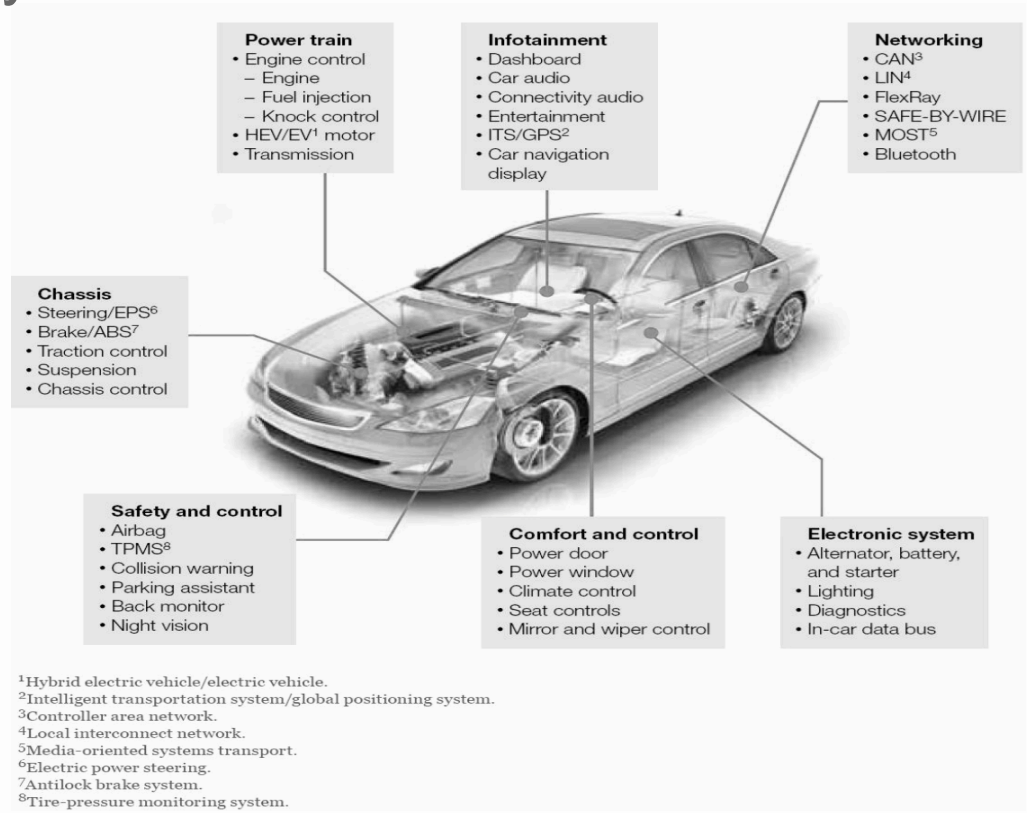
Study of Cockpit management system
Refer to Automotive 2025 consumer edition

Yoshifumi Sakamoto
IBM Japan.

Industrial Services, Global Business Services, IBM Japan, Ltd

200+ MPUs used in a Luxury model

- Disperse development environment
- Challenging just-in-time supply chain management
- Limited to no performance scalability over car lifetime
- Limited re-usability between car models



[1]Hybrid electric vehicle/electric vehicle.
[2]Intelligent transportation system/global positioning system.
[3]Controller area network.
[4]Local interconnect network.
[5]Media-oriented systems transport.
[6]Electric power steering.
[7]Antilock brake system.
[8]Tire-pressure monitoring system.

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Near future : Self–driving car era

Vehicle centric control MPUs will be GOVERNED by the

“Self-driving control unit”.

and

Non-vehicle centric control MPUs will be INTEGRATED into

“Cockpit management unit”.

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Role-Sharing

Keeping safe

To assure physical safety.

Self-driving control

In-car network

- Power Train
- Steering/EPS
- Brake/ABS
- Lighting
- Traction control
- Optical Camera/Lidar
- Suspension
- Diagnostics
- Chassis control
- Airbag

High speed In-Car network

Feeling safe

To provide a feeling of emotional safety.

Cockpit management

- Entertainment
- Navigation
- Dashboard
- Car audio
- Mirror and wiper
- Connectivity audio
- Night vision
- Mirror and wiper
- Seat Controls

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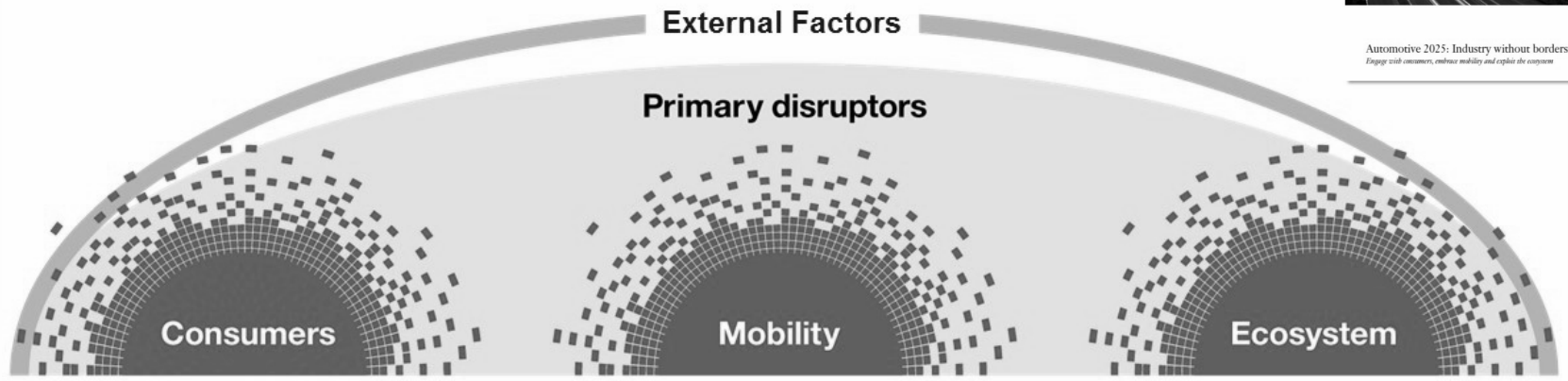
A new relationship – people and cars

How consumers around the world want cars to fit their lives

The *Automotive 2025: Industry without borders* study suggested three disruptors to the industry over the next 10 years



- 62% felt consumers would be expecting **new ownership models**
- 73% of OEMs said that consumers would be involved in **co-creation of mobility services**

- 80% said comprehensive **connected vehicle services** will be a key differentiator
- 75% said **non-traditional industry participants** will have a key role in the consumer-driven mobility ecosystem

- 71% of Industry executives feel there will be significant **disruption in retail channels**
- 54% agree that consumers will want to **buy cars directly thru the internet**

Source: Automotive 2025: industries without borders

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Setting the stage: Consumers were asked about their expectations of how they will get around, how they will be influenced when buying and their desire to co-create

Transportation preferences

- How important is the personal car in your current and future transportation needs?
- How will your transportation preferences change over the next 10 years?

Personal mobility capabilities and services

- Which in-vehicle innovations will be most important?
- What mobility services would be most important?
- How flexible will you be with your modes of transportation?

Buying/owning influencers and participants

- Which types of media will influence your buying decisions?
- How important will the different participants in the buying experience?
- What types of ownership models will interest you?

Desire to co-create new mobility products and services

- Where have you engaged in the design of products and services in the past?
- How involved will you be in the future design of mobility products and services?

- Focus was on consumers who use cars as one of their ways to get around and the changes in how they will buy, use and own in the next 10 years
- Asking consumers to imagine their future mobility expectations over the next 10 years is a challenge – especially when envisioning solutions that are not even available yet.
- We used scenarios to describe the future possibilities and then asked how important these would be

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Agenda

Consumers

- Desire to own cars
- Primary transportation shifts
- Consumer's *digital mobility interest*

Mobility

- Desire for capabilities which enrich the **vehicle experience**
- Desire for services which enrich the **personal experience** of getting around
- Desire for **new models and alternative transportation modes**

The Ecosystem

- Co-creating products and services
- Vehicle buying influencers and participants

Demographics

- Ability to drive
- Car affordability
- Digital maturity

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Consumers

- Desire to own cars
- Primary transportation shifts
- Consumer's *digital mobility interest*

Shifts in how people move from one point to another and the levels of digital mobility interest they have for future mobility solutions

People want to own cars but not all necessarily with a traditional ownership model

The personal car will continue to be a key fixture in personal transportation, but the priority of when it is used will change

Understanding consumers by their *digital mobility interest* provides greater insight into groups with similar interests, attitudes and expectations

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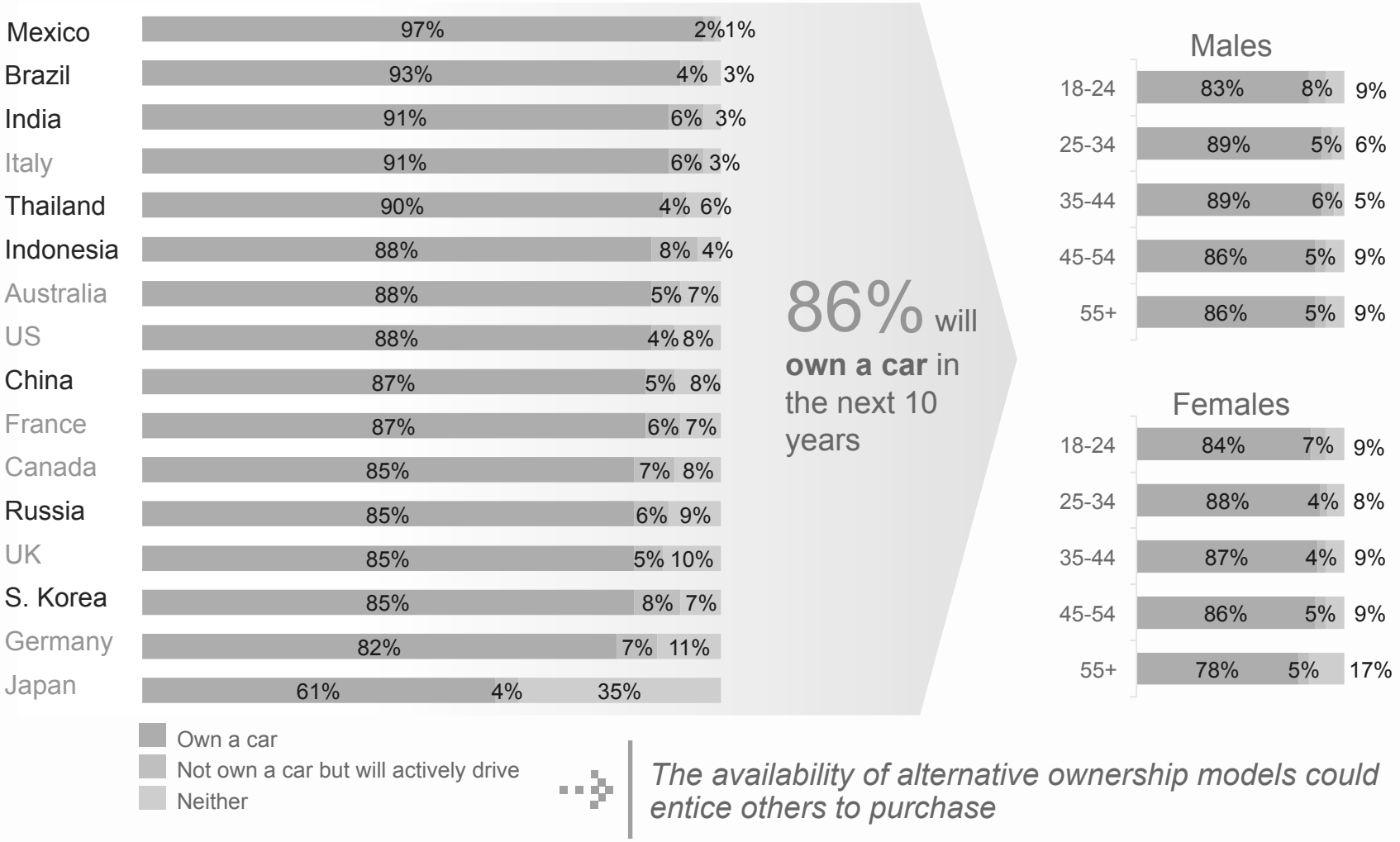
86% of people we surveyed said they will own a car sometime during the next 10 years

Will you own a car or be actively driving sometime during the next 10 years?



The availability of alternative ownership models could entice others to purchase

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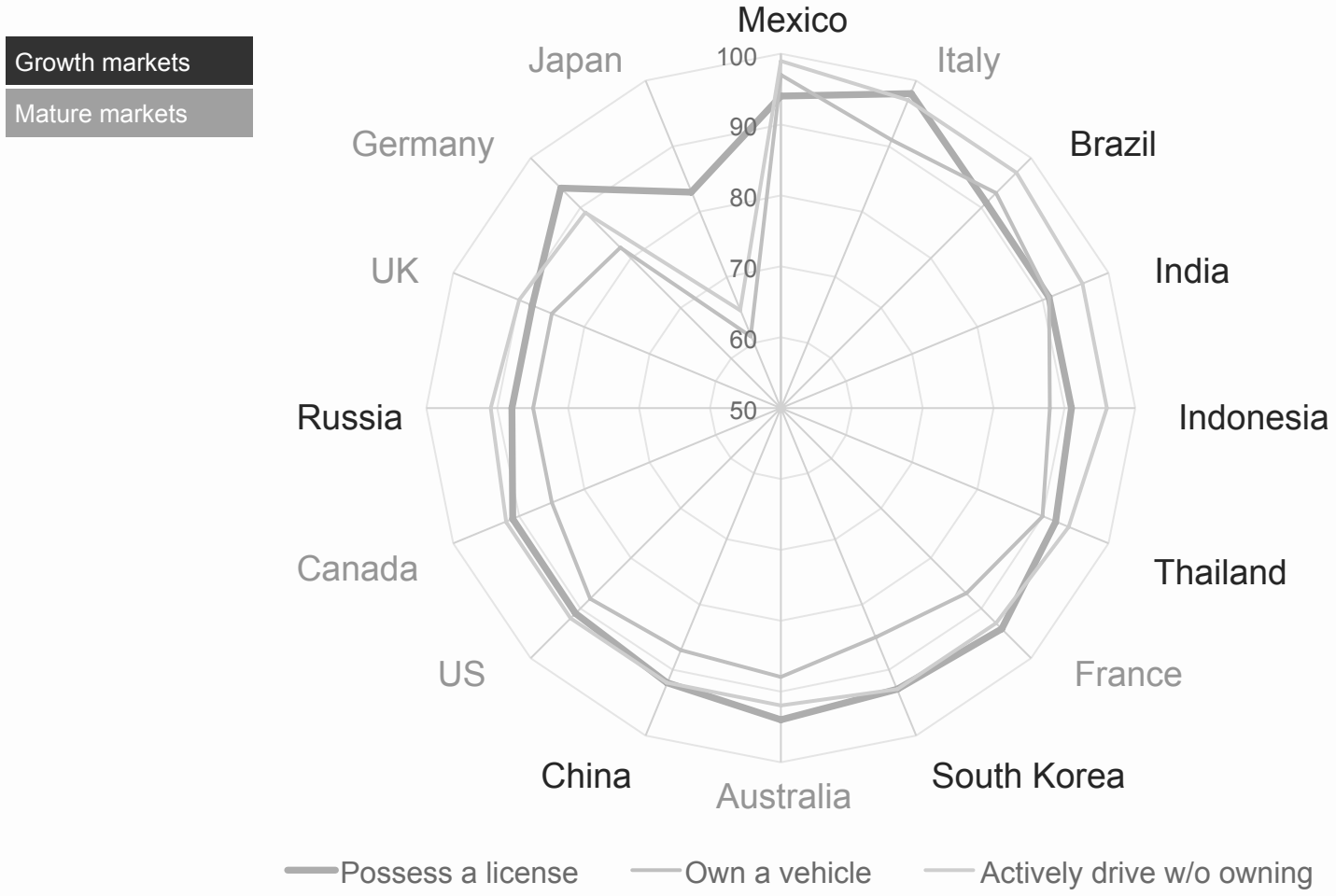
While having a driver's license should be an indicator of consumers who drive, many of the growth markets show even a higher percentage of people who drive than have a license



Reaching out to consumers actively driving and not just owning will provide a greater audience to approach with new mobility solutions

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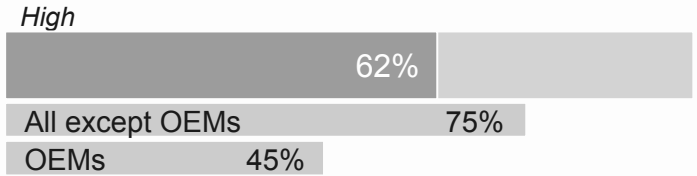
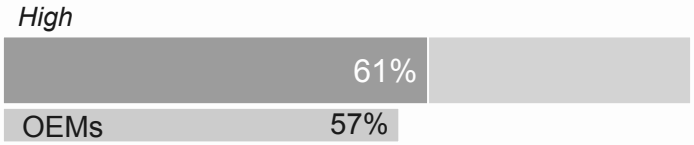
Auto 2025 industry study: Lifestyle attitudes and new mobility alternatives are changing the perception of the need to **own** a vehicle

What will the consumers attitude be towards alternative vehicle ownership models 2025?



- Only 45% of OEMs believe consumers will want alternative ownership models
- Fractional vehicle ownership will exist especially in urban settings

Will flexible pricing across multiple vehicles be a key differentiator in 2025?



- Fifty-seven percent of OEMs highly agree
- Subscription based pricing to include a primary use vehicle and access to other vehicles for certain situations

"Ownership of cars will emerge into new models"
CIO, Major European OEM

Source: Automotive 2025: industries without borders

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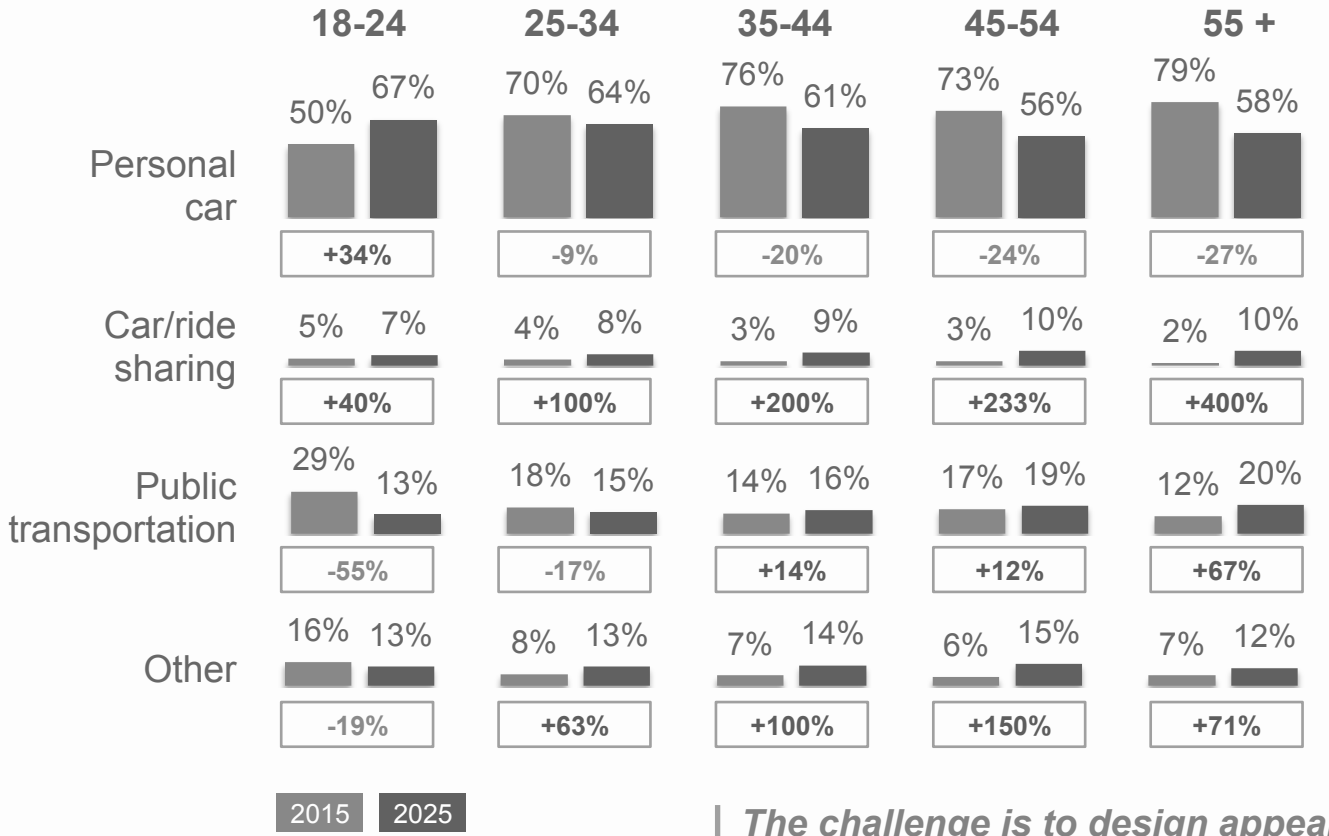
Primary transportation: The personal car remains an aspiration for 18-24 year olds, while other age groups seek additional options

What do you expect will be your primary mode of transportation in 2015 and 2025?



24%

average decline in personal car for

consumers over 35

233%

average increase in car/ride sharing for consumers over 35

The challenge is to design appealing mobility packages for consumers to couple with their desire to access cars

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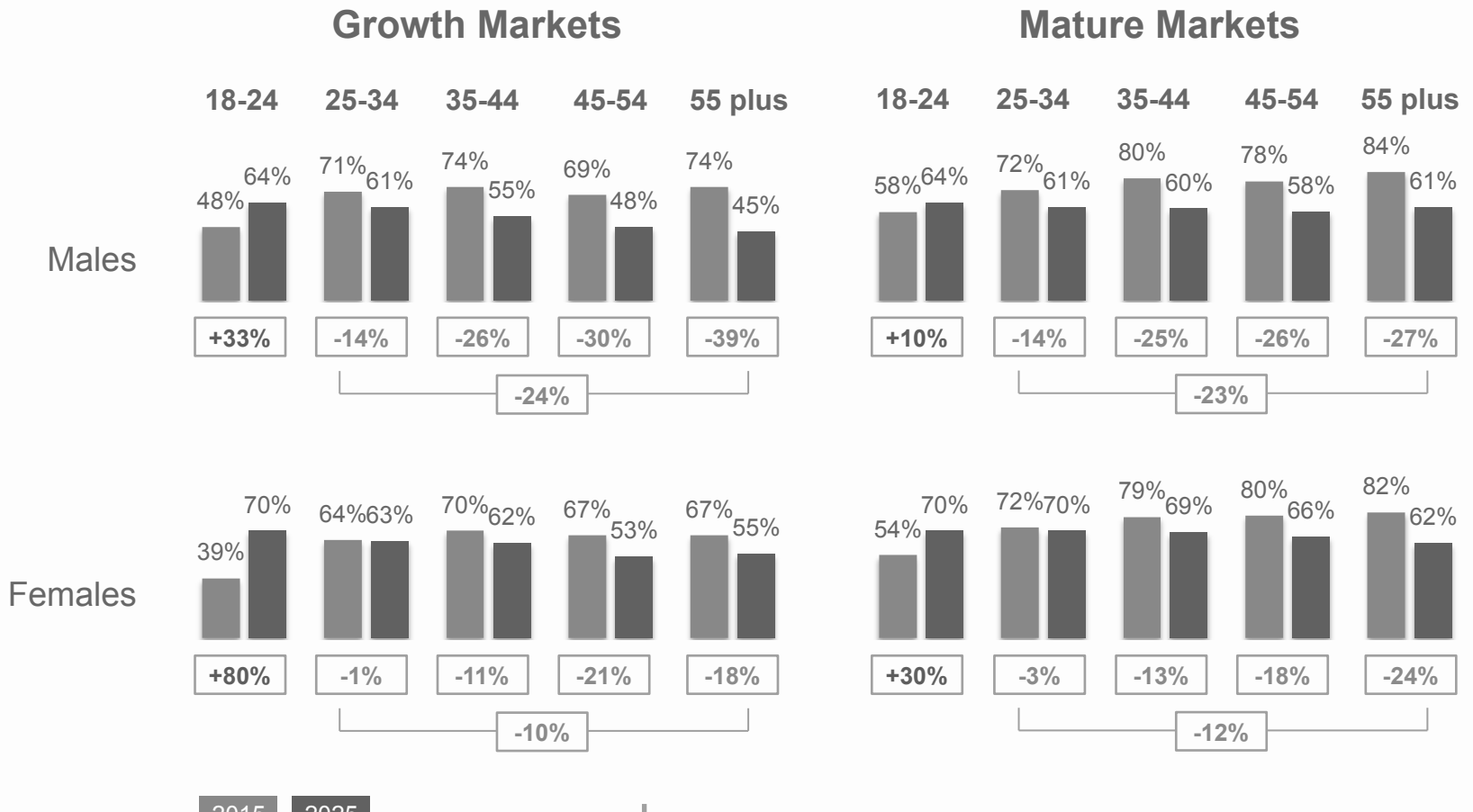
Although female dependency of the personal car as their primary transportation declines for those over 25, just like males, their decline is not as sharp



18-24 year old female will have a much higher increase in personal car usage over males

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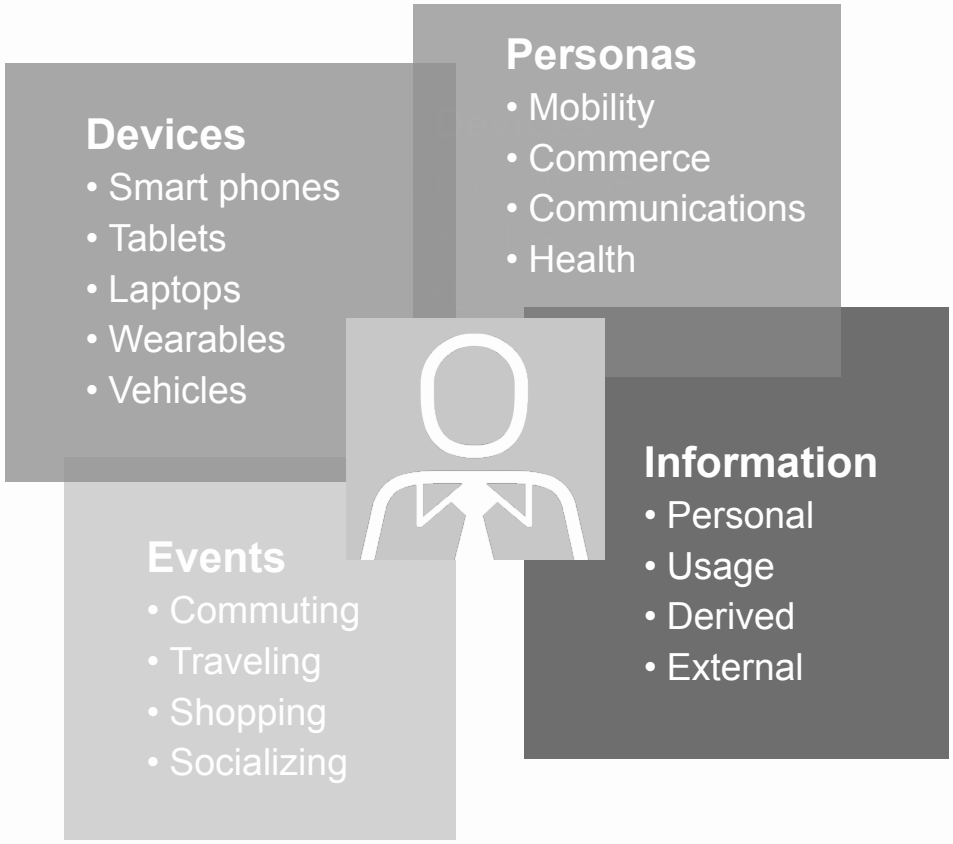
Digital consumers

Personalized devices, information, personas and events



- **Integrated devices** including the vehicle
- **Aggregated information** available based on personal preference
- **Digital personas** with personal preferences that are transferrable between vehicles
- **Lifestyle events** based on their purpose

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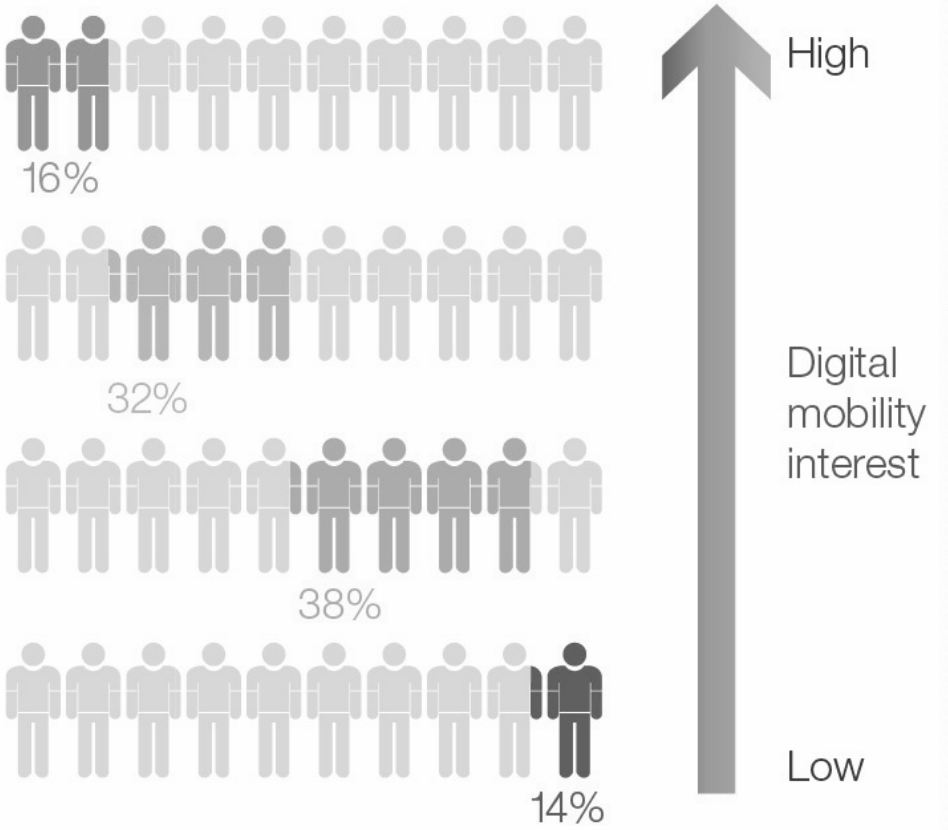
Cluster analysis shows four distinct consumer groups based on their degree of *digital mobility interest*

Pacesetters
Early technology adopters, eager to try new mobility services and options

Fast Followers
Watch Pacesetters and close behind in adoption speed; use many mobility services and options

The Pack
View technology conservatively, but eventually open to it when value is established

Spectators
Happy with status quo; low technology adoption and inflexible with new mobility solution



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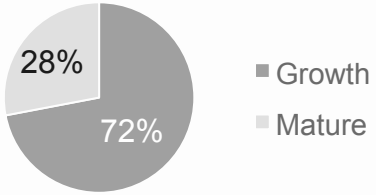
Pacesetters are early technology adopters with a willingness and desire to try new mobility services and options

16% of respondents

Pacesetters

Markets:



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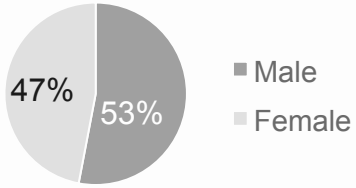

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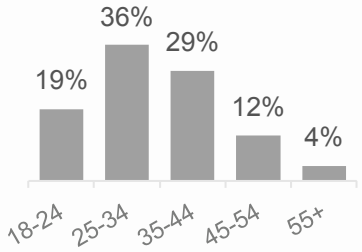
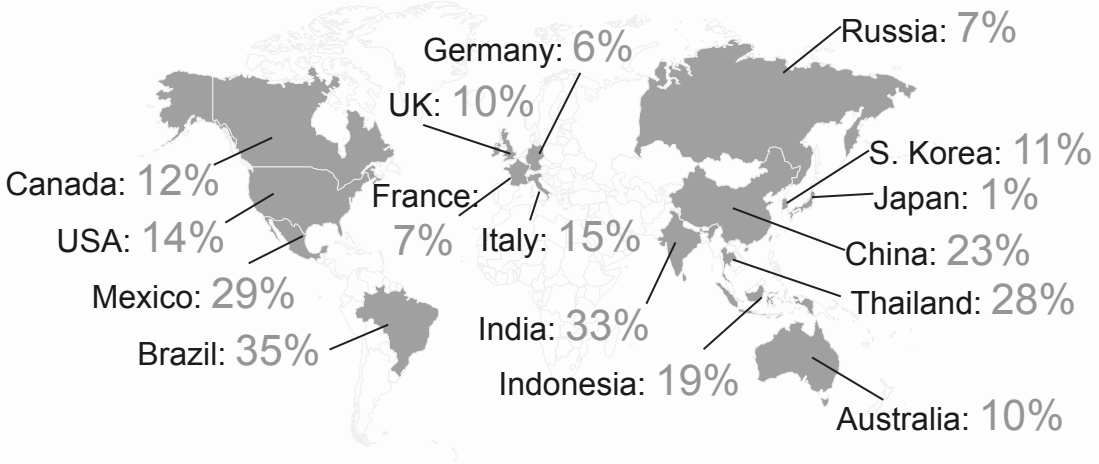
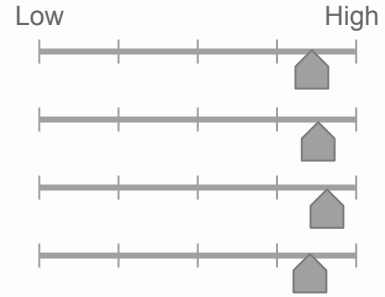




Will own a vehicle or actively drive: 98%

Own or use personal devices: 99%

Digital mobility interest:



- Ways to get around
- Mobility services
- Vehicle capability
- Digital maturity

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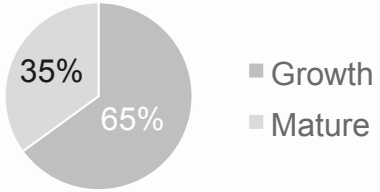
Fast Followers are close behind Pacesetters in adoption speed. The value the initial reaction from Pacesetters for new mobility services and offerings

32% of respondents

Fast Followers

Markets:



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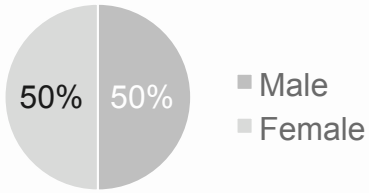

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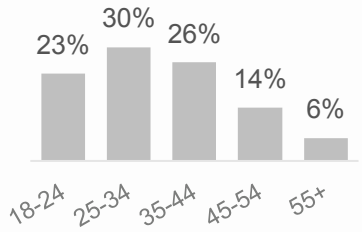
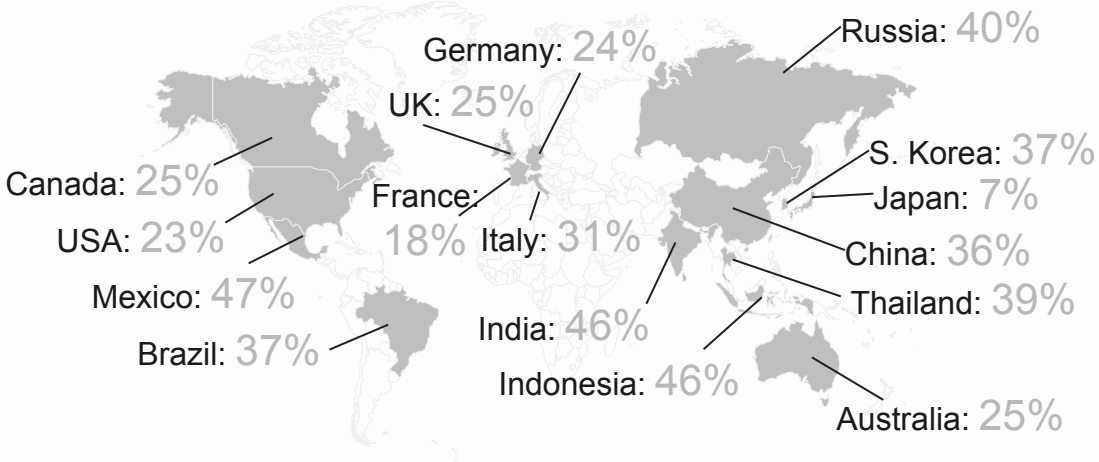
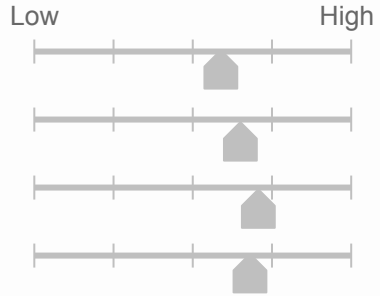




Will own a vehicle or actively drive: **97%**

Own or use personal devices: **99%**

Digital mobility interest:



- Ways to get around
- Mobility services
- Vehicle capability
- Digital maturity

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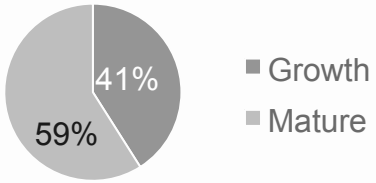
The Pack views technology conservatively. The could eventually open to it once the value is established based on their lifestyle preferences

38% of respondents

The Pack

Markets:



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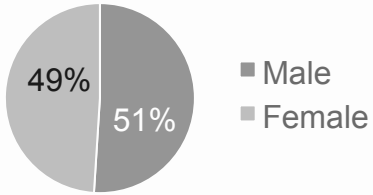

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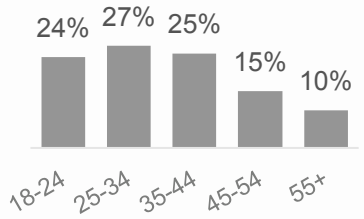
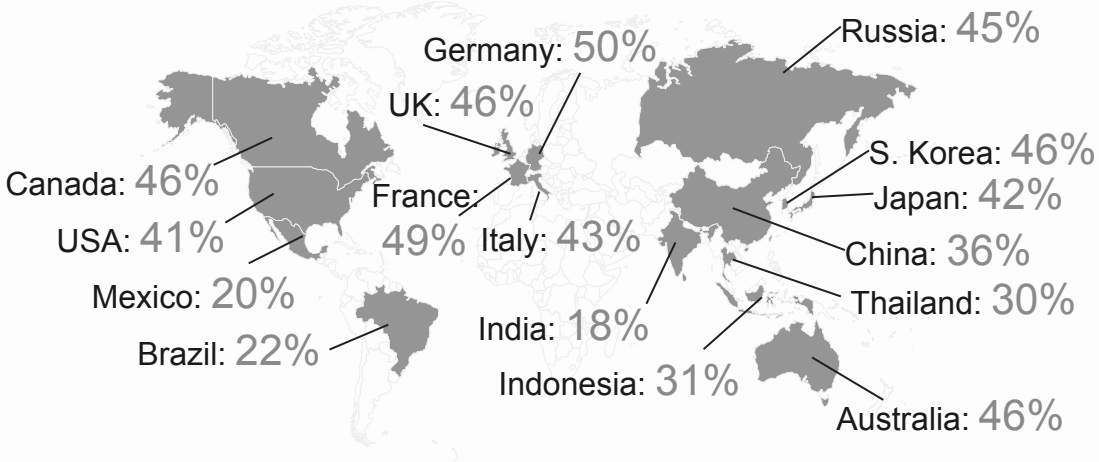


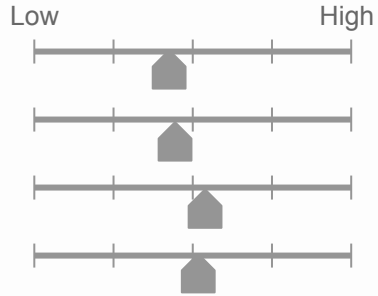


Will own a vehicle or actively drive: 94%

Own or use personal devices: 96%

Digital mobility interest:

- Ways t get around
- Mobility services
- Vehicle capability
- Digital maturity



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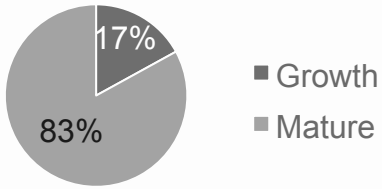
Spectators have a low tolerance for new technology adoption. They are happy with status quo and not very receptive to new mobility solutions

14% of respondents

Spectators

Markets:



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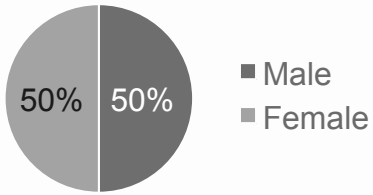

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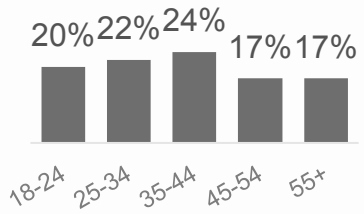
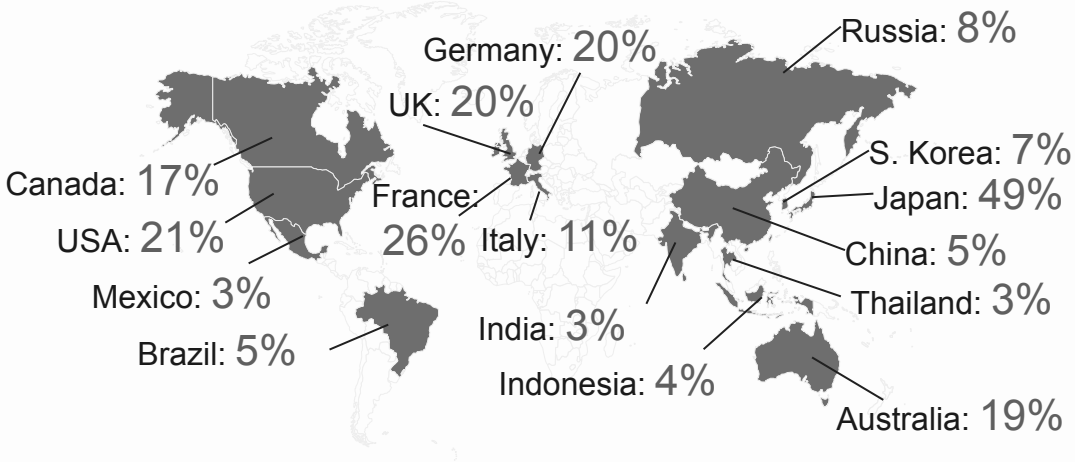
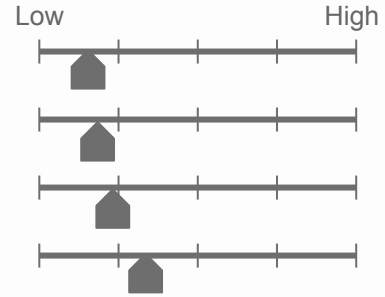




Will own a vehicle or actively drive: 74%

Own or use personal devices: 87%

Digital mobility interest:



- Ways to get around
- Mobility services
- Vehicle capability
- Digital maturity

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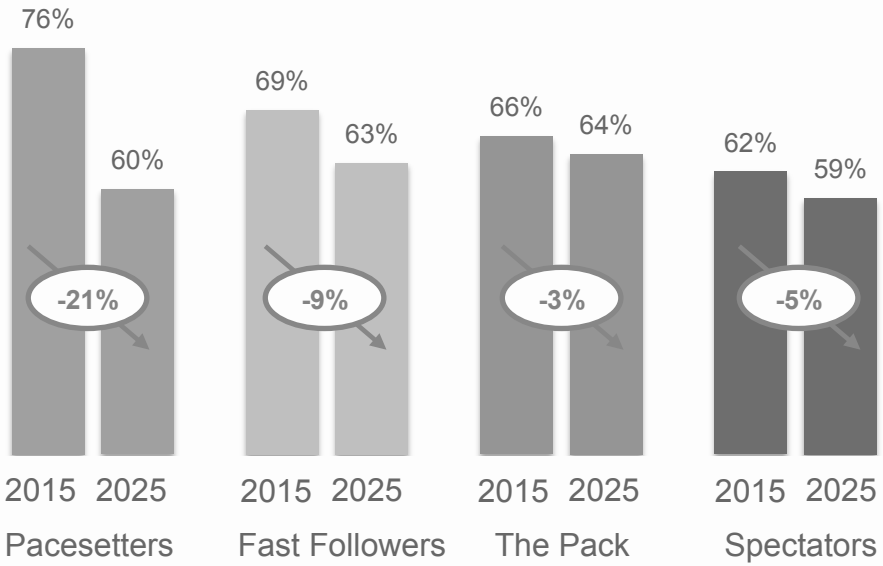
The Pacesetters and Fast Followers show the highest shift in the use of the personal car as their primary transportation mode

What do you expect will be your primary mode of transportation in 2015 and 2025?



Developing mobility solutions that integrate the use of the personal car with other modes of transportation will keep the Pacesetters loyal to a brand

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Consumer Recommendations

Deliver solutions to meet future vehicle usage shifts

- Develop new ownership models using examples from other industries
- Develop apps and other tools to integrate the use of the vehicle with other transportation options
- Leverage deep analytics to help consumers optimize their transportation choices

Understand consumers through their “digital mobility interest”

- Develop profiling scenarios and digital segmentation models as sophisticated as traditional physical segmentation models
- Target Pacesetters and Fast Followers when introducing new innovation
- Influence The Pack with additional information, experiences and proven value

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Mobility

- Desire for capabilities which enrich the **vehicle experience**
- Desire for services which enrich the **personal experience** of getting around
- Desire for **new models and alternative transportation modes**

Automating and personalizing through digital capabilities and services to provide a more effective, efficient and safe experience when moving from one point to another

Consumers show a high level of interest for the self-enabling vehicle innovation that industry executives say will be commonplace by 2025

The consumer response for mobility services supports the industry growth strategy of creating new services-based offerings

Consumers will explore other transportation alternatives as they look for the most cost effective and efficient ways to get around

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Auto 2025 industry study: Intelligent, intuitive, self-enabling vehicles will provide greater personalized vehicle experiences

Self-enabling vehicles

Self-integrating
Secure, seamless digital integration

Self-socializing
Vehicle social networks to assist others, utilizing the vehicle for ancillary tasks

Self-configuring
Personalization and customization to environment

Self-driving
Automated and autonomous mobility

Self-learning
Cognitively optimizing performance to occupants and environment

Self-healing
Analytics and prognostics for service and maintenance

Taking care of its occupants

Working with others

Taking care of itself

IBM.

Self-enabling vehicles have the ability to "take care" of their occupants, themselves and work with others

Source: Automotive 2025: industries without borders

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Ten of sixteen countries listed self-healing as top priority while Asian countries listed self-driving and first or second priority

Growth markets

Mature markets

Self-enabling vehicle capability - ranked by country

Rank	Mexico	Brazil	India	Thailand	Indonesia	China	Russia	S. Korea	Italy	USA	Canada	UK	Australia	Germany	France	Japan
1	Healing	Healing	Driving	Driving	Socializing	Driving	Healing	Driving	Healing	Healing	Healing	Healing	Healing	Healing	Healing	Socializing
2	Socializing	Learning	Learning	Socializing	Driving	Socializing	Socializing	Configuring	Socializing	Learning	Configuring	Learning	Learning	Socializing	Socializing	Driving
3	Driving	Socializing	Socializing	Learning	Healing	Healing	Learning	Healing	Driving	Configuring	Learning	Socializing	Socializing	Learning	Learning	Healing
4	Learning	Configuring	Healing	Configuring	Learning	Learning	Driving	Learning	Learning	Integrating	Driving	Driving	Configuring	Configuring	Driving	Learning
5	Configuring	Integrating	Configuring	Integrating	Integrating	Configuring	Integrating	Socializing	Integrating	Driving	Socializing	Configuring	Driving	Driving	Configuring	Configuring
6	Integrating	Driving	Integrating	Healing	Configuring	Integrating	Configuring	Integrating	Configuring	Socializing	Integrating	Integrating	Integrating	Integrating	Integrating	Integrating
% Avg	77	77	76	70	67	64	64	61	49	47	47	45	43	43	34	20

Integrating · Healing · Learning

Configuring · Driving · Socializing

Note: %Avg is the average of the 6 categories based on responses of “extremely/very interested” per country

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Commerce services received higher priority in the mature countries while health services are important in growth markets

Growth markets

Mature markets

Mobility services - ranked by country

Rank	India	Brazil	Mexico	Indonesia	Thailand	China	S. Korea	Russia	Italy	USA	Canada	UK	Australia	Germany	France	Japan
1	Health	Health	Information	Information	Concierge	Information	Information	Information	Information	Information	Information	Information	Information	Information	Information	Information
2	Concierge	Information	Health	Entertainment	Information	Entertainment	Commerce	Entertainment	Health	Entertainment	Entertainment	Entertainment	Commerce	Entertainment	Entertainment	Commerce
3	Entertainment	Concierge	Entertainment	Health	Health	Health	Concierge	Health	Commerce	Commerce	Concierge	Commerce	Entertainment	Commerce	Commerce	Entertainment
4	Information	Commerce	Commerce	Commerce	Entertainment	Concierge	Entertainment	Commerce	Concierge	Concierge	Commerce	Concierge	Concierge	Concierge	Health	Location-based
5	Commerce	Entertainment	Education	Concierge	Commerce	Commerce	Health	Education	Entertainment	Health	Health	Health	Health	Health	Concierge	Concierge
6	Education	Education	Concierge	Education	Location-based	Location-based	Education	Concierge	Education	Location-based	Location-based	Education	Education	Location-based	Location-based	Health
7	Location-based	Location-based	Location-based	Location-based	Education	Education	Location-based	Location-based	Location-based	Education	Education	Location-based	Location-based	Education	Education	Education
% Avg.	66	65	61	56	56	51	41	40	39	39	39	35	34	33	26	16

Information Commerce Health Location-based

Entertainment Concierge Education

Note: This is the average of the 7 categories based on responses of "extremely/very interested"

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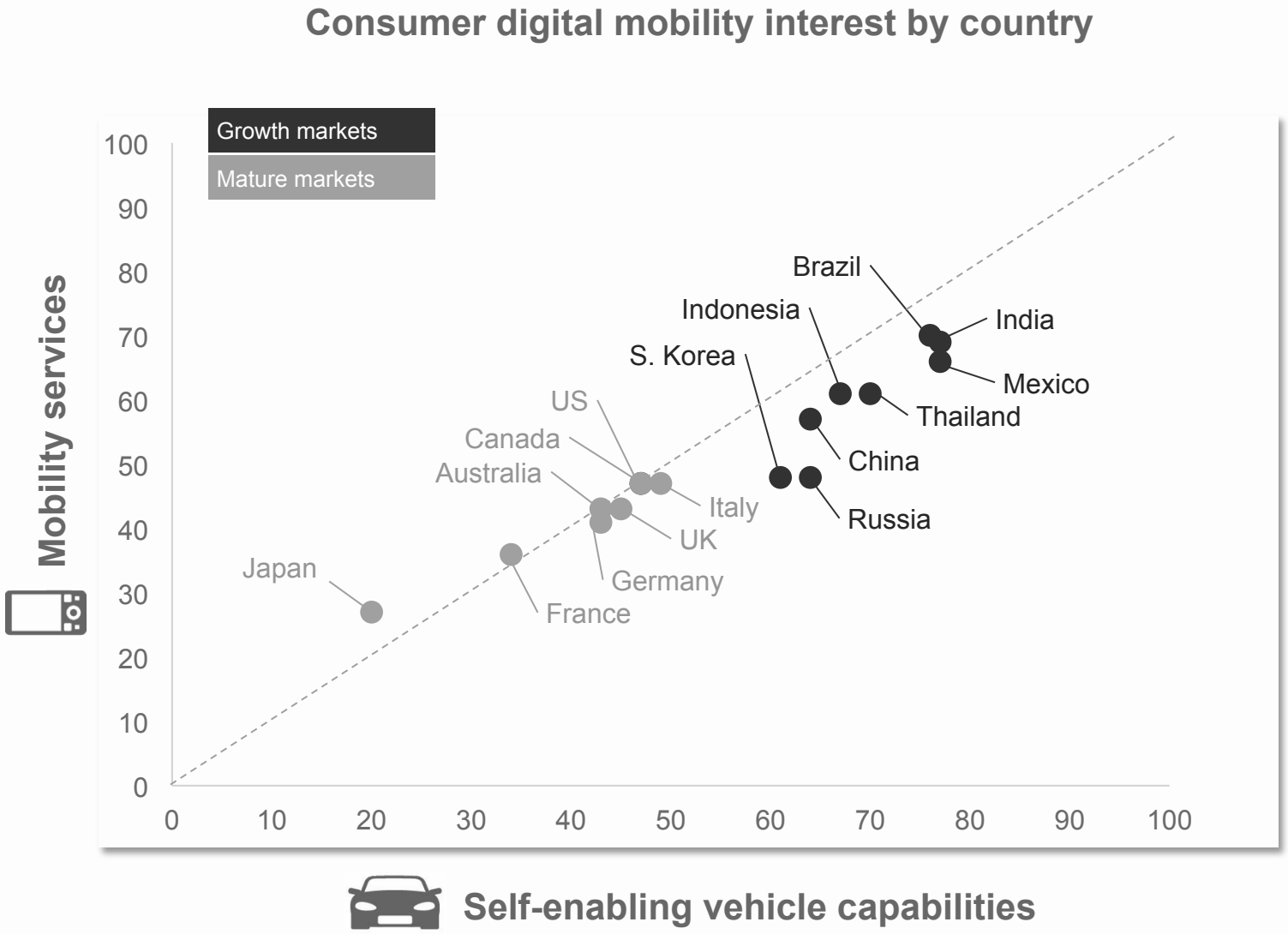
India, Brazil and Mexico show the most interest for vehicle and personal mobility experiences while Japan and France show the least



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Public transportation and multi-modal integration dominate across most countries

Growth markets

Mature markets

Mobility modes - ranking by country

Rank	India	Thailand	Brazil	Indonesia	Mexico	China	S. Korea	Italy	Germany	Canada	USA	Australia	Russia	UK	France	Japan
1																
2																
3																
4																
5																
% Avg.	57	57	55	54	50	49	38	36	32	30	30	28	28	27	23	11

Public transportation integration

Multi-modal integration

Car sharing

On demand ride sharing

Peer-to-peer rental

Note: This is the average of the 5 categories based on responses of “extremely/very interested”

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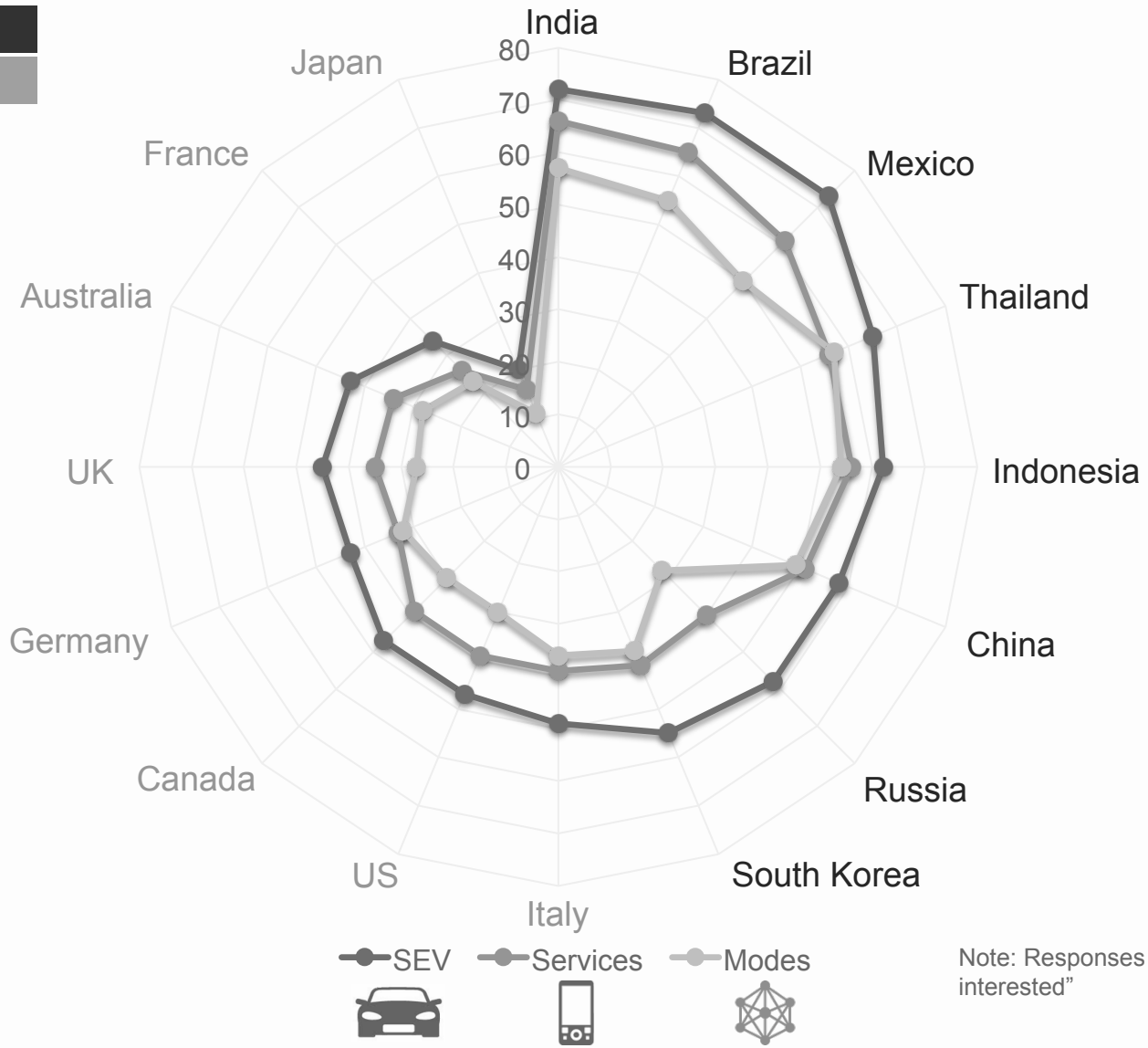
Comparing the three types of mobility solutions across all countries shows a fairly consistent order of importance

Growth markets

Mature markets



Note: Responses of “extremely/very interested”

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Mobility Recommendations

Create personalized in-vehicle digital experiences

- Develop digital experience configurators to align consumer interest with vehicle capability
- Provide cognitive discovery capabilities for consumers to explore and use additional functionality
- Provide a “buddy in the dashboard” to provide intuitive help

Accelerate the development of mobility services

- Create new innovation discovery processes to collaborate with other industries
- Implement Partner/alliance management competency that is institutionalized globally
- Embrace the Open API Economy to encourage new innovation

Deploy to regional expectations

- Leverage consumer acceptance based on “perceived value” vs. “proven value”
- Develop go-to-market strategies based on variances in country priorities
- Maximize analytics and insights to uncover consumer expectation shifts

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Consumer and mobility Recommendations

Deliver solutions to meet future vehicle usage shifts

Understand consumers through their “digital mobility interest”

Create personalized in-vehicle digital experiences

Deploy to regional expectations

Accelerate the development of mobility services

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Need computing performance in car!

Consolidated, virtualized microcontrollers and mainframe class security

- Save the development effort of the software
- Avoid compatibility issues
- Lack of unified security model
- Lack of cloud-access to car data

Only some MPUs have a “hard real-time” requirement, most MPUs have just to be “fast enough”

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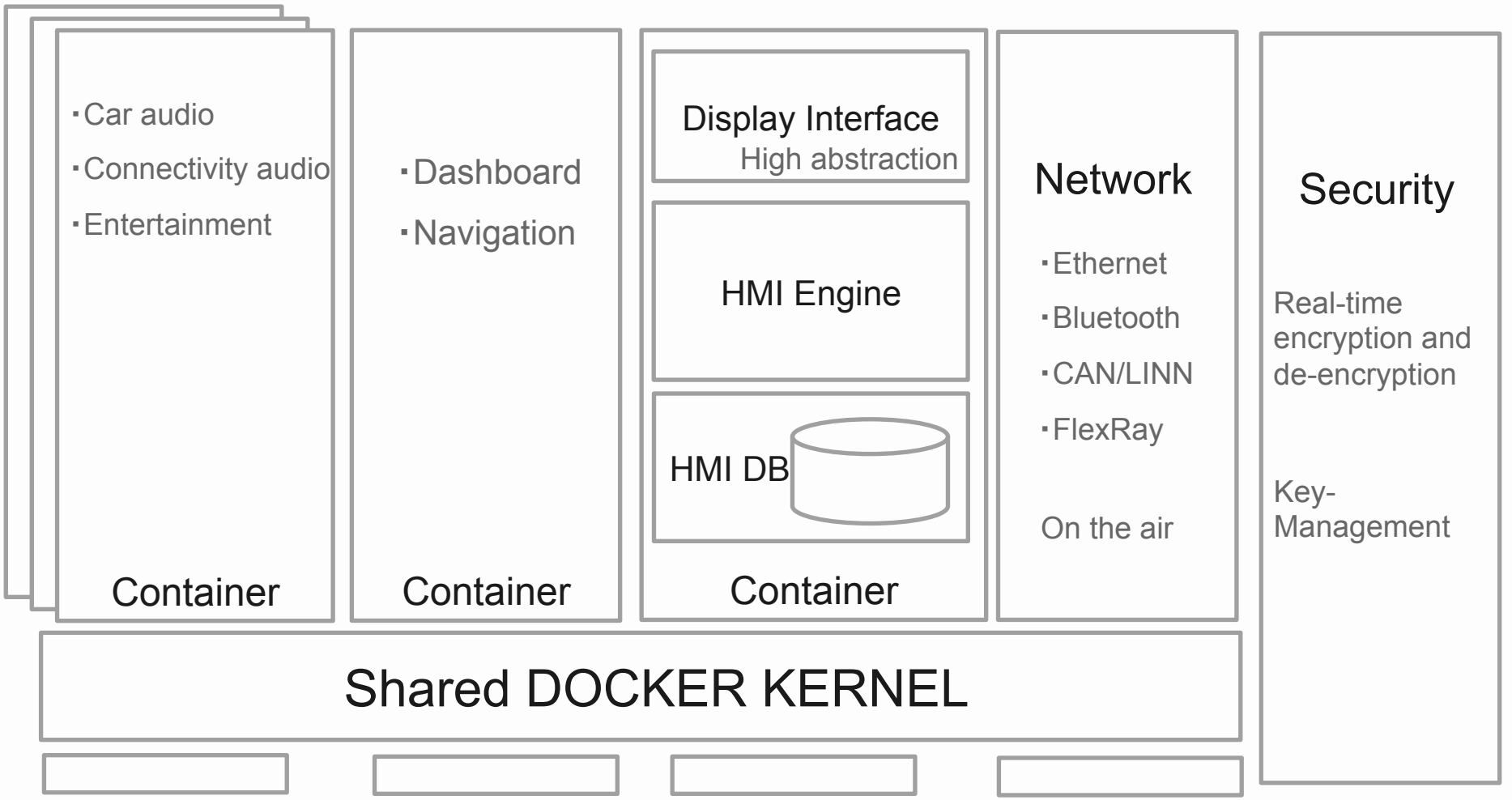
Software View :



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Hardware View (ex.

- Server grade performance – replace +100MPUs
- Flexible extension
- Scalability
- Energy-efficient

IBM and the Netherlands Institute for Radio Astronomy ASTRON have unveiled the world's first water-cooled 64-bit microserver.

http://www.research.ibm.com/labs/zurich/microserver/#fbid=B6gUoBSYAse

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Conclusion

- The future of the car is not limited to just self-driving and deep learning.

- Cockpit management system is a big challenge for semiconductor development.

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Thank you for your attention

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