack of public trust. The purpose of this study is to investigate the key factors influencing the adoption of driverless cars. Drawing on quantitative evidence, the study found that the ability of the driverless car to meet performance expectations and its reliability were important adoption determinants. Significant concerns included privacy (autonomy, location tracking and surveillance) and security (from hackers). The paper provides implications for firms developing the next generation of car features and early implementation sites.

1. Introduction

The World Health Organization has indicated that 1.2 million people die in accidents each year (WHO, 2015). Driverless cars have been deemed an important technology in reducing a portion of those deaths due to human error (Kyriakidis et al., 2015). A driverless car, otherwise termed a self-driving car or an autonomous car, broadly refers to a robotic vehicle that works without a human operator (Benenson et al., 2008; Paden et al., 2016). More specifically, it can be defined as ‘those in which at least some aspects of a safety-critical control function (e.g. steering, throttle or braking) occur without direct driver input’ (NHTSA, 2013, p. 7). There are various levels of automation of driverless cars and various classification systems exist (the widely adopted SAE standard, the National Highway Traffic Safety Administration (NHTSA) standard and the German Federal Highway Research Institute (BASt) standard). These systems generally encompass five levels of automation from no automation to various levels of partial automation to fully automated (Kyriakidis et al., 2015).

Since the Internet and smart phone revolutions, driverless cars have now been deemed as one of the key disruptors in the next technology revolution along with drones and the internet of things and have been recognized as a key area for future research (NHTSA, 2013). Google’s self-driving car has become a hot topic in the media and governments around the world have begun to develop strategies to address the challenges that may result from self-driving vehicles (Schoettle and Sivak, 2014).

While driverless cars promise to provide many benefits, a key barrier to its adoption is the public trust in driverless cars (Bansal et al., 2016; Kyriakidis et al., 2015). As automobiles are becoming unsustainable, there has been many consequences such as the emission of carbon, high traffic and accidents (Paden et al., 2016). To control these, driverless cars have been proposed as a suitable alternative. Although this may potentially provide safety and efficiency benefits, there are major concerns around the public’s willingness to adopt the technology. These concerns relate to security, trust, privacy, reliability and liability (Fagnant and Kockelman, 2015). Additionally, there are certain situations in which users may be more willing to adopt driverless cars, compared to others. Further research in understanding the scenarios when users are most willing to adopt driverless cars will assist in early

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implementation programs among adopting target groups and settings.

Consequently, this study will attempt to answer the following research question: 'What are the key factors influencing trust in driverless cars?' It will investigate perceptions of benefits, concerns, trust and importantly, situations when users are more willing to adopt driverless cars.

It is widely accepted that driverless cars will not become mainstream on the majority of roads globally in the immediate future (Benenson et al., 2008; Godoy et al., 2015). The most likely adoption settings may be in closed environments such as university campuses, airports, golf courses, holiday parks and retirement villages (Miralles-Guasch and Domene, 2010). However, the majority of existing studies have collected data in broad brushed random approaches internationally or nationally rather than focus on closed environments. For instance, a study by Kyriakidis et al. (2015) obtained 5,000 broad responses from 109 countries with only 40 countries having at least 25 responses. Similarly, a study by Schoettle and Sivak (2014) collected 1533 responses from the US, UK and Australia. However, as the mass consumer market would not be the first ones to adopt the technology, research is needed that is more nuanced in terms of the groups and situations when people will most likely adopt the technology. For instance, prior studies did not indicate who may be willing to use driverless vehicles for public transportation. In fact, prior research makes little mention of public transport, although government transport departments and those providing transport services in certain closed precincts will be interested in attitudes towards driverless cars (Lam et al., 2016).

Given the need to focus on early adoption settings of closed environments as a public transportation service, the scope of this study will focus on obtaining responses from a closed environment of a university setting, where driverless cars will soon be launched as a free service to transport passengers around the campus. This has important implications for the implementation of driverless cars in closed settings.

The study is significant for many reasons. First, it provides an understanding of key factors influencing the adoption of driverless cars in closed settings such as university campuses. Second, it may also have implications for the implementation of driverless solutions in other closed settings such as airports, golf courses, holiday parks and retirement villages. The Royal Automobile Association (RAA) in Australia offers mobility options for the elderly. For the RAA, cars and their drivers may increasingly be less of their business model with an aging population as the members with valid driver's licenses decrease (Gifford, 2017). Therefore, understanding key factors in closed environments will be helpful. Third, the research will be helpful to car manufacturers as they will be interested in offering the next generation of convenience features for early adopting target markets which will be known to us through the survey.

2. Literature review

In understanding key factors in the adoption of driverless cars, two key bodies of literature have been drawn upon, namely technology adoption and driverless cars. Fig. 1 illustrates these two key streams and associated factors which will be discussed further in this paper.

2.1. Technology adoption

Pertinent technology adoption theories include the technology adoption model (TAM) (Davis, 1989) and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003). From these theories, relevant factors include reliability, performance expectancy, trust, security and privacy. The latter three factors also feature in the driverless cars literature, which also uncovers a range of factors as per Fig. 1.

TAM was developed by Davis (1989) in which acceptance was defined as the decision by users to use technology. It helped to explore the reasons behind the adoption of technology among individuals and cultures exploring behavioral intentions or external

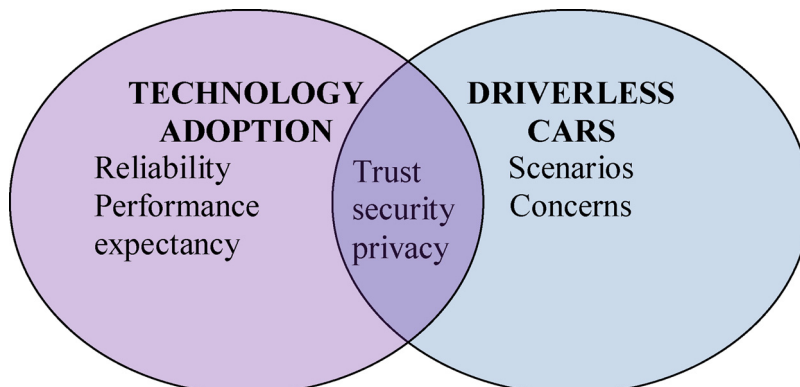


Fig. 1. Key literature and factors influencing the adoption of driverless cars.

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