

Automotive Replacement Component Business Framework Review

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Abstract

The automotive Replacement Component (RC) industry is a low volume, high profits business. Since RCs are used to replace failing, failed, or worn components for in-service vehicles, it is a business that is needed to support the vehicle for its entire life duration. RCs also requires no component development cost thus making it a business that any manufacturer can easily enter, resulting in a variety of price-quality option in the market. Furthermore, RCs can also be remanufactured from recovered End-of-Life Vehicle (ELV) components. This paper reviews relevant literature on the topic and introduces the types of Replacement Equipment Manufacturers (REMs) available, the perception of its RCs, and the ecosystem it operates in. Gap in current literature in terms of existing frameworks will then be discussed as to justify the need to develop a dedicated framework on the RC business in order to support existing automotive industry ecosystem frameworks.

Keywords: Replacement Equipment Manufacturer (REM), Original Equipment Manufacturer (OEM), Non-Original Equipment Manufacturer (Non-OEM), Replacement Component (RC), Automotive Business Process Framework.

1.0 INTRODUCTION.

In-service automotive components will fail when it reaches its end-of-life stage either prematurely or naturally. At this particular moment, the vehicle will stop functioning effectively and for critical components, it may lead to major incidents. In order to avoid such risks, critical components are routinely inspected during vehicle servicing and failing components will get replaced. Less critical components will not be closely monitored and will usually get replaced only when it fails or worn out. Regardless of the situation, automotive Replacement Component (RC) will be used. RCs are also referred as Replacement Equipment Manufacturer (REM) Components, and are manufactured as either a new component, or as a remanufactured component. Either type can be sourced from Replacement Equipment Manufacturers (REM) such as: (1) vehicle manufacturers, also referred as Original Equipment Manufacturers (OEM); (2) component suppliers to OEMs (Suppliers); (3) OEM licensed, third party manufacturer (Third Party); and, (4) non-licensed, third party manufacturer (Non-OEM). Zulhaidi et al (2012) reports that RCs produced by Non-OEM REMs are the riskiest as they may include substandard or fake components and parts, as they are not related to the OEM nor its test standards. The RC ecosystem is graphically represented in Figure 1.

2.0 AUTOMOTIVE REPLACEMENT COMPONENT BUSINESS.

The automotive RC business falls under the spare parts business category. The business which includes activities such as purchasing, warehousing, selling, delivering, customer services, and warranty management, is very profitable especially to Suppliers where it normally makes up two thirds of the profit from a third of the sales volume (Suomala, Sievänen, and Paranko, 2002). A study by Noeuvéglise and Chevenement (2012) echoes this finding as it was found that the overall RC business contributes to 10 percent of the global sales, but contributes to more than 50 percent of the net income for an average industrial company. Thailand's Board of Investment (2012) has

also reported that 30 percent of OEM and Supplier production volume in Thailand is for RC, and its revenue is higher.

Besides being profitable, the RC business is also a strategic business. For instance, Nigeria has moved away from its initial stand of importing RCs to having its RC ecosystem developed as to allow manufacturing of RCs within its borders (National Automotive Council, 2014). Malaysia’s New Automotive Policy (Malaysia Automotive Institute, 2014) also recognized the importance of the RC business and has laid out policies and strategies in order to increase RC production volume with view to export.

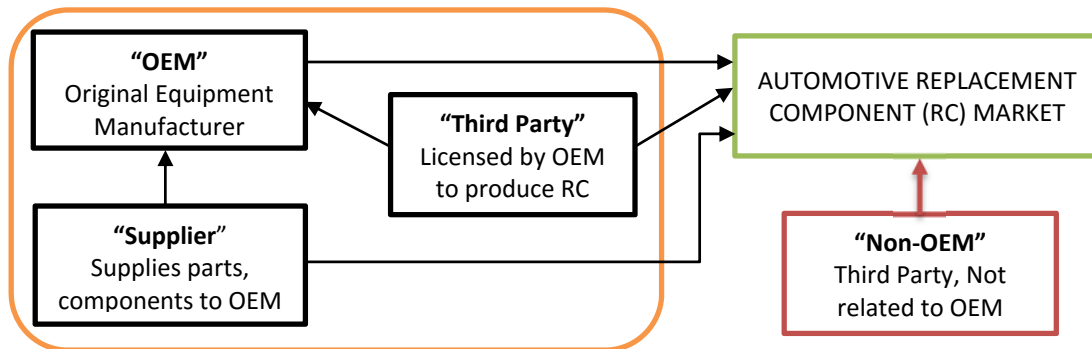


Fig. 1: Automotive Replacement Component (RC) sources flow.

3.0 EXISTING AUTOMOTIVE REPLACEMENT COMPONENT BUSINESS PROCESS FRAMEWORKS.

Wagner and Lindemann (2008) proposed that major effort should go towards overlooked areas of the industry, such as the definition of research frameworks with an integrated perspective on replacement component classification, demand forecasting, inventory management, and performance measurement. Bacchetti and Sacconi (2012) also suggested that such a framework should model management practices and policies as top level decisions will influence choices made at lower levels, and also promote adoption of differentiated approaches as different parts may correspond to different technique and strategies. However, relevant existing frameworks on the area does not represent these suggestions and is more logistical and supply chain in nature. These frameworks captures the relationship of the entire automotive ecosystem without going into detail on the RC business, and are briefly reviewed in the following sub-sections.

3.1 Forward Supply of Automotive Replacement Components Framework.

A forward supply of RC framework is used to represent an automotive ecosystem where only new RCs are being produced, and no remanufacturing activity exist. Such a framework has been proposed by Wagner and Lindeman (2008), Wagner et al (2012), and Zuhaidi et al (2012). Wagner et al (2012) improves on the previous work done by Wagner and Lindeman (2008) and includes market research as an important element in stabilizing market demand. Zuhaidi et al (2012) on the other hand models second hand RC supply along with Supplier (“OEM Supply” in the framework), Third Party (“Non OEM Aftermarket Supply, Official” in the framework), and Non-OEM (“Non OEM Aftermarket Supply, Approved/Substandard/Fake” in the framework), it still could not be considered as a closed looped or complete RC supply framework since the second hand parts are acquired from foreign market, and the recovery process (closed loop enabler) is being performed elsewhere. Furthermore, the depth of the recovery process is low as it only involves reusing the recovered components as-is, without increasing the residual value and life of the component or part. RCs from this type are also considered substandard RCs since it

does not have the same life or value as a brand new RC. The framework developed by Zulhaidi et al (2012) is shown in Figure 2.

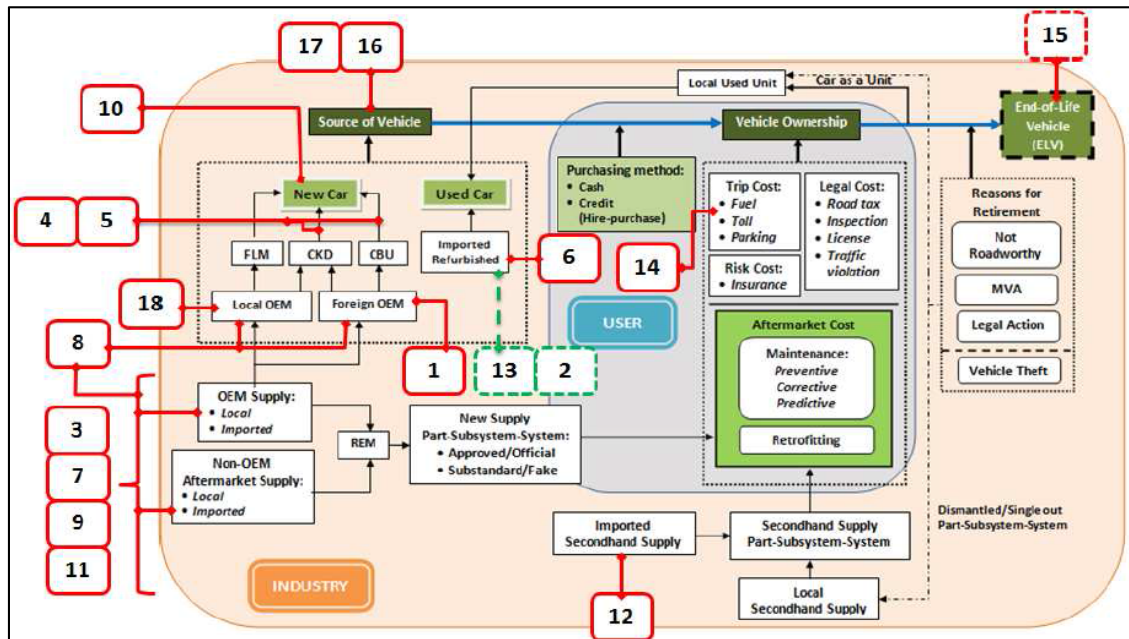


Figure 2. Forward supply automotive ecosystem (Zulhaidi et al, 2012)

3.2 Closed Looped Supply of Automotive Replacement Components Framework.

A closed looped supply of RC framework is used to represent an automotive ecosystem where RCs are being produced and remanufactured. Normally RCs framework will include End-of-Life Vehicle (ELV) management and recovery, reuse, recycling, and remanufacturing business processes. A business process is defined as a business activity a company might want to perform in a supply chain. Such a framework has been proposed by Masoumik et al (2014), Hamzah et al (2013), and by the Malaysia Automotive Institute (2014), shown in Figure 3 and Figure 4 respectively. Since it was developed using the IDEF methodology, the framework modelled by Hamzah et al (2013) represents business processes that existed throughout the four life stages of a vehicle. However, it only models OEM, Supplier (both modelled as “OEM parts” in the framework), and Third Party (modelled as “Remanufactured spare parts”) RCs. Apart from not modelling Non-OEM RCs, the framework is also incapable of differentiating between local and imported RCs.

Similar to the framework proposed by Hamzah et al (2013), the framework proposed by Malaysia Automotive Institute (2014) is also a super system level view of the automotive industry. However, multiple strategic roadmaps and facilities are represented and connected to this framework, as compared to only business processes. Nevertheless, there are gaps found in this framework as its focus is towards OEM and Supplier RCs only. Third Party or Non-OEM RCs are not represented specifically at this level of the framework, and may be modelled in one of the connected strategic roadmaps. Besides representing the physical flow of RCs, both frameworks are also capable to represent information flow, which would allow representation of reverse engineering of components for remanufacturing, and redesign of components for optimum recovery or disassembly, recycling, and remanufacturing. This flexibility in representation by both frameworks would also allow the modelling of Non OEM’s reverse engineering activity where OEM components are reversed engineered for RC production. Kim, Lee and Ryu (2012) also reported that such activity could be possible for Non OEMs and would eliminate the need for product development and testing.

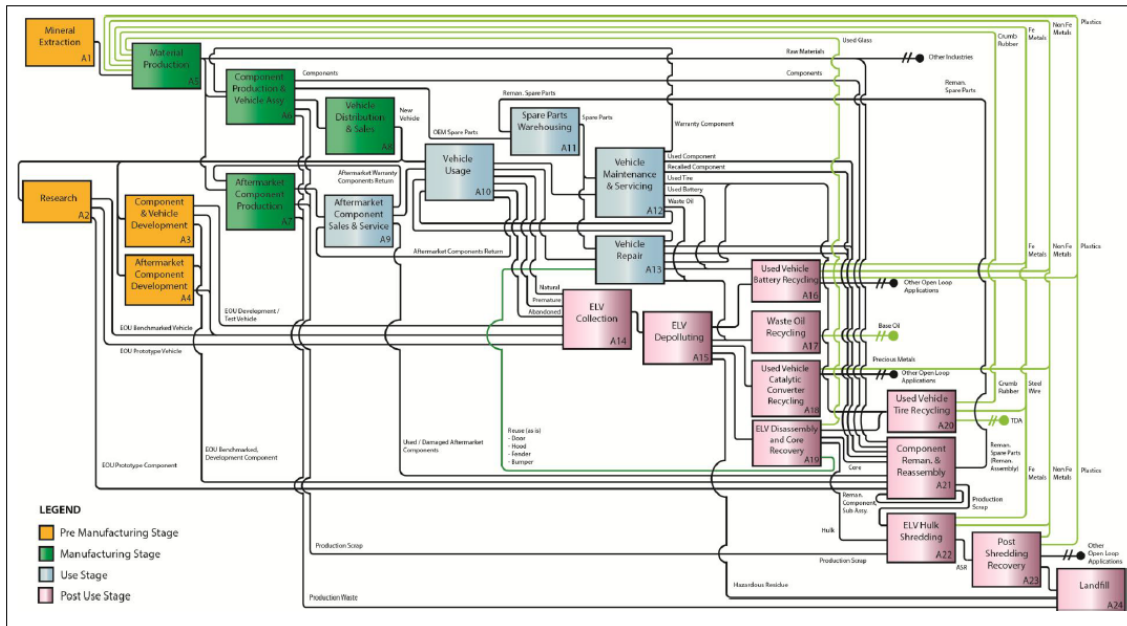


Figure 3. Sustainable Automotive Supply Chain Relationship Model (Hamzah et al, 2013)

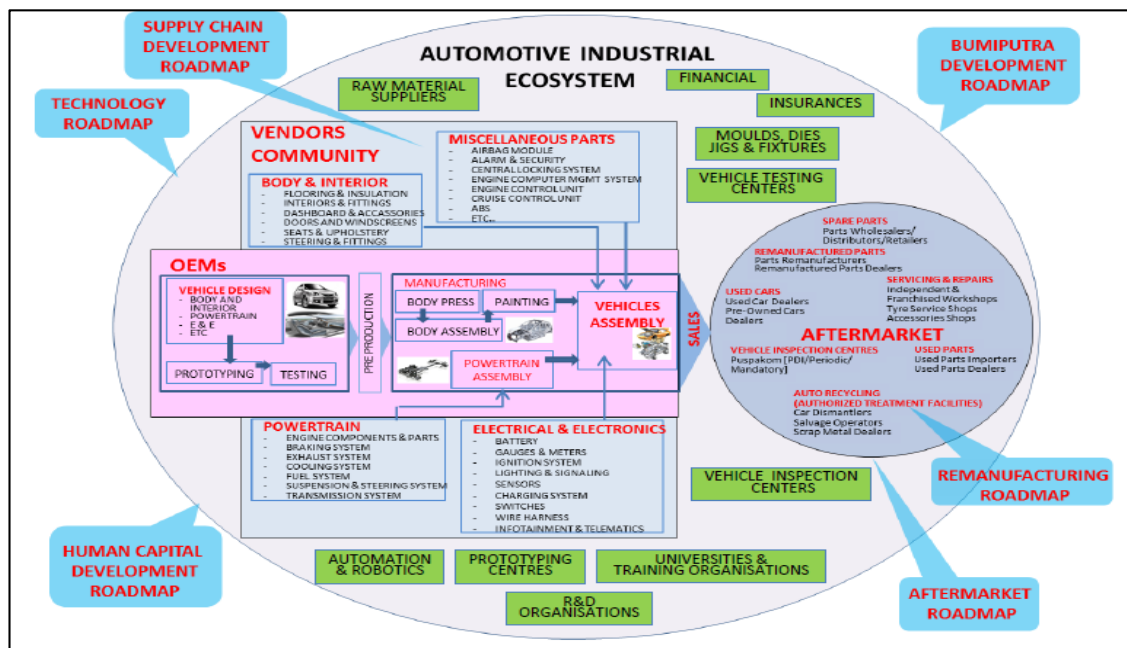


Figure 4. Automotive Industrial Ecosystem (Malaysia Automotive Institute, 2014)

4.0 DISCUSSION

Based on the review of existing frameworks on the matter, the overlooked framework areas suggested by Wagner and Linderman (2008) and Bacchetti and Sacconi (2012) are also overlooked in these frameworks. Furthermore, apart from the framework proposed by the Malaysia Automotive Institute (2014), all other frameworks does not cover both domestic and export. However, this framework does not have the depth required for a super system level framework as was the framework proposed by Hamzah et al (2013). It was also observed that no one framework represented all four types of REM. Table 1 shows the complete comparison result.

Table 1. Comparison between existing frameworks against “overlooked” areas

ID	Author (year)	“Overlooked” Research Framework Areas									Supply Chain Configuration		Supply Chain Scope			
		RC Classification (by REM)				Demand Forecasting	Inventory Mgmt.	Performance Measurement	Management Practice	Management Policy						
		OEM	Supplier	Third Party	Non OEM						Forward	Closed	Domestic	Export	Physical	Information
1	Zulhaidi et al (2013)	X	X		X	X					X		X		X	
2	Hamzah et al (2013)	X	X	X								X	X		X	X
3	Malaysia Automotive Institute (2014)	X	X	X								X	X	X	X	X
4	Cavalieri et al (2008)	X	X					X			X		X		X	
5	Legnani et al (2008)	X	X			X					X		X		X	
6	Souza et al (2011)	X	X								x		X		X	

5.0 CONCLUSION

Since there exist a gap in existing literature with respect to Replacement Components, the Replacement Equipment Manufacturers involved, and the ecosystem it operates in, a more in-depth study in the area is needed. Furthermore, since existing frameworks only focuses more on the automotive industry at a super system level, a specific system or sub-system level view of the Replacement Component should be developed to further improve and enhance existing frameworks.

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