



TELEMATICS STRATEGY FOR AUTOMOBILE INSURERS

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EXECUTIVE SUMMARY

This whitepaper investigates the business implications telematics services and Pay-as-you-drive (PAYD) insurance in particular, from the perspective of automobile insurance providers. Specifically, it discusses

- the PROFITABILITY and competitive dynamics of PAYD insurance,
- a simplified BUSINESS CASE for a new market entrant with a PAYD product,
- the present STRUCTURE OF INTERNATIONAL MARKETS for insurance telematics services,
- DRIVERS AND BARRIERS for the focus markets Switzerland-Austria-Germany, and
- the design of insurance telematics BUSINESS MODELS.

With respect to PAYD insurance as an isolated offering, we show that the likelihood of commercial success is the largest for a new market entrant offering a PAYD insurance product. In this scenario, profitability of a business case depends primarily on two factors, technology costs and the reduction of the average claims rate in a PAYD tariff class that could not be formed by conventional rate-making approaches. Technology costs likely to reduce over time and with larger scale. The average claim rate, on the other hand, is difficult to project since it depends on the behavior of market participants after the introduction of a PAYD offering. Conclusively, the introduction of such an offering constitutes a risky endeavor that is subject to several uncertainties, but comes with the prospect of substantial profits in an otherwise saturated market.

The presented business case is restricted to PAYD insurance. The market analysis and an in-depth interview study revealed that a range of REACTIVE telematics services is largely accepted today and has found promoters in most markets of Europe and the United States. Often, such services are bundled to increase the value-added while creating synergies in terms of shared technology costs. On the other hand, a second category of PROACTIVE telematics services, including PAYD insurance, has found only limited adoption. One key barrier for such services are privacy concerns of customers. However, innovative vendors such as INSURETHEBOX (UK) have demonstrated that these are manageable.

Lastly, we provide a business model template for insurance telematics services. The template is validated with two exemplary offerings and can serve as an implementation-oriented decision tool for insurance companies and their partners. It combines the insights gained in the previous parts of this study. With the specific domains introduced in the template, insurers can more precisely estimate costs and revenues of telematics offerings and clearly define their market positioning. The paper closes with recommendations for action directed towards automobile insurance providers.

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1 INTRODUCTION

Today's automobiles are versatile data acquisition platforms equipped with a plethora of sensors that enable the monitoring and control of engine, transmission, and chassis systems¹. Besides local vehicle systems, sensor data are increasingly processed through external computing infrastructure typically referred to as TELEMATICS. The trend for the interconnection of vehicles is driven by the prospect of functional improvements such as collision warnings or remote maintenance, which provide safety and comfort to drivers. In a broader perspective, however, the integration of formerly insular vehicle systems with globe-spanning data networks is posed to transform the automotive economy. With declining transaction costs between physical and virtual world, vehicles become nodes in what has been termed the INTERNET OF THINGS, providing individuals and firms with a continuous stream of fine-granular and timely state information that enable novel applications and services. The vast amount of data accumulated in such systems furthermore reveal patterns of vehicle usage characteristics in unprecedented detail and over extensive observation horizons. In the insurance business sector – where informational assets are essential for competitive advantage – these developments represent a major driver of change. This paper investigates how automobile insurers can successfully build service models based on telematics technology, and integrate them into their business strategy. An overview of relevant vehicle sensing technologies constitutes a starting point for this analysis in the subsequent section. Section 1.2 provides a definition of telematics services, and briefly outlines the concept of Pay-as-you-drive insurance models, an important type of such services. The detailed scope of the study at hand is laid out in Section 1.3.

1.1 IN-VEHICLE SENSING TECHNOLOGY

While in 1976 the recording of driving data for research purposes in a sensorized vehicle required extensive hardware modifications and bulky equipment such as digital tape recorders², today's technology exhibits vastly improved performance at miniature scale and at a fraction of the cost. Data collection units installed in vehicles – often referred to as in-vehicle data recorders (IVDR) – provide driving and travel information from hundreds and thousands of vehicles over years of operation. Particularly rich in information are three sources of sensor data: Satellite positioning, inertial measurement units, and a vehicle's On-board Diagnostic (OBD) interface. They employ different technologies and may be used alone or in combinations. The paragraphs below summarize their respective principles of operation as well as their data yields.

¹ Ribbens, W. B. (2012). *Understanding automotive electronics: An engineering perspective*. Elsevier, Waltham, MA.

² Helander, M. and Hagvall, B. (1976). An instrumented vehicle for studies of driver behavior. *Accident Analysis & Prevention*, 8:271–277

SATELLITE POSITIONING

Satellite positioning is an umbrella term for technologies in which a vehicle-based receiver computes its location through triangulation with beacon satellites in earth's orbit. A prominent instance is the Global Positioning System (GPS) developed by the US Department of Defense in the 1970s. Further, similar systems include the Russian Global Navigation Satellite System (GLONASS), the European Union Galileo positioning system, and the Chinese Compass navigation system. Among these, GPS has by far found the broadest adoption. GPS provides the absolute geographic location of vehicles with an accuracy of a few meters; differential GPS – a technology that uses local reference receivers to estimate error corrections – can achieve improved sub-meter accuracy³. As GPS locations can be recomputed several times a second, they in theory allow for the inference of continuous vehicle trajectories. In practice, however, GPS has proven to be susceptible to various disturbances, and is particularly affected by signal obstruction in densely populated areas as well as underground, e.g., in tunnels.

INERTIAL MEASUREMENT UNITS (IMU)

IMU comprise accelerometers or gyroscopes, or a combination thereof, typically mounted along two or three perpendicular axes. Accelerometers measure the proper acceleration through the displacement of a spring that is connected to an otherwise unconstrained mass. State-of-the art accelerometers are usually micro-electromechanical systems (MEMS) that can be manufactured in small packaging, and come at a low cost due to economies of scale. Gyroscopes, on the other hand, measure angular velocity from forces that appear when the axis of rotation of a rotating mass changes its attitude. While IMUs can also be used to track location changes in inertial navigation systems (dead reckoning), this requires high-grade sensors that come at excessive costs. In vehicles, IMU are conventionally employed in stability control, for instance, or to trigger airbag deployment.

THE ON-BOARD DIAGNOSTICS (OBD) INTERFACE

The OBD interface is not a single sensor, but a standardized way of accessing a vehicle's Controller Area Network (CAN). It is specified to be independent of vehicle make or model and was made mandatory in its current form (OBD-II) for all vehicles sold in the US by 1996, and for all vehicles sold in the European Union by 2004. Through connecting to the OBD port in a vehicle, which is typically located beneath the instrument panel in passenger cars, various parameters can be read from the CAN. These comprise odometer, speedometer, engine speed, temperature, among others. The OBD interface gives third party technology suppliers the opportunity to access these parameters without the involvement of manufacturers, or the need of tapping into vehicle hardware.

³ Parkinson, B. W. and Spilker, J. J. (1996). Global positioning system: Theory and applications. American Institute of Aeronautics and Astronautics.

Exhibit 1 provides a simplified comparison of the data on vehicle usage available from these three sensing options. The comparison gives reliable availability, limited availability, or missing availability of quantitative and qualitative usage characteristics. From the table, it is evident that the different data sources complement each other, and optimal coverage is achieved by combining all of them.

		GPS	IMU	OBD
Quantitative vehicle usage	Driving duration	reliable	limited	reliable
	Mileage	limited	n.a.	reliable
Qualitative vehicle usage	Daytime / weekday	reliable	limited	reliable
	Area / road type	available	n.a.	n.a.
	Velocity	limited	limited	reliable
	Longitudinal acceleration	limited	reliable	limited
	Lateral acceleration	n.a.	reliable	n.a.

Exhibit 1. Vehicle usage information obtainable from various sensing solutions

An alternative to IVDR-based sensing are applications that leverage the sensing equipment of mobile phone platforms. Selected insurers have begun to release such applications⁴. Mobile platforms are increasingly popular and typically include GPS and IMU sensors, and may also be used in combination with adapters to access the OBD interface. For in-vehicle sensing, mobile platforms are generally less reliable than dedicated solutions since they do not have a known and fixed pose relative to the vehicle, suffer from limited power supply, and may be activated and deactivated at the user's discretion. However, they also bring about additional advantages such as the visualization of data, pre-existing data plans from mobile carriers, and very low installation barriers. Thus, they can be seen as somewhat complementary to vehicle-installed IVDRs.

⁴ Paefgen, J., Kehr, F., Zhai, Y., and Michahelles, F. (2012). Driving behavior analysis with smartphones: Insights from a controlled field study. In Proceedings of the Conference on Mobile and Ubiquitous Media, Ulm, Germany. ACM.

1.2 TELEMATICS SERVICES AND PAY-AS-YOU-DRIVE INSURANCE

By integrating the remote vehicle sensing technologies discussed above with their information systems, organizations can provide **TELEMATICS SERVICES** to business partners and end customers. Exhibit 2 provides an overview of possible components and stakeholders of an integrated telematics solution. Next to sensing, i.e., the acquisition of data in vehicles, telematics systems comprise data storage, real-time or batch processing algorithms, as well as specific applications and analytics for the collected data. Rights and roles management, together with a billing system are further important functionalities. Increasingly popular are front-end graphical user interfaces accessible through Web browsers or mobile phones, where data is visualized and accessed interactively. Besides drivers, stakeholders of telematics systems can include automotive manufacturers, toll collection agencies, research institutions, or fleet operators, for instance.

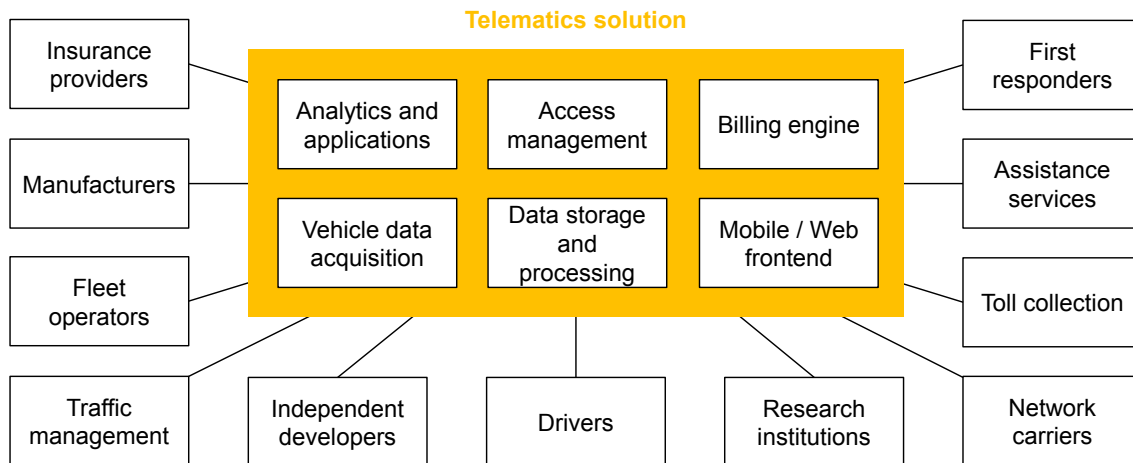


Exhibit 2. Model of a general-purpose telematics solution

In key markets, insurers have begun to introduce telematics services. Examples include automated emergency event notification, accident data recorders, and remote assistance (see Section 3). Conventionally, the majority of these services are **REACTIVE** in nature, i.e., they only come into effect in the rare event of an accident or another, critical situation. As the average annual claim frequency in automobile insurance in Europe lies around six to seven percent⁵, more than ten years have to be expected to pass between such events, during which the installed technology is not used for service provision of any kind. A comparatively recent advance, on the other hand, represent **PROACTIVE** telematics services, where an insurer includes vehicular sensor data in the determination of insurance premiums, or other in informational services provided to drivers on a regular basis.

⁵ Comité Européen des Assurances (2011). European insurance in figures.

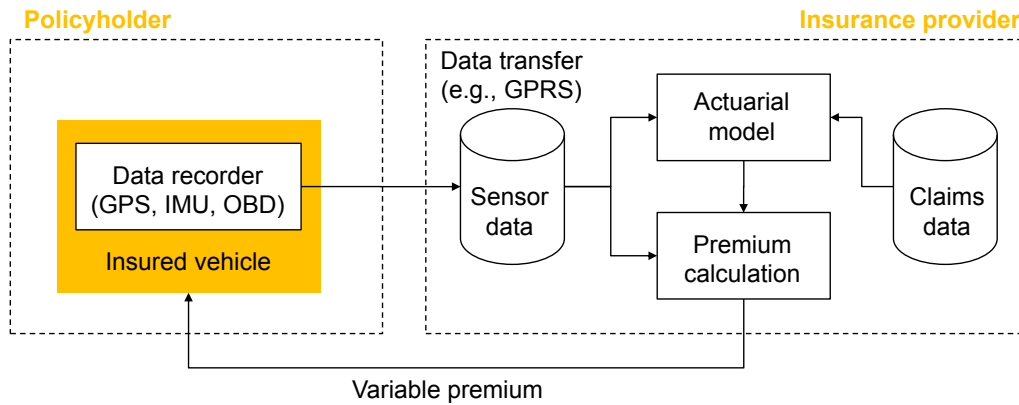


Exhibit 3. System model of Pay-as-you-drive insurance product

A system model of the frequently discussed concept of Pay-as-you-drive (PAYD) automobile insurance that is based on vehicular sensor data is given in Exhibit 3. On the physical level, it discriminates two separate functional units. These are a sensor unit installed on the client side in an insured vehicle, and the insurer's back-end system, which may incorporate components operated by a third-party technology provider. The sensor unit in the vehicle records risk-relevant data and transmits them periodically to a repository, typically over a wireless communication network. By matching long-term records of recorded data with historical data on insurance claims associated with specific vehicles, insurers develop actuarial models that estimate accident risk and expected claims cost for a policy portfolio. Using these estimates, actual premium to be billed to the policy holder can be determined, taking into account further pricing factors such as discounts, rewards, and the competitive tariff structure of a market. This enables insurance tariffs that

- more precisely reflect the actual risk exposure of insured vehicles and
- are adaptive over time, thereby yielding risk-minimizing incentives for policyholders.

In consequence, information asymmetry between insurers and policyholders is reduced, and adverse selection and moral hazard are mitigated⁶. Furthermore, vehicular sensor data may replace other, potentially discriminatory rate factors such as gender or nationality⁷, a recent insurance

⁶ Chiappori, P.-A., Jullien, B., Salanié, B., Salanié, F., and Chiappori, A. P.-A. (2006). Asymmetric information in insurance: General testable implications. *RAND Journal of Economics*, 37(4):783–798.

⁷ Buzzacchi, L. and Valletti, T. M. (2005). Strategic price discrimination in compulsory insurance markets. *The Geneva Risk and Insurance Review*, 30(1):71–97.

regulation issue in many countries. The European Court of Justice, for instance, has ruled unisex tariffs mandatory for all insurance policies underwritten after the year 2012⁸. PAYD insurance has also been associated with macroeconomic benefits such as insurance affordability, higher consumer surplus, and reduced externalities in the literature. By substituting conventional lump-sum premium payments with flexible rates, societal costs arising from individual mobility are more adequately allocated⁹. Last but not least, it promises a significant improvement of traffic safety¹⁰, helping to reduce the more than 1.2 million road traffic fatalities incurred globally each year¹¹.

1.3 SCOPE OF THIS STUDY

PAYD insurance and telematics services in general bring about new opportunities for innovation in the automobile insurance domain. However, in the focus markets of this study – Switzerland, Austria, and Germany – they have failed to find significant adoption in the past. While extensive theoretical treatises on their potential benefits exist, there is little evidence of their concrete value proposition for insurance firms. Decision-makers hesitate to advocate their introduction in the wake of unproven business models, and the undefined role of PAYD insurance within the broader context of telematics services. Against this background, the study at hand pursues two major objectives. Firstly, it analyzes the causes of the limited adoption of telematics services as of today. Secondly, it takes a sober look on the true potential of such services, and how insurers may seize it.

In Section 2, we present microeconomic considerations with regard to the PROFITABILITY specifically of PAYD insurance offerings under various market scenarios. For a special case – a new market entrant with a monopolistic PAYD offering – a business case analysis is presented. In Section 3, we extend the scope of analysis to the broader context of telematics services with relevance to insurance businesses. We suggest that the parallel introduction of PAYD insurance with other telematics services yields additional value for policyholders and cost savings potential for insurers. Existing offers of both PAYD and other insurance services are surveyed in a market study and evaluated through interview research. In Section 4, we develop a conceptual business model template that supports the design and marketing of PAYD insurance in combination with other telematics services. In the final Section 5, specific recommendations for action are provided for insurers considering the introduction of telematics services.

⁸ Temming, F. (2011). ECJ finally paves the way for unisex premiums and benefits in insurance and related financial service contracts. *German Law Journal*, 13(1):105–122.

⁹ Litman, T. (1997). Distance-based vehicle insurance as a traffic demand management strategy. *Transportation Quarterly*, 51(3):119–138.

¹⁰ Bolderdijk, J. W., Knockaert, J., Steg, E. M., and Verhoef, E. T. (2011). Effects of pay-as-you-drive vehicle insurance on young drivers' speed choice: Results of a dutch field experiment. *Accident Analysis & Prevention*, 43(3):1181–6.

¹¹ World Health Organization (2009). *Global status report on road safety*.

2 PROFITABILITY OF PAYD INSURANCE

PAYD insurance is arguably the most vividly discussed class of telematics services in automobile insurance. However, at least as a stand-alone service, one can express strong doubts whether market participants are well-advised to introduce a novel PAYD insurance scheme. This section will provide analytical arguments for this claim, and then demonstrate under which circumstances PAYD insurance may still achieve profitability for an insurance provider.

2.1 ANALYSIS OF COMPETITIVE EQUILIBRIA

We consider equilibria in insurance markets where PAYD insurance products are available parallel to conventional tariffs. A variety of previous work^{12,13,14} has addressed the economics of PAYD insurance. While the complexity of the matter at hand is acknowledged, we use a simplified, aggregated model of an insurance market in order to assess the profitability of PAYD insurance from a supply perspective. Let an automobile insurer have a number of I tariff classes, each of which is characterized by an annual claim frequency α_i denoting the fraction of policies in that tariff class on which a claim is incurred in any given year. Alternatively, α_i may also be described as the mean of probabilities of accident involvement for a year across all policyholders in a tariff class. The average claim cost per tariff class is denoted as c_i and is assumed to include claim adjustment as well as operational expenses. Furthermore, we assume that claim frequencies and costs are independently distributed, and therefore that the expected value of their product is equal to the product of their respective expected values. With n_i policies in each class i , the expected annual claim costs C of an insurer then become

$$C = \sum_i (n_i \alpha_i c_i).$$

For the sake of simplicity, all insurers in the market are assumed to employ equally good ratemaking techniques and thus operate with identical tariff classes. The profit π of an insurer is the difference between the overall sum of written premiums and the expected annual claims cost, plus investment returns on collected premiums that are feasible due to a delay between premium collection and claims expenditures. If these returns amount to a fraction r of premiums, annual profits amount to

¹² Filipova, L., Welzel, P., and Filipova-Neumann, L. (2010). Reducing asymmetric information in insurance markets: Cars with black boxes. *Telematics and Informatics*, 27(4):394–403.

¹³ Hollis, A. and Strauss, J. (2007). Privacy, driving data and automobile insurance: An economic analysis.

¹⁴ Gerpott, T. J. and Berg, S. (2011). Pay-As-You-Drive Angebote von Erstversicherern für Privatkunden. *Zeitschrift für die gesamte Versicherungswissenschaft*, 101(1):3–29.

$$\pi = P - C + r P.$$

Under the assumption of an efficient insurance market, insurers will price policies competitively such that the insurance premium p_i paid in a certain tariff class is equal to the product $\alpha_i c_i$. Then, the sum of written premiums P at equilibrium is equal to the expected annual claims cost, and

$$P - C = \sum_i (n_i p_i) - C = 0.$$

In this situation, an insurer's profits stem solely from investment returns and $\pi = r P$. This result is empirically valid for the automobile insurance markets in most European countries, where combined ratios¹⁵ are close to 100%.

With the introduction of PAYD insurance tariffs by an insurer, a new set of J tariff classes is effectively obtained. For this new set, two changes can be expected:

- The reduction of information asymmetry between insurers and policyholders improves the insurer's ability to DIFFERENTIATE between risks. That means that policyholders that used to belong to the same tariff class i may now belong to new tariff classes j_1, j_2 where they pay different premiums.
- The variable premium structure means that policyholders of PAYD insurance face adaptive tariff classes and thus are provided with an incentive to REDUCE their individual accident risk, e.g., by driving less.

In the following, we will examine the effect of these changes in both short-run and long-run equilibria, where the former focusses on a monopolistic market entrant, while the latter describes a scenario of perfect competition with PAYD insurance tariffs available from a majority of insurance firms.

SHORT-RUN EQUILIBRIUM: MONOPOLISTIC COMPETITION

In a monopolistic scenario, only one insurer in the market for automobile insurance introduces a PAYD offering. The monopoly may be a result of diverging business strategies, technological capabilities, or a strong patent portfolio¹⁶. The corresponding insurer is supposed to have a sufficiently small market share so that its competitors' conventional tariff classes are not affected by the PAYD insurance activities. PAYD insurance policyholders pay a premium p_j that may be

¹⁵ Comité Européen des Assurances (2011). European insurance in figures.

¹⁶ Desyllas, P. and Sako, M. (2012). Profiting from business model innovation: Evidence from Pay-As-You-Drive auto insurance. *Research Policy*, 42(1):101–116.

larger than $(\alpha_j c_j)$ due to the monopoly. If $p_j < p_i$, a PAYD policyholder will pay less in annual premiums and is likely to remain in the PAYD insurance scheme. If $p_j > p_i$, the policyholder will at some point revert to conventional insurance where he was better off. In consequence, the insurer will make losses in his non-PAYD insurance business as only policyholders with higher expected annual claim cost remain in the conventional tariffs. However, he will not be able to increase premiums in these tariffs as this would cause policyholders to switch to competitors that offer premiums p_i at market price. Therefore, the insurer depends on acquiring sufficient low-risk policyholders from competitors for his PAYD offering, so that the PAYD insurance profits compensate for losses in his conventional offerings. If he is able to do so, a short-run equilibrium is reached.

LONG-RUN EQUILIBRIUM: PERFECT COMPETITION

On the long run, however, if his PAYD offering is successful, it will continue to attract low-risk policyholders from competitors. Ultimately, this will cause other insurers to introduce their own PAYD insurance offerings. In the long-run equilibrium, new tariffs for both PAYD and non-PAYD insurance will be established such that the equilibrium conditions laid out above hold again. However, as mentioned above, PAYD insurance customers will to some extent alter their driving habits if it allows them to enter a new tariff class with lower premiums. In the long-run, this behavior will result in lower vehicle mileage and possibly less accidents per mile, which is the main argument of proponents of regulatory support of PAYD insurance¹⁷. If the aggregated annual claims in the insurance market ΣC decrease as a result, so do the aggregated written premiums ΣP at competitive equilibrium. Thus, insurers profits ($r \Sigma P$) will decrease in the long run following the introduction of PAYD insurance.

To subsume, the two scenarios considered above demonstrate that the introduction of PAYD insurance comes with significant uncertainties from the perspective of a single insurance provider, and yields an overall decrease in profits on the long run for the market as a whole. While this brief treatment cannot replace a more thorough analysis of the matter that should explicitly model the utility of policyholders and profit-maximization by insurance providers, it provides an accessible explanation for the limited success that PAYD insurance had had in the market thus far. The next section will therefore disregard the notion of PAYD insurance as an additional offering from established insurance providers, but consider the special case of a new market entrant without an existing portfolio of policyholders instead.

¹⁷ Litman, T. (1997). Distance-based vehicle insurance as a traffic demand management strategy. *Transportation Quarterly*, 51(3):119–138.

2.2 BUSINESS CASE ANALYSIS FOR NEW SWISS MARKET ENTRANT

The business case evaluates the investment value of a new market entrant to the automobile insurance market in Switzerland that only offers PAYD insurance products. All figures are based on a recent statistical report of the European Insurance Association, in which the Swiss Insurance Association is a member organization¹⁸.

The following assumptions are made in the business case:

- The PAYD insurance provider uses the same tariff classes as an established insurer, but offers a premium discount d if a certain level of exposure is not exceeded by a policyholder.
- In doing so, he achieves a lower claim frequency $\alpha^* < \alpha_i$, while the average claim cost c – here considered without claim adjustment expenses – remains constant. In Switzerland, α is typically around 6% for the overall population of vehicles.
- Setting up PAYD system infrastructure requires an initial investment y_0 .
- Installation and briefing costs for a new policyholder amount to y_1 . This figure also comprises provisions to distribution partners, and customer acquisition costs, e.g. advertisement, in general.
- Operation of PAYD infrastructure and data transmission costs y_3 per annum and policyholder. This continuous cost factor includes administration and support for customers.
- As the Swiss insurance association does not publish expense ratios for automobile insurance, the European average of approximately 20% is used, and denoted as η . The expense ratio models all costs associated with a claim, including fees incurred from assistance and repair partner firms.
- Finally, a fraction ρ – the retention rate – of policyholders per year continues their contract, while the remainder switches to alternate insurance providers.

The assumed reduction of claim frequency is an aggregated estimate and stems from diverse selection effects. Primarily, insureds will switch to the PAYD tariff if they are a better off than in a conventional tariff class. However, good risks may opt for PAYD tariffs also because of additional telematics services provided to them, as further discussed in Section 3. In general, there are also grounds for the assumption that safety-conscious drivers are more likely to consent in the installation of monitoring technology in their vehicles.

¹⁸ Comité Européen des Assurances (2011). European insurance in figures.

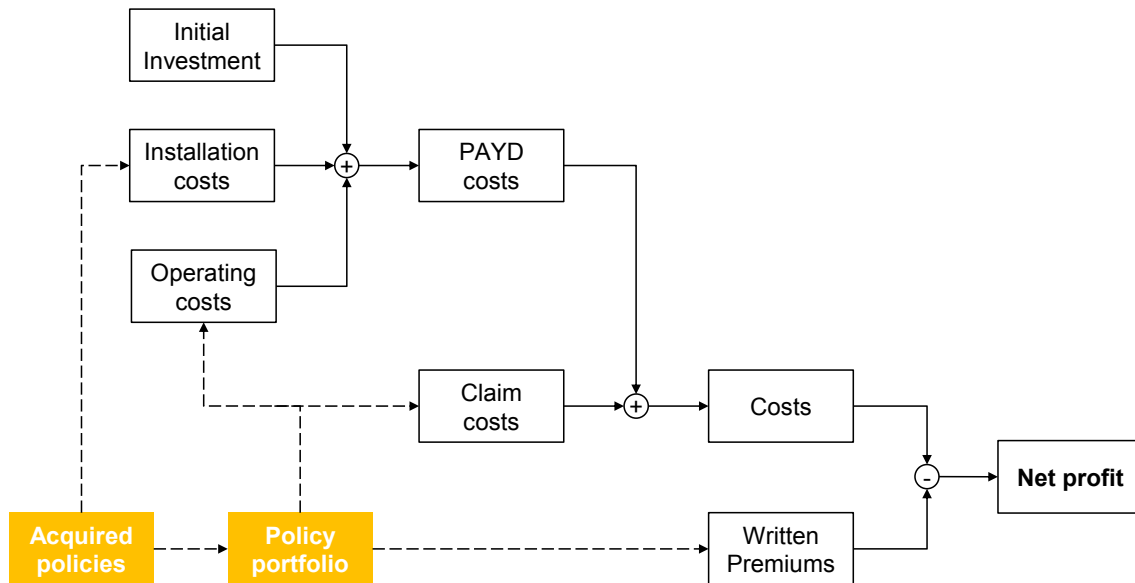


Exhibit 4. Structure of PAYD insurance business case

The structure of the business case is visualized in Exhibit 4. The size of the PAYD insurance policy portfolio is denoted as N , while the number of acquired customers in a given year is denoted as ΔN . In order to estimate written premiums, the rounded average automobile insurance premium in Switzerland, $p = \text{CHF } 600$, is used. Received premiums of the PAYD insurance provider in year k then amount to

$$P_k = N d p.$$

Expenses are calculated based on this figure as (ηP) , so that the overall annual costs in year k are given by

$$C_k = y_1 \Delta N + (\alpha^* c + y_2) N + \eta P.$$

For the average claim cost c , a value of CHF 7,500 is used.

The baseline scenario progresses as follows. After the first year, the market share of the PAYD insurance provider is 0.1%, or around 4,900 policyholders. For the subsequent years, the market share reaches 0.2%, 0.5%, 1.0%, and finally 2.0% after the fifth year. For another 5 years, the market share is assumed constant at 2.0%, so that $\Delta N = (1 - \rho) N$. Parameter values for the baseline scenario are listed in Exhibit 5.

Parameter	Variable	Baseline value
Initial Investment	y_0	CHF 1,000,000
Acquisition and Installation costs	y_1	CHF 100
Operating costs	y_2	CHF 100
PAYD insurance premium discount	d	10%
Average claim frequency	α^*	4%
Customer retention rate	ρ	90%

Exhibit 5. Parameters and baseline values for PAYD business case

Future profits and losses are discounted according to the Net Present Value (NPV) method. Using the previously established equations, the NPV is calculated from annual profits π_k across years $k = (1, 2, 3, \dots, 10)$ as

$$\text{NPV} = y_0 + \sum_k [\pi_k (1 - r)^k] = y_0 + \sum_k [(P_k - C_k) (1 - r)^k]$$

for values of the discount rate r of 10%, 15%, and 20%. Besides the baseline scenario, NPVs are computed for both favorable and unfavorable parameter deviations in order to assess the sensitivity of results with respect to uncertainty in the parameter estimates. For the first four parameters, deviations of +/- 50% are considered. Furthermore, deviations of +/- 1 percentage point of the claim frequency parameter α and +/- 10 percentage points for the retention rate parameter ρ are considered. Exhibit 6 provides the corresponding outputs.

From these results, several insights can be inferred. The baseline scenario NPVs demonstrate that profitability is achieved with reasonable parameter choices. This result is not significantly affected by changes in the initial investment, which allows for some uncertainty regarding the cost of system implementation and testing. A moderate effect is observed upon changes of the installation cost parameter y_1 . While future advancements in miniaturization and design may further decrease technology costs, this result shows that prices of on-board units are within acceptable range already today.

The largest impact on NPV is observed for the annual operating cost parameter y_2 . This emphasizes the importance of low-cost data acquisition methods and devices for the success of PAYD insurance. Surprisingly, the hypothetical PAYD insurance provider can offer substantial discounts without jeopardizing profitability. This facilitates the acquisition of new customers from conventional insurance tariffs. The same holds for deviations of the baseline customer retention rate. The average claims rate is the second most influential parameter in the business case. If the

PAYD insurance claims rate is only one percentage point lower than the conventional claim rate of around 6% – i.e., PAYD policyholders are 17% less likely to have an accident – the resulting NPVs are negative. A market entrant with a PAYD insurance offering should be able to achieve a claim rate reduction of around 25% for his portfolio compared to a conventional insurer in order to be successful.

Scenario	Net Present Value in CHF		
	r = 10%	r = 15%	r = 20%
Baseline	21,066,337	6,001,464	3,358,312
$y_0 = 500,000$	21,566,337	6,501,464	3,858,312
$y_0 = 200,000$	20,066,337	5,001,464	2,358,312
$y_1 = 50$	26,983,380	9,705,951	6,178,802
$y_1 = 200$	9,232,250	(1,407,511)	(2,282,669)
$y_2 = 50$	48,405,387	17,622,785	11,422,258
$y_2 = 200$	(33,611,765)	(17,241,178)	(12,769,580)
$d = 5\%$	25,987,366	8,093,302	4,809,822
$d = 20\%$	11,224,278	1,817,788	455,291
$\alpha^* = 3\%$	57,974,055	21,690,247	14,244,639
$\alpha^* = 5\%$	(15,841,382)	(9,687,320)	(7,528,015)
$\rho = 100\%$	26,490,047	8,284,078	4,931,901
$\rho = 80\%$	15,642,626	3,718,850	1,784,723

Exhibit 6. Sensitivity analysis of business case NPV

The presented business case analysis comes with various caveats. Particularly the cost assumptions require a validation that lies beyond the scope of this study. Moreover, they are subject to variations over time due to technological development, and depend on the scale of operation as well as on the particular cost structure of an insurer. Another important limitation is the capital cost of risk reserves. Liability automobile insurance policies in Switzerland are required by law to cover up to CHF 100,000,000 per case, with certain solvency requirements imposed. These provisions are very costly for a new market entrant who essentially operates on venture capital, and it is not clear to which extent they can be reinsured. However, results do reflect the essential dynamics that dominate the obtain NPVs, and can form the starting point of a more thorough treatment by practitioners interested in the matter.

3 UNDERSTANDING INSURANCE TELEMATICS SERVICES

So far, the analysis of the business implications of PAYD insurance has remained limited in scope. In assessing market dynamics and profitability, PAYD insurance was considered as a stand-alone service. This approach may be questioned from the perspective of both insurers and customers. If an insurer decides to invest in IVDRs, IT infrastructure, and data transmission contracts, a broad range of services becomes feasible at very low marginal cost. Furthermore, as a stand-alone service, the added value that PAYD insurance brings for policyholders lies solely in premium reductions. A broad service bundle, however, may change this perception and yield additional revenue sources and higher customer satisfaction.

Therefore, this section will investigate related services based on in-vehicle sensing technology, and their value proposition for insurance businesses. At first, a classification scheme for such services is introduced. Thereafter a market study reviews existing implementations of these services by insurers with respect to design, bundling, and marketing. The market study is complemented by interviews conducted with insurance providers in order to determine drivers and barriers associated with the discussed services.

3.1 CLASSIFICATION OF INSURANCE TELEMATICS SERVICES

In the following, we propose a taxonomy to distinguish services based on (1) functionality as perceived by an insurance customer, and (2) significant differences in technological requirements for their implementation. A separate definition of PAYD insurance as a service is omitted, as the concept is thoroughly explained in the introduction of this paper.

EMERGENCY EVENT NOTIFICATION

In the case of a severe vehicle accident, driver and passengers may not be able to notify emergency services. Accelerometers can be employed to detect impact forces of a vehicle crash, a method which is commonly employed for airbag triggering. If such an event is triggered by the crossing of some threshold, a message is dispatched. From a satellite positioning sensor, the message contains location information of the incident site which allows emergency services to react even faster. Especially during night time and on rural roads, where a significant amount of accident happen, this reduces first response times and can save lives. Among regulatory bodies of the European Commission, this concept has found strong supporters, so that it has been proposed to become a mandatory vehicle technology under the label e-Call. From an insurance business perspective, while such offerings may indirectly reduce insurance claims as first aid arrives sooner, they more prominently position insurers as providers of personal safety and increase customer retention rates.

REMOTE ASSISTANCE

An extension of the concept of emergency event notification is remote assistance and claim management. Remote assistance comprises services that support insurance customers in the case of a break down or accident, triggered automatically or manually by the driver. Satellite positioning helps these services not only to find the incident site faster, but also to give the customer an estimated time of arrival of tow trucks et cetera. Through early intervention, insurers can also reduce liability costs, e.g., by directing the claim into a service partner's facility. Furthermore, it has been pointed out that automated claim management holds significant potential to reduce process costs by avoiding media breaks between written forms and insurers' IT systems¹⁹.

ACCIDENT DATA RECORDING

In another service concept, telematics technology not only transmits occurrence and position of an accident, but instead records detailed sensor data on the events preceding an accident situation. This concept follows the idea of a BLACK BOX as used in aviation to facilitate accident analysis and prevention. In the automotive context, such solutions are commonly referred to as event data recorders (EDR). EDR continuously store IMU data – possibly augmented by position and OBD data – within a moving time window of between 30 seconds to several minutes duration. When an accident event is detected, recording is stopped and the most recent data can be extracted. The main advantage of EDR is that they allow for an ex-post reconstruction of accident circumstances, and in particular an assessment of the liability of involved parties. Using EDR, insurance providers can more easily resolve disputes regarding claims. Insurance fraud is also mitigated, as damages to vehicles can be precisely matched with preceding maneuvers and parameters such as collision angle and velocity. Furthermore, there is evidence that already the mere presence of an EDR in a vehicle reduces accident risk. This observation can be attributed to the risk-averse drivers that consent to the installation of EDR, as well as to changes in driving behavior resulting from the perceived surveillance. Consequently, insurance offerings exist that grant premium discounts conditional on EDR installation in an insured vehicle. The relevance of EDR data in understanding accident antecedents has recently motivated legislative initiatives in the United States aimed at making EDR mandatory vehicle equipment²⁰.

STOLEN VEHICLE TRACKING

Due to the broad availability of wireless data networks internationally, radio-enabled IVDR can also be employed to track unauthorized vehicle use based on position information. If unauthorized use, e.g., theft, is reported, service providers can locate the vehicle and, depending on the jurisdiction, even shut down core vehicle functions. Particularly in regions where vehicle theft is

¹⁹ Baecker, O., Ippisch, T., Michahelles, F., Roth, S., and Fleisch, E. (2009). Mobile claims assistance. In Proceedings of the 8th International Conference on Mobile and Ubiquitous Multimedia, pages 1–9, Cambridge, UK. ACM.

²⁰ Askland, A. (2006). The double edged sword that is the EDR. Berkeley Electronic Press Legal Series, 1255.

common, and for high-valued vehicles, tracking has proven to significantly reduce claims and acts as a deterrent.

PAY-HOW-YOU-DRIVE

An extension of the exposure-based pricing concept of PAYD insurance is to take into account individual driving style. This requires sensor data from which low-level vehicle control patterns can be inferred. IMU data is employed to analyze acceleration and deceleration behavior, excessive velocities in turns, vehicle slip, and other features. From position information, speed violations can be identified, and – given sufficiently high resolution and accuracy – acceleration patterns can be assessed as well. Several studies claim that safe driving as determined through such measurements also correlates with fuel efficiency²¹. This would allow insurance policies that specifically reward ecological driving and target environmentally conscious customer segments²². In the perception of customers, the assessment of driving behavior based on data collected in vehicles is significantly more privacy-intrusive than exposure-based tariffs²³. Furthermore, besides some existing studies on the subject, the degree to which such driving behavior metrics allow for an objective rating of accident risk still appears questionable. If measurements are affected by uncontrolled factors such as weather, traffic, or vehicle suspension, inadequate pricing and discrimination of certain groups of drivers have to be expected.

DRIVER FEEDBACK AND REWARDS

Information regarding driving behavior and, indirectly, accident risk can also be used to provide drivers with an evaluation of their performance. This is commonly referred to as a **FEEDBACK INTERVENTION** in the behavioral science literature. Feedback interventions may include, but are not limited to the communication of variable premium levels. They focus on motivations, intentions, and habits of individuals, and are based on some reference scale of driving behavior. Drivers are provided with feedback via applications that present qualitative driving style evaluations as well as quantitative scores. These services aim primarily not at a punishment of undesired behavior, but rather on giving customers non-monetary incentives to change their habits, thereby building trust and improving customer loyalty. These measures can also include social comparisons or the publishing of such information on social media websites. As with Pay-how-you-drive tariffs, feedback to drivers may also emphasize economical driving and provide customers with an opportunity to save fuel costs while being beneficial to the environment. These arguments are additional levers to motivate a change in driving behavior.

²¹ af Wahlberg, A. (2007). Long-term effects of training in economical driving: Fuel consumption, accidents, driver acceleration behavior and technical feedback. *International Journal of Industrial Ergonomics*, 37(4):333–343.

²² Bodderas, M. (2011). *Essays on Service Management*. Dissertation, University of St. Gallen.

²³ Mayer, P. (2012). *Empirical Investigations on User Perception and the Effectiveness of Persuasive Technologies*. Dissertation, University of St. Gallen.

3.2 SURVEY OF OFFERINGS IN KEY INSURANCE MARKETS

To determine the prevalence of the different services discussed in the previous section, a research group at the University of St. Gallen conducted a market study from 2011 to 2012 across key insurance markets. The following markets and insurance offerings were taken into account, in alphabetical order:

- Austria: SAFELINE (Uniqua)
- Belgium: LA G-BOX (Axa), IDEAL AUTO JR. (P&V), S² SAFE AND SAVE (Vivium)
- Germany: MEINCOPILOT (Provinzial), SV COPILOT (Sparkassenversicherung)
- United Kingdom: GREEN WHEELS (more th>n), COVERBOX (offered by Allianz, The Co-operative, Groupama, Markerstudy Group, Sabre, Equity, and Red Star), INSURETHEBOX (offered by the company of the same name), PAY HOW YOU DRIVE (Acorn Insurance Group)
- Italy: UNIBOX TOP, UNIBOX FULL, UNIBOX EASY, UNIBOX MOTO (all Unipol Assicurazioni), GENERALI SEI IN AUTO GPS (Generali), OTTO SAT (INA Assitalia), LINEARSAT (Linear Assicurazioni), FULL ROYAL BOX (Reale Mutua), PROTEZIONE AUTOGIOV@NI, AUTOMETRICA (both Axa), SESTOSENDO (Allianz Lloyd Adriatico)
- South Africa: MIDRIVE-STYLE (MiWay), PAY AS YOU DRIVE! (Hollard)
- France: LA G-BOX (Axa), PAY AS YOU DRIVE (Amaguiz), EASY DRIVE (Solly Azar)
- Switzerland: CRASH RECORDER (Allianz Suisse), CRASH RECORDER (Axa), HELPBOX (Allianz Suisse)
- United States: TEEN GPS PROGRAM (21st Century Insurance), TEEN SAFE DRIVER PROGRAM (Amfam), TEENSURANCE (Safeco), LOW-MILEAGE DISCOUNT (GMAC Insurance), SNAPSHOT (Progressive), DRIVE SAFE & SAVE (State Farm), UDRIVE (AAA Auto Insurance)

At first, a quantitative analysis of service combinations, i.e., bundles, was conducted. For each insurance offering, the inclusion of a specific service was registered through a binary indicator variable. Then, correlations between these variables were computed using the ϕ -4-point correlation formula²⁴ to determine which service combinations are the most likely. Significance of correlations was derived using the χ^2 test on two-by-two contingency tables of pairwise case combinations. Results are provided in Exhibit 7.

²⁴ Davenport, E. and El-Sanhury, N. (1991). Phi/phi-max: Review and synthesis. Educational and Psychological Measurement, 51:821–828.

	Pay-as-you-drive	Emergency notification	Remote assistance	Pay-how-you-drive	Feedback and rewards	Stolen vehicle tracking
Emergency notification	0.121					
Remote assistance	0.279	0.721***				
Pay-how-you-drive	- 0.166	- 0.101	0.072			
Feedback and rewards	- 0.099	- 0.343**	- 0.257*	0.306*		
Stolen vehicle tracking	- 0.016	0.604***	0.488***	- 0.197	- 0.288	
Accident data recorder	- 0.165	0.004	0.134	- 0.016	- 0.206	- 0.064

Exhibit 7. Correlations in insurance telematics service bundles (Sig. * <0.1 , ** <0.05 , * <0.01)**

The strongest correlations were observed for the three-tuple of emergency notification, remote assistance, and stolen vehicle tracking. All these services require a GPS sensor and wireless connectivity. However, since data is only transmitted in exceptional situations, they can be provided without costly long-term data subscriptions. Emergency notification, Pay-how-you-drive, as well as feedback and reward schemes were another coinciding three-tuple, albeit with lesser significance. This second bundle emphasizes driving safety, and is concerned with improving driving behavior and providing support in emergencies. The remaining two services, PAYD insurance and accident data recorders, appear to be more independently offered by insurers. A second part of the market analysis identified qualitative characteristics of individual insurance markets with broad adoption of telematics services.

ITALY

In volume, Italy is by far the largest market for telematics-based insurance services, with more than 1 million subscriptions in total. This leading role may be attributed to the high automobile insurance claim costs in Italy in general, and to comparatively high levels of both insurance fraud and vehicle theft in particular²⁵. Therefore, potential premium reductions achievable through preventive telematics services are substantial. Furthermore, with on-board units and back-end systems in place, additional services that leverage existing infrastructure such as PAYD insurance can be realized at significantly lower costs. The expected competitive dynamics of PAYD insurance outlined in Section 2 thus do not fully apply to Italy, where the pervasiveness of preventive telematics services lowered entry barriers.

²⁵ Comité Européen des Assurances (2011). European insurance in figures.

UNITED KINGDOM

The United Kingdom, a competitive automobile insurance market with low margins and strong direct distribution channels exhibits different characteristics. Established market players have been reluctant to introduce telematics services. Pioneering insurer Norwich Union discontinued its PAYD insurance pilot program in 2009. Recently, INSURETHEBOX – a new market entrant without a portfolio of conventional policies – has seen continued growth with an innovative offering that combines a broad range of telematics services. With an INSURETHEBOX policy, drivers purchase a vehicle mileage allowance similar to a prepaid mobile contract. By improving their driving behavior, policyholders can earn additional miles – an optional feature, as drivers are not punished for risky behavior in any way. In addition, INSURETHEBOX rewards its customers with additional mileage if they use the shopping Websites of associated partners. This product has found 100,000 customers within two years of operation. The advertised value proposition of INSURETHEBOX is an average premium discount of GBP 574 p.a. in comparison to conventional insurance tariffs.

UNITED STATES

In the United States – the world's largest insurance market – a majority of telematics offerings focus on driving behavior, i.e., behavior-based pricing and feedback schemes. This observation may be due to the large number of teen drivers in the United States, where a driving license can be obtained already at age sixteen, contrary to most European countries. The supervision of young drivers is often marketed towards their parents, who have an interest in increasing the safety of their offspring. Reducing the high insurance premiums that are also often borne by parents constitutes an additional motivating factor. The United States have also taken on a pioneering role with respect to telematics systems that are built into vehicles through the manufacturer ex works. For instance, because it uses the OnStar telematics system from GM, the GMAC Insurance Low-Mileage Discount does not require the installation of any in-vehicle technology through the insurer or a service provider.

SOUTH AFRICA

The South African market exhibits characteristics that are similar to Italy and thus has also seen broader adoption of telematics services. In the remaining countries considered in the market survey, namely Austria, Belgium, France, Germany, and Switzerland, their adoption remains limited to niche products and pilots.

3.3 INTERVIEW STUDY IN AUSTRIA, GERMANY AND SWITZERLAND

To further investigate the opportunities and challenges that come with telematics services in the insurance business, an in-depth interview study was conducted with thirteen insurance professionals in the focus markets of Austria, Germany, and Switzerland. Interviews were based on an unstructured questionnaire. Interviewees were affiliated with Allianz (Germany), Allianz Suisse (Switzerland), Allianz Österreich (Austria), Axa Winterthur (Switzerland), HUK Coburg (Germany), Mobiliar (Switzerland), ÖRAG (Germany), and Uniqua (Austria). The questionnaire was divided into three sections: assessment of telematics-based insurance services, general telematics questions, and prognosis. The overall objective of the interview study was to identify a set of specific drivers that facilitate, and barriers that protract the adoption of telematics services. Initial questions asked for a definition of the term INSURANCE TELEMATICS, as well as for current activities in that direction within the interviewee's company. Next, interviewees were introduced to the taxonomy developed in the previous section. For each of the seven service categories, interviewees were requested to give an assessment based on their individual background. The questionnaire inquired in particular

- levers through which insurance telematics services can improve an insurer's combined ratio performance,
- customer segments that are particularly suitable for such offerings,
- opportunities to achieve a differentiated market position through insurance telematics, and
- critical attributes of telematics services that determine their acceptance by customers.

Lastly, interviewees were asked for a prognosis with respect to the future role of telematics services in their company, and the insurance market as a whole.

We summarize the main results from the interview study as follows. Expected claim reduction is a dominant innovation driver across services, while privacy concerns and low trust in insurers are the dominant barriers. Insurers also have significant cost concerns with respect to more advanced telematics services, while the proven technology of established services is seen as supportive in their introduction. Doubts with respect to technological capabilities are also evident from the frequently mentioned fear of malfunctions and manipulation. The most challenging barrier, however, may be internal firm boundaries. Enabling employees and agents to actively promote telematics offerings towards customers poses a significant challenge for insurance management. A conclusive overview of drivers and barriers is provided in Exhibit 8. An in-depth evaluation of the interviewees' responses provided us with a broad range of insights with respect to how insurers can create value through telematics services. Based on these insights, the next section develops a business model template which insurers can utilize to build telematics offerings.

	Emergency notification	Remote assistance	Acc. data recorder	Stolen vehicle tracking	PAYD	PHYD	Feedback
Drivers							
Proven technology	■		■	■			
Claim reduction		■	■	■	■	■	■
Fraud detection				■			
Market pull	■			■			
Increased interaction		■			■	■	■
Regulation	■						
Barriers							
Malfunctions	■	■		■			
Privacy and trust		■	■	■	■	■	■
Costs					■	■	■
Manipulation				■	■	■	
Distribution and volume		■		■	■		
Existing competition	■	■					■

Exhibit 8. Overview of innovation drivers and barriers for insurance telematics

4 TELEMATICS BUSINESS MODELS FOR AUTOMOBILE INSURANCE PROVIDERS

Section 3 has revealed that service bundles catering to a broad spectrum of customer needs are the norm in existing offerings, and allow for substantial synergies with respect to technology costs. Yet, insurers face the challenge of mitigating the associated complexity and designing consistent BUSINESS MODELS based on such bundles. The objective of this section is therefore to provide insurers with a decision support tool in the form of a business model template. By combining generic building blocks from this template, they can generate, assess, and implement new offerings.

4.1 BUSINESS MODEL TEMPLATE

The proposed business model template is based on the well-known MARKETING MIX business tool that differentiates between the 4 Ps of product, price, promotion and place. It is extended by three further domains: profit, platform, and partner. An overview of the template is provided in Exhibit 9. In the following, its individual domains are discussed in detail.

Product	Emergency notification	Remote assistance	Accident data recording	Stolen vehicle tracking
	PAYD	PHYD	Feedback / Rewards	
Price	Free-of-charge	Activation fee	Fixed-rate subscription	Variable rate subscription
Promotion	Novice / young driver	Low-mileage	Safety-concerned	Environmentally-conscious
	Budget	High-value		
Place	Direct / on-line distribution	Agent or broker	3rd party	
Performance	Acquisition	Added value	Retention	
Platform	On-board unit	Vehicle-embedded	Smartphone	
Partner	Various			

Exhibit 9. Insurance telematics business model template

PRODUCT

This domain refers to the actual service bundle to be implemented in an insurer's telematics offering. As the previous sections have shown, each service comes with specific innovation drivers and barriers, and certain bundles are empirically more common than others. The service combination determines the technological requirements and influences design decisions in all other domains of the template.

PRICE

The second domain in the template is the mode of payment for a telematics offering. It determines to a significant degree how the costs of an offering are perceived by potential customers. The template differentiates between free-of-charge service provision, one-time payment upon service activation, and continuing subscriptions with both fixed and variable – e.g., usage based – subscription fees.

PROMOTION

The promotion domain describes various target customers for a telematics offering. It largely determines the branding and communication of a service. Possible target groups are novice or young drivers; low-mileage, safety-concerned, or environmentally-conscious drivers; and budget or high-value insurance customers. They differ in their propensity to pay for a service and their risk classification.

PLACE

This domain determines the preferred distribution channel. Telematics services are complex products that may exceed the expertise of sales staff that are trained to explain insurance tariffs to customers. Unless included in conventional incentive systems such as commission schemes, motivation for driving sales is presumably low. In on-line distribution channels, on the other hand, convincing product presentations and instructional materials are required. Lastly, insurers may also opt to use additional distribution channels such as automobile clubs or manufacturers, which may be in a more suitable situation to propose telematics service offerings to customers.

PERFORMANCE

Particular consideration should be bestowed to the financial performance expected from a telematics offering. Three performance dimensions can be distinguished: the acquisition of new customers, the generation of additional value from current customers, and their retention, i.e. the prolongation of the business relationship with a customer. Acquisition of new customers may be facilitated by discounts and a unique, innovative position in an insurance market. Added value on the other hand can be generated from the services themselves, risk selection effects, or a long-term reduction of operational costs, e.g. for the case of remote assistance. Customer retention is increased by the installation of hardware in vehicles, accounts of bonus points or prepaid mileage,

and a general intensification of interaction with customers. Exhibit 10 schematically depicts how telematics services create new interaction opportunities with customers outside of the conventional insurance value chain.

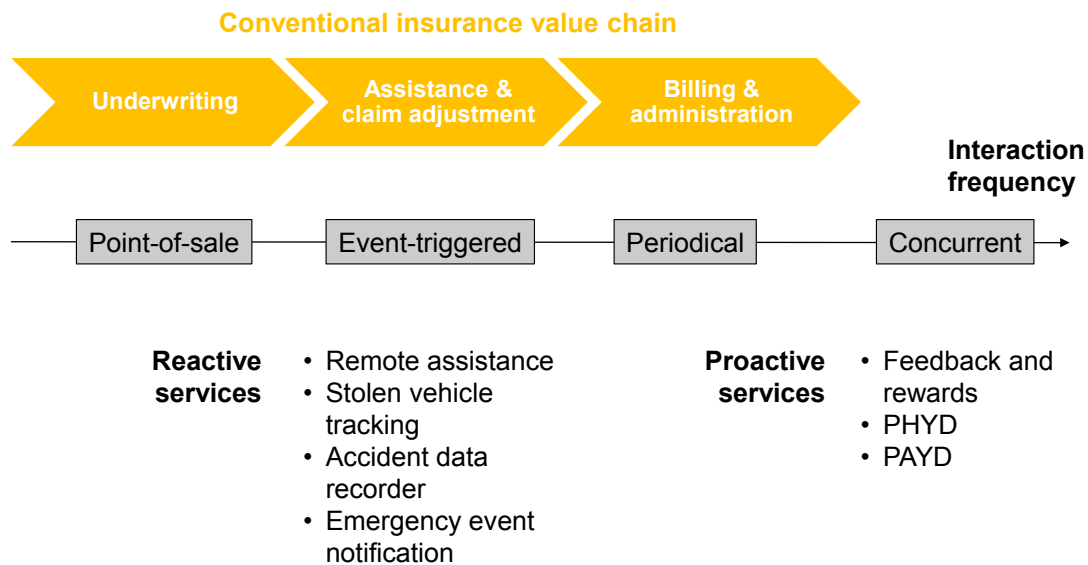


Exhibit 10. Interaction opportunities enabled by telematics services

PLATFORM

While all telematics services are based on a sensor platform in the vehicle, different technological options for their realization exist. Frequently discussed and in use by a majority of insurance telematics providers today are on-board unit solutions that require the installation of a dedicated device in vehicles. Such technology may also be embedded in vehicle electronics ex works, in collaboration between insurers and manufacturers. Alternatively, Smartphone-based solutions are also feasible, though limited in reliability and data quality.

PARTNER

The last domain of the business model template is the partner network of an insurer. The described services deliver data that is of interest to potential partners that may contribute financially, through specific competences, or by increasing the customer base. Furthermore, partner networks can deliver a broad spectrum of non-insurance-related telematics services to customers. Such a shared effort would bring additional synergies in terms of technology costs and increase the attractiveness of a telematics service bundle to the customer. Such service ECOSYSTEMS follow similar patterns in Web and mobile service provisioning. However, insurers must consider that conflicts of interests may arise with other stakeholders that jeopardize their business models. Automobile manufacturers, for instance, also have a strong interest in delivering remote assistance services to

vehicles as repair and maintenance are highly profitable activities to them, which may in turn result in higher claim costs to insurers.

4.2 EXEMPLARY BUSINESS MODELS IN OPERATION

To demonstrate instantiations of the presented business model template, two exemplary insurance telematics offerings are contrasted. These are the HELPBOX product of ALLIANZ SUISSE, and INSURETHEBOX from the United Kingdom. The two offerings are on somewhat opposed ends of the spectrum, and reflect the competitive situation and customer preferences in the respective markets. The HELPBOX is a conservative telematics solution that implements emergency notification as a stand-alone service. It is priced as a premium service, with CHF 100 installation cost and CHF 180 in annual subscription fees, with a minimum contract of three years. Consequently, it addresses the needs of safety-concerned, solvent vehicle owners. It is primarily distributed over agent or broker networks, in accordance with the preferences of Swiss insurance customers. The performance type is mostly added value, as Allianz Suisse can be expected to earn a high margin off service subscriptions. However, retention effects may also play a role, and the HELPBOX sales are supported by discounts on automobile insurance premiums. The HELPBOX is an on-board unit solution that is installed in the vehicle. Besides assistance service providers, no other partner companies are involved.

Product	Emergency notification	Remote assistance	Accident data recording	Stolen vehicle tracking
	PAYD	PHYD	Feedback / Rewards	
Price	Free-of-charge	Activation fee	Fixed-rate subscription	Variable rate subscription
Promotion	Novice / young driver	Low-mileage	Safety-concerned	Environmentally-conscious
	Budget	High-value		
Place	Direct / on-line distribution	Agent or broker	3rd party	
Performance	Acquisition	Added value	Retention	
Platform	On-board unit	Vehicle-embedded	Smartphone	
Partner	Assistance service provider			



Exhibit 11. Highlighted blocks represent the business model of the HELPBOX (Allianz Suisse)

INSURETHEBOX, on the other hand, is a very innovative solution that implements a broad range of services. Policyholders purchase miles for their account similar to prepaid mobile phone contracts. Furthermore, bonus miles are awarded for safe driving. In addition to these PAYD insurance and behavior feedback-type services, emergency notification and vehicle tracking functionalities are also provided. INSURETHEBOX is clearly positioned as a cost-saving option for novice and low-mileage drivers, and is distributed solely via on-line channels as the company is a new market entrant without a sales agent network. Currently, the performance criterion is primarily growth, i.e., customer acquisition. The technology platform is also an on-board unit, albeit of presumably higher technical complexity than the HELPBOX variant. Besides for safe driving, INSURETHEBOX also rewards bonus miles for on-line shopping with certain vendors and is set to establish a broad partner network.

Product	Emergency notification	Remote assistance	Accident data recording	Stolen vehicle tracking
	PAYD	PHYD	Feedback / Rewards	
Price	Free-of-charge	Activation fee	Fixed-rate subscription	Variable rate subscription
Promotion	Novice / young driver	Low-mileage	Safety-concerned	Environmentally-conscious
	Budget	High-value		
Place	Direct / on-line distribution	Agent or broker	3rd party	
Performance	Acquisition	Added value	Retention	
Platform	On-board unit	Vehicle-embedded	Smartphone	
Partner	Assistance service provider	Technology supplier	Shopping websites	



Exhibit 12. Highlighted blocks represent the business model of INSURETHEBOX

5 RECOMMENDATIONS FOR ACTION

To conclude this paper, we provide a set of specific guidelines that insurers can follow in the introduction of a telematics-based offering.

REWARD INSTEAD OF PUNISH POLICYHOLDERS

Exposure-based insurance tariffs are inherently fair – but they raise concerns among consumers that they may end up worse off. It is difficult to communicate to a policyholder that he is a high-risk driver without triggering emotional reactions. Instead, insurers should aim at supporting their customers in becoming safe and ecological drivers, and emphasize improvements through both communication and financial rewards.

RESPECT POLICYHOLDERS' PRIVACY

Privacy concerns can jeopardize any remote sensing application – customers want to decide which data they share and which not. And they need to be assured that such agreements are met. Insurers should avoid so-called BLACK BOXES and instead proactively address privacy issues, explaining the used technology and making the acquired data transparent. One option is to omit positioning data entirely and instead use less privacy-intrusive sensing options.

COMBINE MULTIPLE TELEMATICS SERVICES

A bundling of the services discussed in this Whitepaper is advantageous for many reasons, prominent ones being cost effectiveness and more convincing sales pitches. Additional, non-insurance services such as driving efficiency training may be included as well. If in doubt with respect to specific services, they can be made optional. Delivering tangible customer value is essential – see the business model template above.

DEFINE CONSISTENT TARGET SEGMENTS

PAYD insurance and telematics services in general are not one-size-fits all. Age, vehicle usage, driving style, income, and other parameters – many of which are also used in pricing – can be used to differentiate customer segments and address them individually. As with all insurance products, distribution channels and incentives have a significant impact on the resulting policy portfolio.

BENEFIT FROM LOCK-IN EFFECTS

Technology installed in a vehicle strengthens customer loyalty. Even if a change of vendor comes at no additional cost to insurants, the hassle of removing telematics equipment forms a barrier. If customers accumulate data over longer periods from which they gain specific advantages or statuses, this mechanism is reinforced.

KEEP TRACK OF TECHNOLOGY INNOVATIONS

Automotive technologies, and particularly telematics, are far from being static. Technological capabilities improve fast, while costs decline. In the long term perspective, there is little doubt that vehicle connectivity will become very affordable and thus ubiquitous. However, present limitations and the costs of overcoming them should be well-understood. Insurers should closely monitor telematics activities in their markets and abroad. If successful novel products emerge, they should not hesitate to copy them, but give consideration to intellectual property rights.

LEVERAGE MOBILE PLATFORMS

Phones and other mobile devices are low-cost sensing solutions that offer a high degree of connectivity. Furthermore, they allow for ubiquitous interaction with customers. Mobile applications can complement in-vehicle installations and offer an additional channel for accessing information. However, as a stand-alone solution for the implementation of adaptive insurance premiums, they are neither very reliable nor auditable.

PIGGYBACK INDUSTRIALIZATION ON SERVICES THE MARKET WANTS

On the long term, telematics infrastructure that is well-integrated with an insurer's information system reduces paperwork and streamlines claim management and assistance processes. However, this should never be the primary motivation behind the launch of a service. Rather, services for which customer demand is evident should be implemented with process efficiency gains in mind.

DEFINE AND MAINTAIN A POSITION TOWARDS MANUFACTURERS

Automotive manufacturers, in collaboration with their financial services captives, will build upon their technological competencies in extending their value chain towards telematics services. In many ways, they may profit from competitive advantages over insurance providers in this attempt. Whether they use ex works telematics systems or aftermarket solutions, insurers should develop a strong position and identify potential conflicts of interest.

BUILD PARTNER ALLIANCES

Finally, in bringing PAYD insurance and other services to the market, insurers should seek alliances with complementary partners. The United Kingdom-based firm INSURETHEBOX demonstrates how such alliances with technology providers and retail businesses can create mutual value. As other telematics services outside of the insurance domain reach marketability, they may jump on the bandwagon and yield a contribution margin for shared infrastructure. Fleet management in collaboration with business customers, car sharing or rental agencies may offer additional momentum to the proliferation of telematics services.

ABOUT THE I-LAB

The I-Lab is a joint initiative of the University of St. Gallen and ETH Zurich. We explore design and technology-based innovation in the insurance sector. In close cooperation with partners in the insurance industry we develop new business ideas and business models, built demonstrators as well as prototypes and test their acceptance by the customer.

THE AUTHORS

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JONAS BEST and LUKAS EGLI participated in this study in the course of their B.A. theses in business administration at the University of St. Gallen.

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