Providing Real-time Information for Transit Riders: In Search of an Equitable Technology

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Outline

- Introduction / Background

- National and American Transit Agency Trend

- St. Louis Metro Rider's Mobile and Technology Utilization

- Trend Analysis & Alternative Technology Access

- Summary/Suggestions

Background

- Increase in Transit Real-Time Information
  - The availability of the technologies providing this information is unknown
  - Communication Preferences & Technology Utilization
- Agencies need to utilize the positive effects of real-time information
  - Customers will ride the system more
  - Lower perceived wait time
  - Overall higher satisfaction with service

Real-Time Information Technologies

- Smartphone Application

- Interactive Voice Response (IVR)

- Text Messaging (SMS)

- Mobile-Based Website

- Computer-Based Website

- Signage

Next Train Arrival Time at Station | Washington, DC
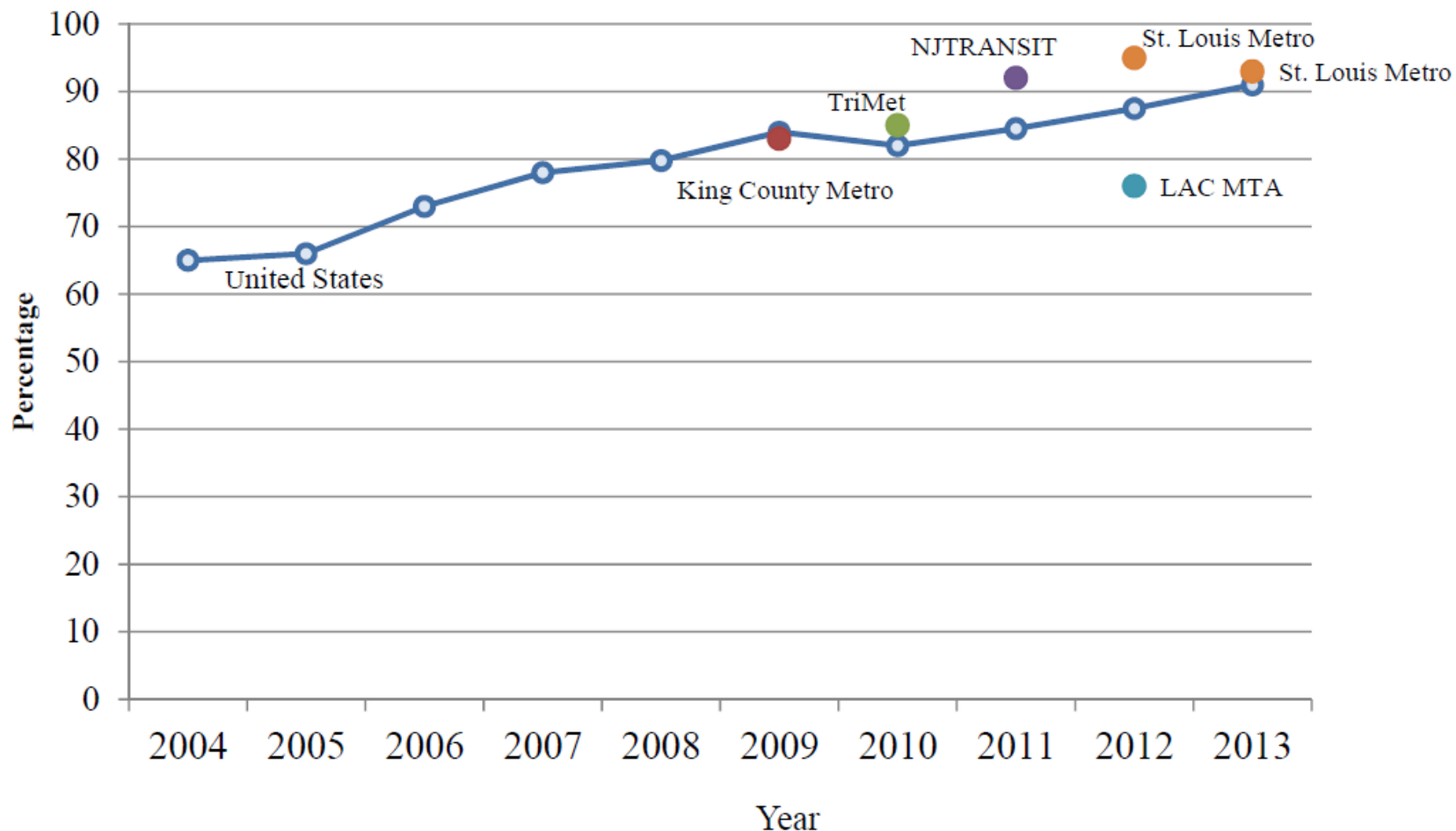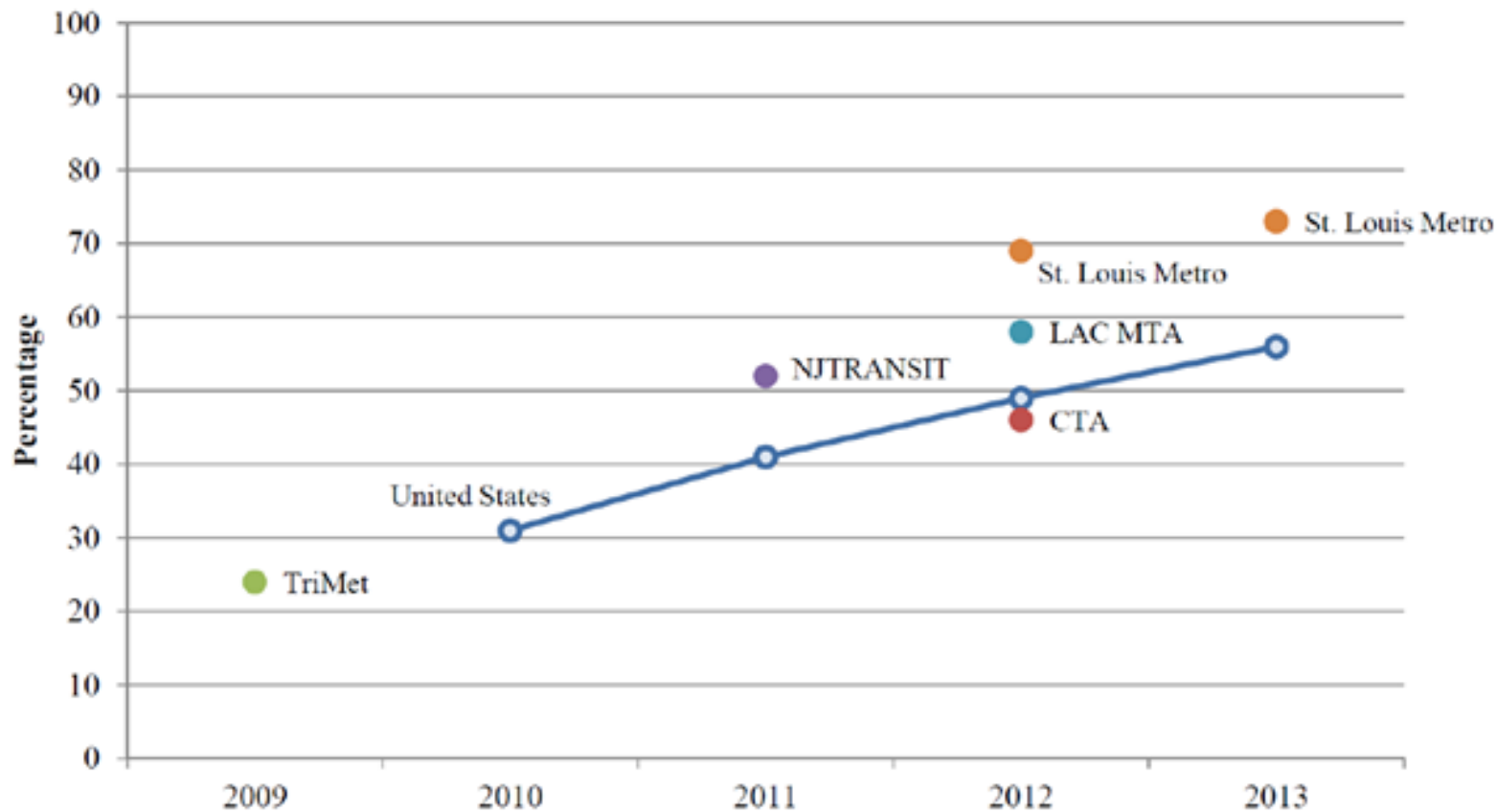
National and American Transit Agency Trends

Cell Phone Ownership

- In 2013, 91% of Americans own a Cell Phone
- Steady increase since 2004
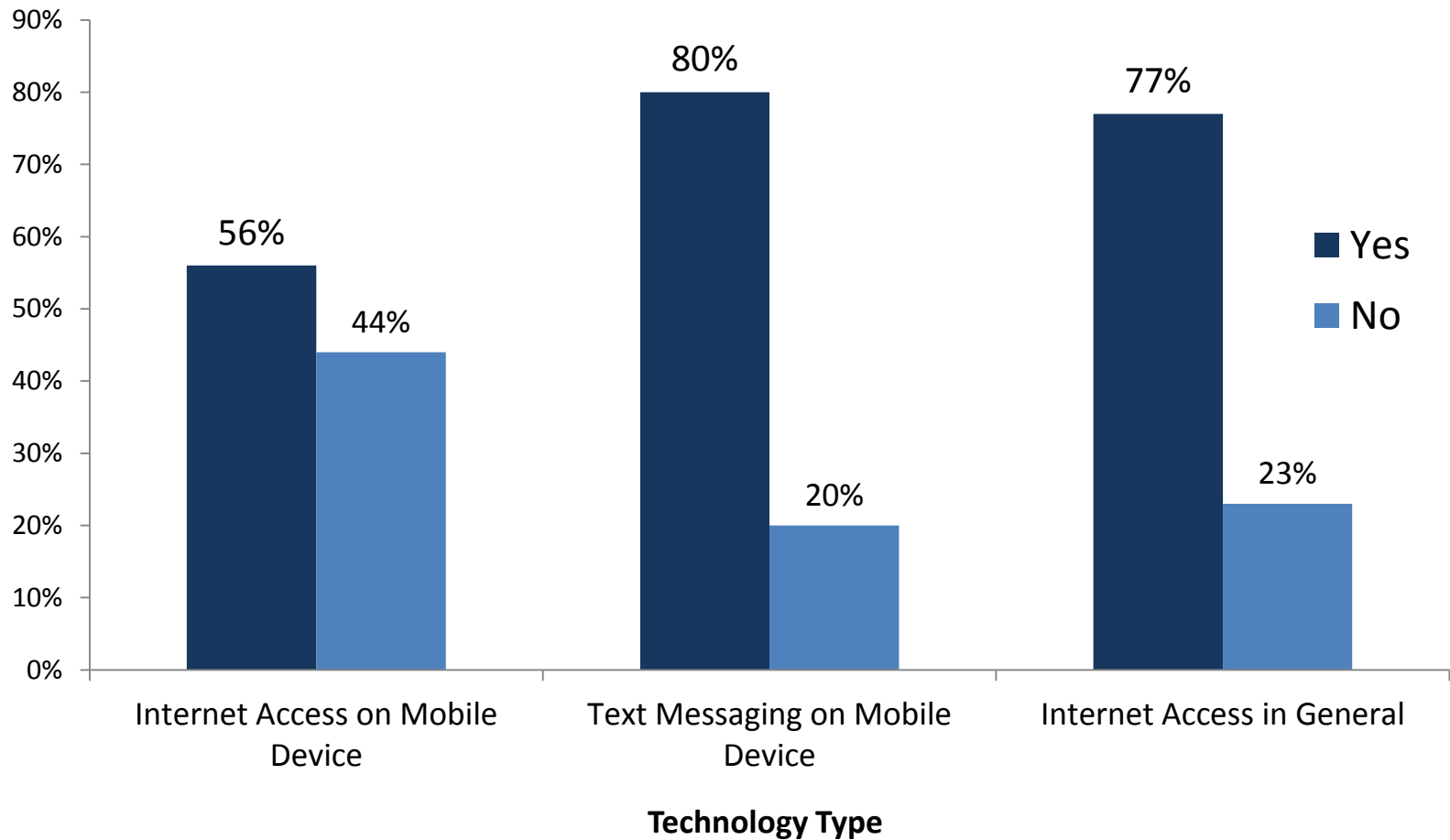
Smartphone Ownership

Source: Pew Internet

- 2013 - the majority of Americans own a smartphone
- Smartphone ownership is higher among Transit Riders

Alternative Technology - United States

Alternative Real-Time Information Technologies Availability among Americans

Technology Type

| Background | Methodology | National Trends | Technology Utilization | Implications |

St. Louis Metro Rider's Mobile and Technology Utilization

St. Louis Methodology

- Saint Louis Metro Transit
  - On-Board Survey | Summer 2012 + 2013
  - Statistical Analysis:
    - Overall Availability
    - Cross Tabulations
    - Chi-Square Test
    - Binomial Logistic Regression

St. Louis Survey Questions

4) What type of cell phone do you mainly use?

1) iPhone   2) Blackberry   3) Android-based   4) Windows 7-based   5) Non-Smartphone   6) Don't use a cell phone

→ If you use a cell phone, does it have internet access *that you use*?   Yes   No

→ If you use a cell phone, does it have a text messaging ability *that you use*?   Yes   No

5) Do you have internet access from a computer at home, work, school, or other place?   Yes   No

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12) I am: Male   Female

13) I am: 1) Black/African American   2) White/Caucasian   3) Latino/Hispanic American   4) Asian/Asian American   5) Other

14) My age is: ☐ 18 or under ☐ 19 – 24 ☐ 25 – 30 ☐ 31 – 35 ☐ 36 – 40 ☐ 41 – 45 ☐ 46 – 50 ☐ 51 - 64 ☐ 65 – 74 ☐ 75+

15) I am *(circle all that apply)*:   1) Employed Full-Time   2) Employed Part-Time   3) Unemployed   4) Student   5) Homemaker   6) Retired

17) What was your <u>combined household</u> income before taxes in 2011?

1) Under $20,000   2) $20,000 - $39,999   3) $40,000 - $59,999   4) $60,000 - $79,999   5) $80,000 - $99,999   6) $100,000 or more

Mobile Technology Trend

Cell Phone Ownership

Year	Ownership
2007	68%
2008	70%
2012	92%
2013	91%

Smartphone Ownership

Year	Ownership
2012	70%
2013	73%

■ Bus

Mobile Technology Availability

Cell Phone Ownership Based on Age

Age	Smartphone	Non-Smartphone	No Cell Phone	n
65 +	39%	38%	23%	n = 98
51 to 64	51%	33%	17%	n = 448
46 to 50	66%	23%	11%	n = 247
41 to 45	70%	21%	9%	n = 232
36 to 40	78%	18%		n = 242
31 to 35	76%	16%	8%	n = 250
25 to 30	86%	12%		n = 411
19 to 24	86%	9%		n = 548
18 or under	83%	10%	7%	n = 191
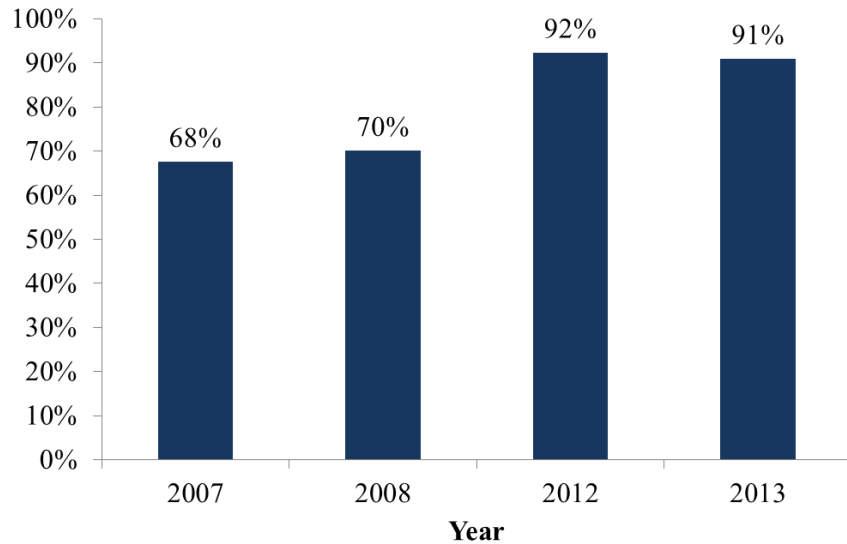
■ Smartphone   ■ Non-Smartphone   □ No Cell Phone
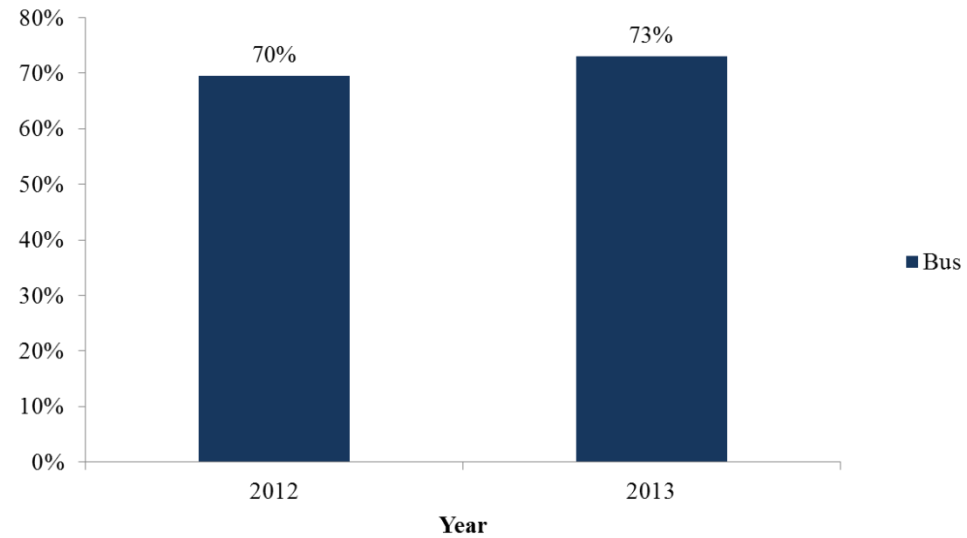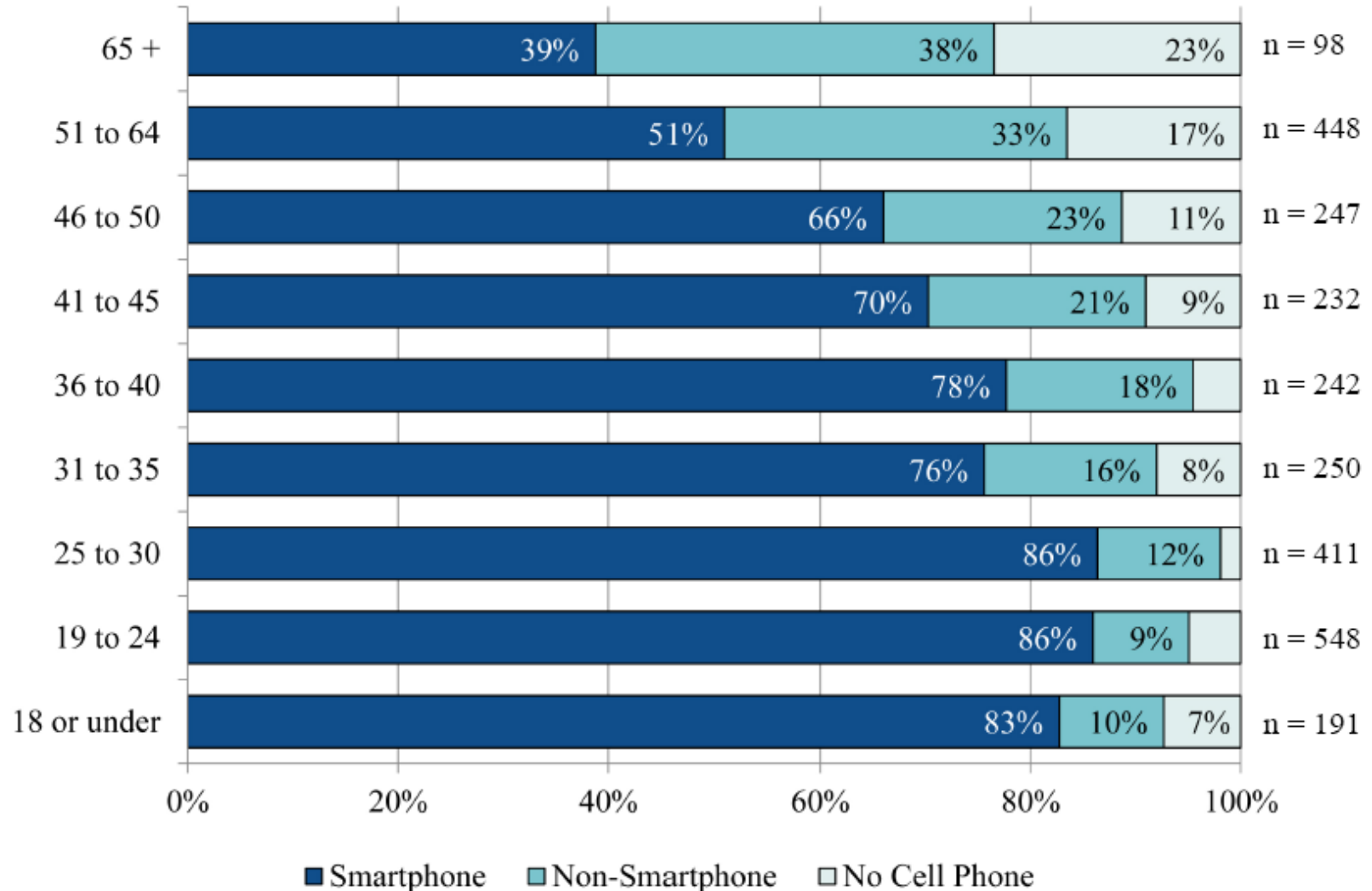
Mobile Technology Availability

Cell Phone Ownership Based on Employment

Employment	Smartphone	Non-Smartphone	No Cell Phone	n
Employed Full-Time	77%	17%	6%	n = 1221
Employed Part-Time	77%	15%	8%	n = 459
Student	80%	15%		n = 260
Employed Full-Time and Student	89%	5%		n = 55
Employed Part-Time and Student	83%	16%		n = 98
Unemployed	57%	29%	14%	n = 270
Retired	48%	29%	24%	n = 153
Homemaker	44%	34%	22%	n = 41

■ Smartphone ■ Non-Smartphone □ No Cell Phone
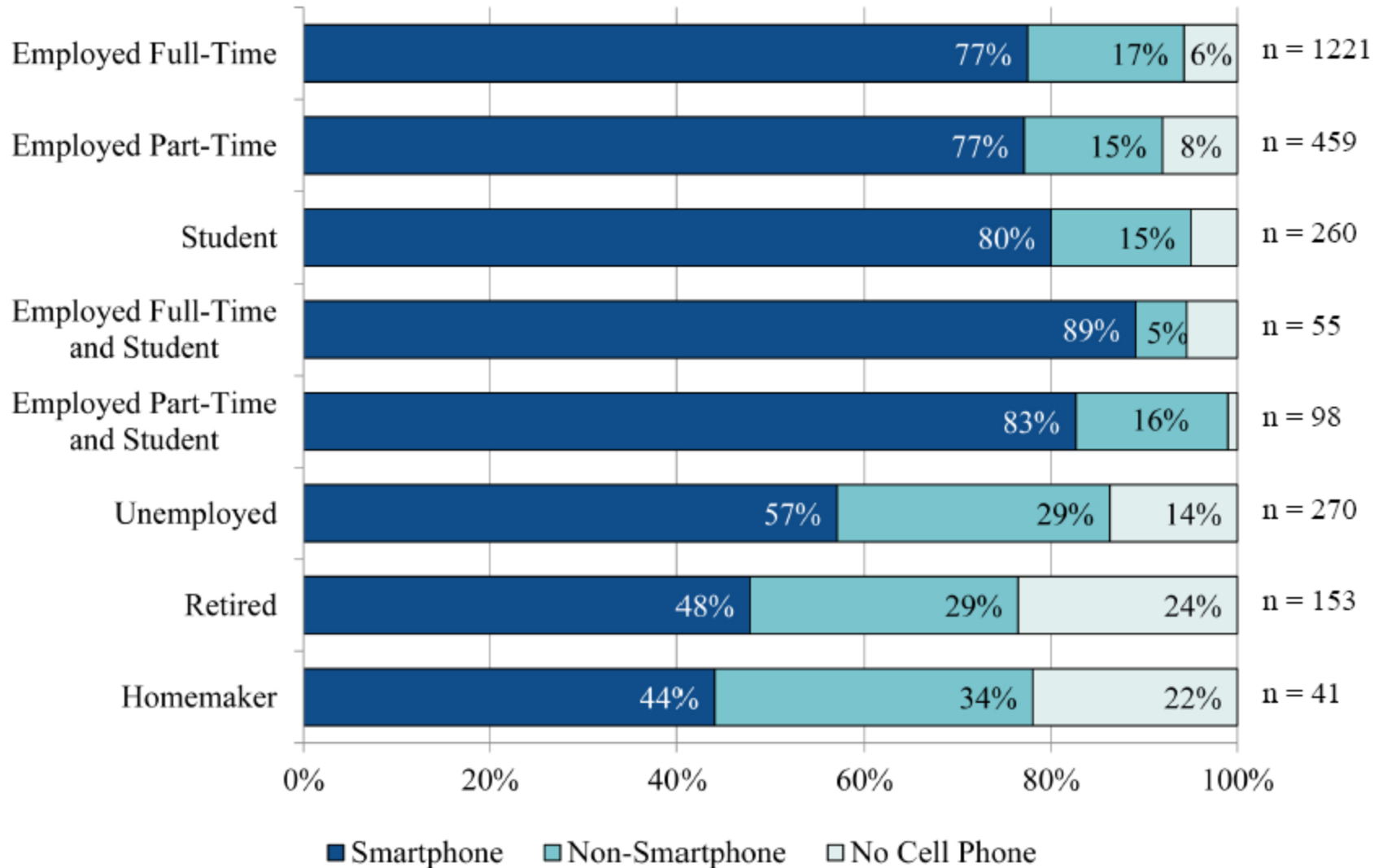
Mobile Technology Availability

Cell Phone Ownership Based on Income
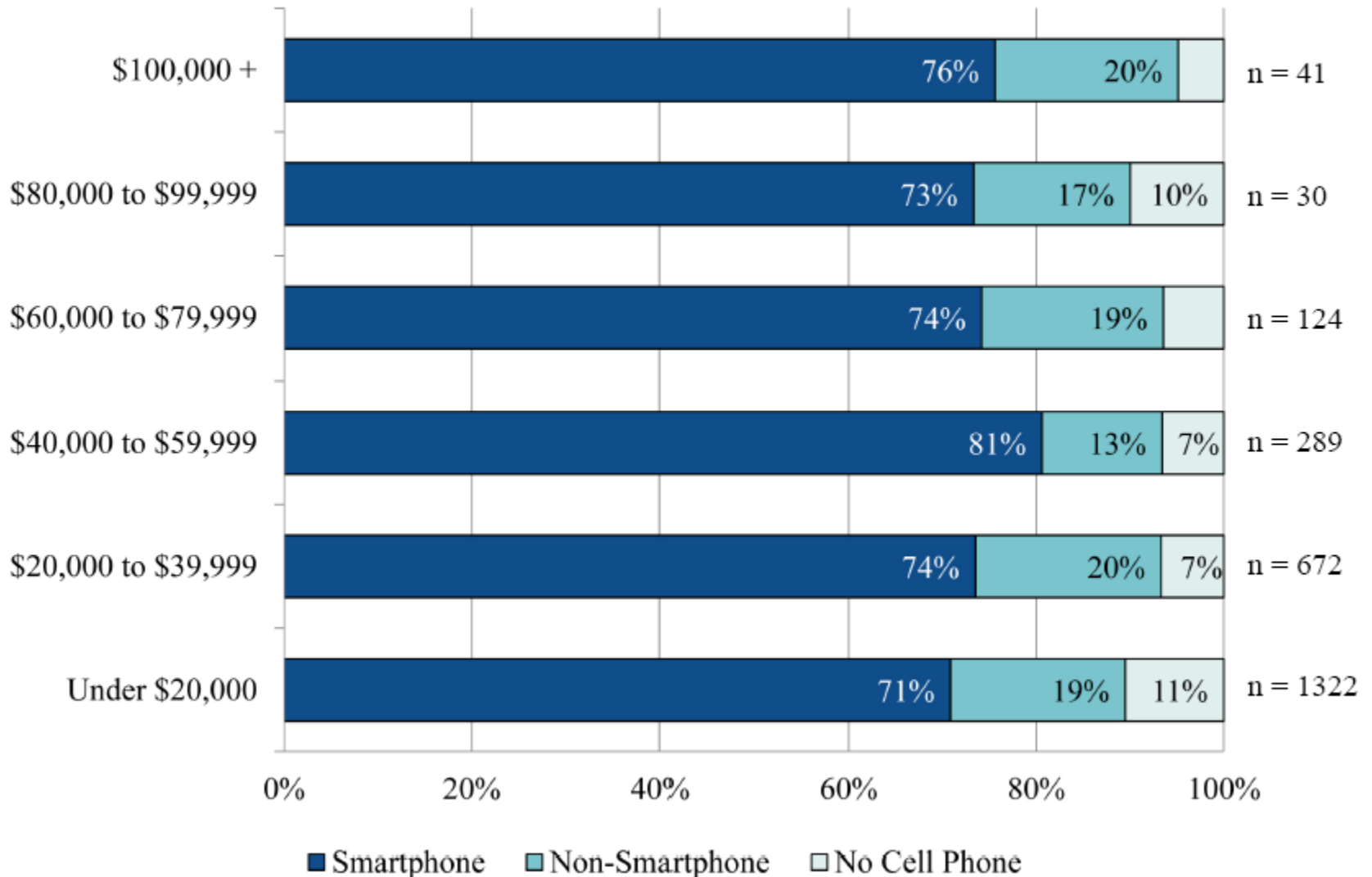
Income	Smartphone	Non-Smartphone	No Cell Phone	n
$100,000 +	76%	20%		n = 41
$80,000 to $99,999	73%	17%	10%	n = 30
$60,000 to $79,999	74%	19%		n = 124
$40,000 to $59,999	81%	13%	7%	n = 289
$20,000 to $39,999	74%	20%	7%	n = 672
Under $20,000	71%	19%	11%	n = 1322

Mobile Technology Availability

Cell Phone Ownership Based on Race

Race	Smartphone	Non-Smartphone	No Cell Phone	n
Black/African American	76%	16%	8%	n = 1970
White/Caucasian	62%	27%	11%	n = 471
Asian/Asian American	73%	27%		n = 49
Latino/Hispanic American	74%	17%	9%	n = 35
Other	78%	12%	10%	n = 91

■ Smartphone ■ Non-Smartphone □ No Cell Phone
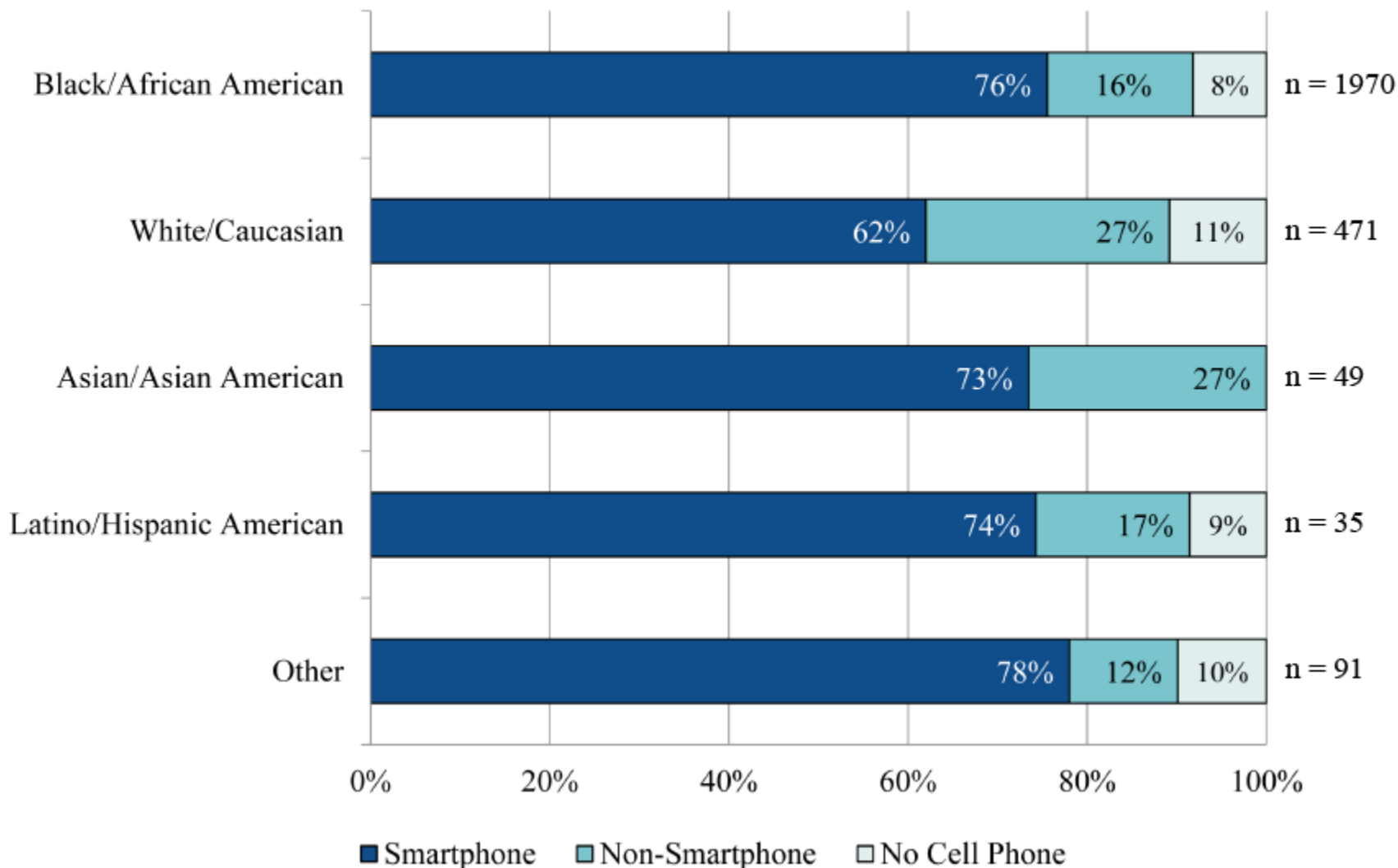
Mobile Technology Availability

- Inverse relationship between age and smartphone ownership

- Retired, unemployed, and homemakers most likely to not have smartphones

- Slight relationship between income and smartphone ownership

- White / Caucasians have lowest percentage of smartphone ownership

- No notable difference between males and females

Chi-Squared Test

2012 Survey

| | MetroBus Riders | | | MetroLink Riders | | |
| | Owns a Smartphone with Internet Access | | Chi square test of independence | Owns a Smartphone with Internet Access | | Chi square test of independence |
	Y	N		Y	N	
Age			$X^2 = 168.212$, 1 d.f. $p < 0.0001$			$X^2 = 140.367$, 1 d.f. $p < 0.0001$
40 and Under	62%	38%		65%	35%	
Over 40	28%	72%		37%	63%	
Employment			$X^2 = 54.740$, 1 d.f. $p < 0.0001$			$X^2 = 45.005$, 1 d.f. $p < 0.0001$
Full-Time, Part-Time, Student, or Full-Time & Student	53%	47%		57%	43%	
Unemployed, Homemaker, Retired	28%	72%		33%	67%	
Income			$X^2 = 3.105$, 1 d.f. $p > 0.05$			$X^2 = 3.448$, 1 d.f. $p > 0.05$
Under $20,000	46%	54%		51%	49%	
Over $20,000	51%	49%		56%	44%	
Race			$X^2 = 8.959$, 1 d.f. $p < 0.01$			$X^2 = 8.024$, 1 d.f. $p < 0.01$
White / Caucasian	40%	60%		49%	51%	
Other	50%	50%		56%	44%	
Gender			$X^2 = 3.759$, 1 d.f. $p > 0.05$			$X^2 = 0.065$, 1 d.f. $p > 0.05$
Male	53%	47%		53%	47%	
Female	59%	41%		53%	47%	

Background | National Trend | Technology Utilization | Trend Analysis | Implications

Logistic Regression

Bus 2013

Variable Name	Coefficient	S.E.	% of Total Sample	P-Value
Intercept	1.461	0.099	-	< 0.0001
Black / African American	-0.327	0.088	69%	< 0.0001
40 Years Old and Below	-1.262	0.082	56%	< 0.0001
Employed and/or Student	-0.925	0.094	72%	< 0.0001
Income Over $80,000	-0.503	0.262	3%	0.0551

Bus 2012

Variable Name	Coefficient	S.E.	% of Total Sample	P-Value
Intercept	1.432	0.133	-	< 0.0001
Black / African American	-0.100	0.117	66%	0.3892
40 Years Old and Below	-1.335	0.111	55%	< 0.0001
Employed and/or Student	-0.620	0.124	70%	< 0.0001
Income Over $80,000	-0.517	0.300	3%	0.085

Mobile Technology Availability

- Age is a major contributor to smartphone application availability

- Riders who are not Black / African Americans need an alternative technology for real-time information

- Confirmation riders employed and/or students more likely to have smartphone applications
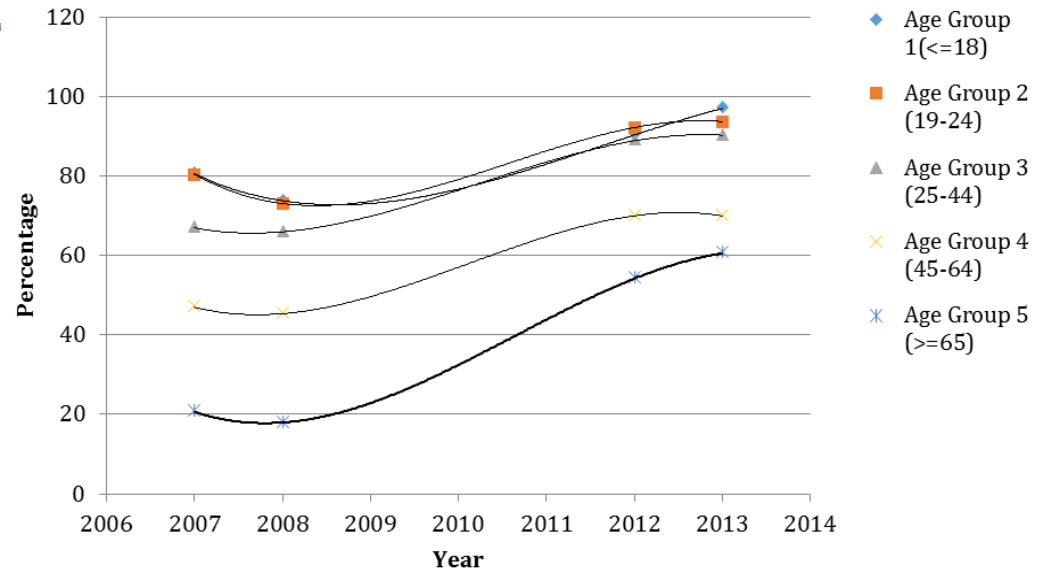
- No clear trend regarding income

- Gender has no influence

Trend Analysis & Alternative Technology Access

Trend Analysis
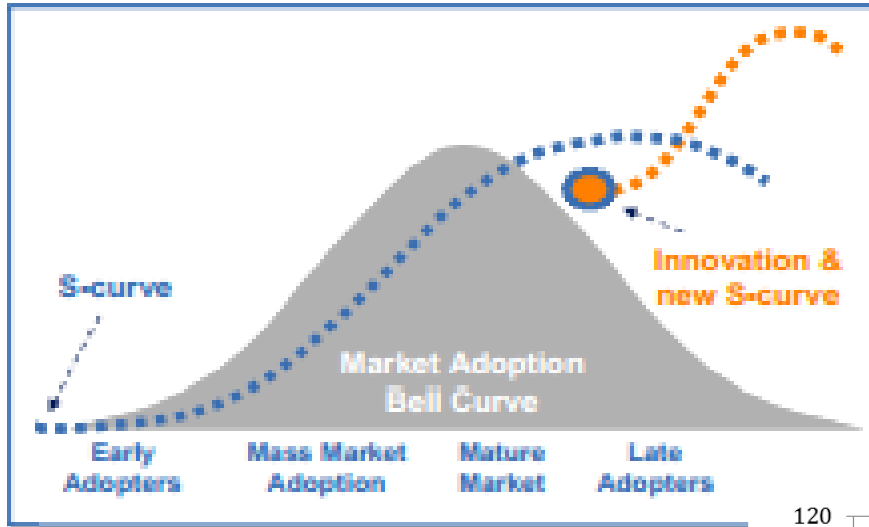
Technology Adoption Pattern
(Nelson and Phelp 1966,
Blackman 1978)

Adoption Pattern, St. Louis
Metro, 2007 -2013

Trend Analysis

National Transit Ridership Trend , 2005 - 2012
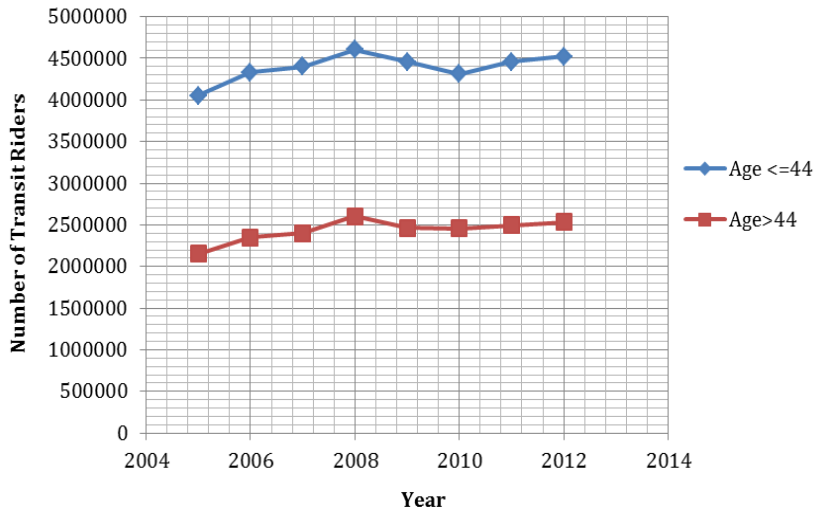
National PopulationTrend , 2005 - 2012

$y = 0.0037x - 6.8867$
$R^2 = 0.9793$

$y = -0.0027x + 5.8882$
$R^2 = 0.9239$

$y = 0.2366x - 473.89$
$R^2 = 0.9901$

$y = 0.2416x - 484.11$
$R^2 = 0.9525$
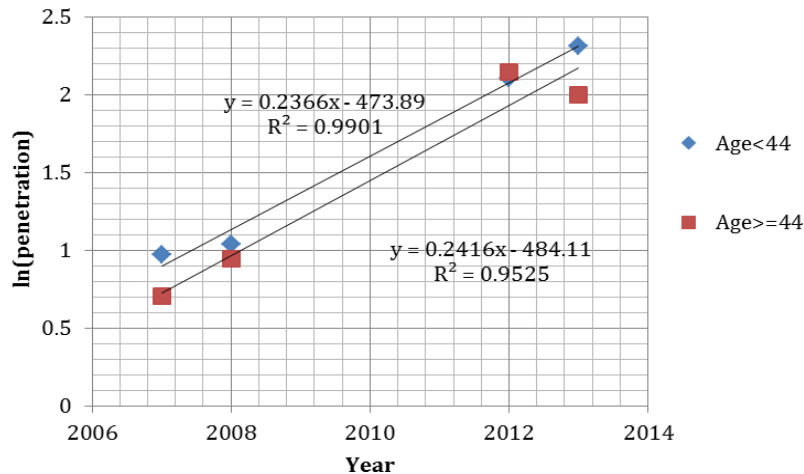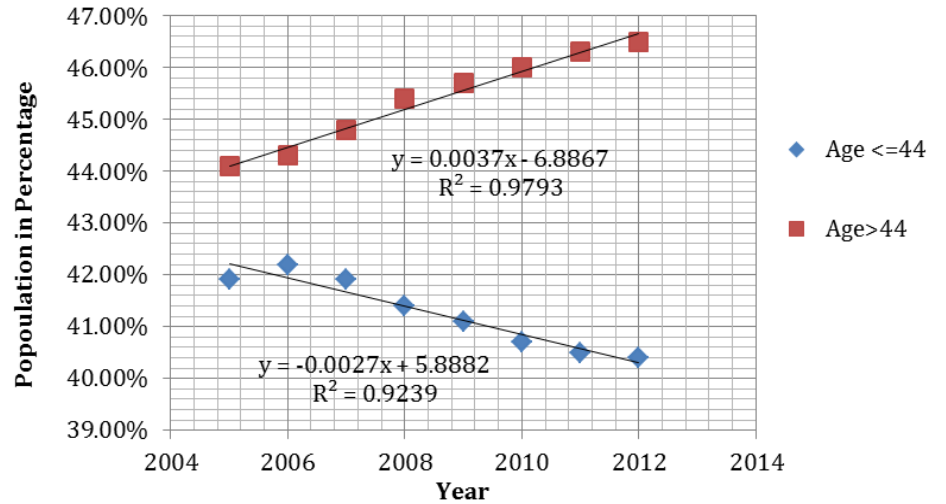
Technology Adoption Trend, St. Louis, 2007 - 2013

Trend Analysis

Predicted number of riders with smartphone access in a particular year

= [number of riders in base year

× (percent increase in transit ridership for an age group

− population growth rate in that age group)

× number of years]

× technology penetration rate in that age group for that year

Assuming St. Louis Metro has 100 riders in 2013,

In 2018:

Age Group	Ridership Change Rate	Population Change Rate	Total Riders	Technology Penetration Rate	Number of Riders with Access
<= 44	1.00	-0.10	550.00	94.58	520.19
> 44	1.80	0.30	750.00	87.20	654.00

Implications

- For age group <44 years, smartphone based applications may have a sufficient coverage

- For age group >=44 years, smartphone based applications do not have a good coverage and:
  - Clubbing all age groups blankets the 65+ age group
  - Technology has a saturation – it will never capture all riders

.

Therefore, there has to be an additional technology platform beside smartphone based application

Alternative Technology Access

2013 Survey

Alternative Technology Access		Bus Riders		Rail Riders	
		All Riders	Riders without Smartphone Applications	All Riders	Riders without Smartphone Applications
IVR	Yes	91%	74%	94%	81%
	No	9%	26%	6%	19%
Mobile-Based Website	Yes	71%	24%	73%	22%
	No	29%	76%	27%	78%
SMS	Yes	82%	61%	86%	65%
	No	18%	39%	14%	35%
Computer-Based Website	Yes	76%	61%	81%	75%
	No	24%	39%	19%	25%

Background   Methodology   National Trends   **Technology Utilization**   Implications

Alternative Technology Access

Overlap of Technology Availability among Riders Without Smartphone Applications
MetroBus, 2013

Chart data:

Alternative Technology	Have Access to this AND another Technology	ONLY have Access to this Technology
IVR	67%	7%
Mobile Website	20%	
SMS	44%	15%
Computer	49%	12%
None (Signage)		15%

Legend:
- ■ Have Access to this AND another Technology
- ■ ONLY have Access to this Technology
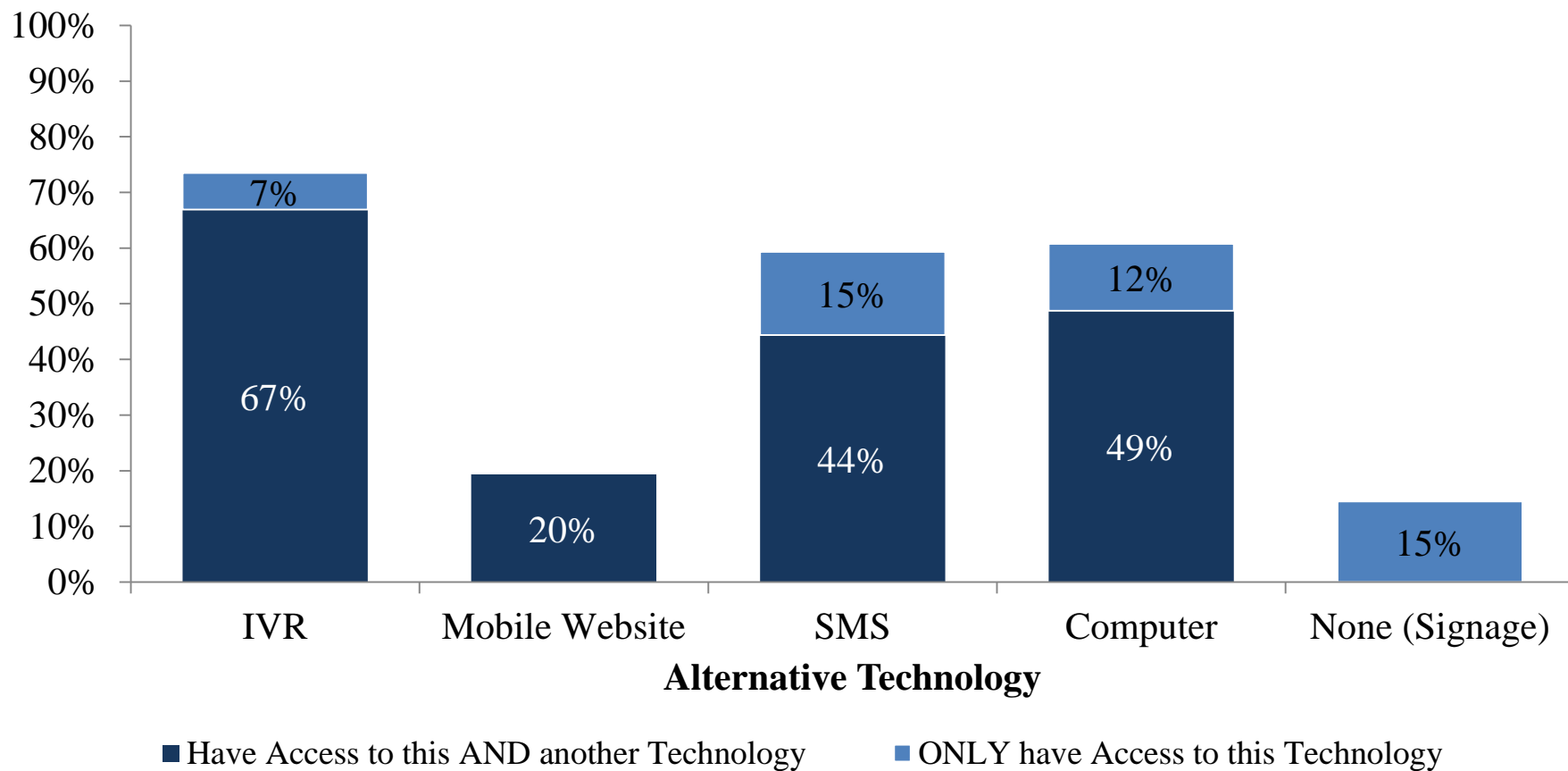
Summary / Suggestions

Summary

- Strong trend toward internet-based applications over traditional methods of communication

  – Trip planning behavior – shifting toward convenience, accessibility, immediacy of electronic information

- Dramatic increase in bi-modal cell phone use and access to the internet

- Increasing smartphone adoption

  – Growing potential for service improvements such as mobile tech apps (RTI) and revenue enhancements (smartphone integrated fare collection).

Suggestion

What is the Best Alternative Technology?

- Based on goals and resources of agency
- Subjective answer—technology preferences differs between users
- Our recommendations: In addition to smartphone apps,
  - Interactive Voice Response (IVR)
  - Computer-Based Website

Alternative Technology Availability

Internet Access on Mobile Device

Legend: ■ Yes ■ No

Agency	Yes	No
LAC MTA	76%	24%
St. Louis Metro	72%	28%
United States	56%	44%

2012   2012   2012

Alternative Technology Availability

Text Messaging on Mobile Device

Alternative Technology Availability

Internet Access on Computer
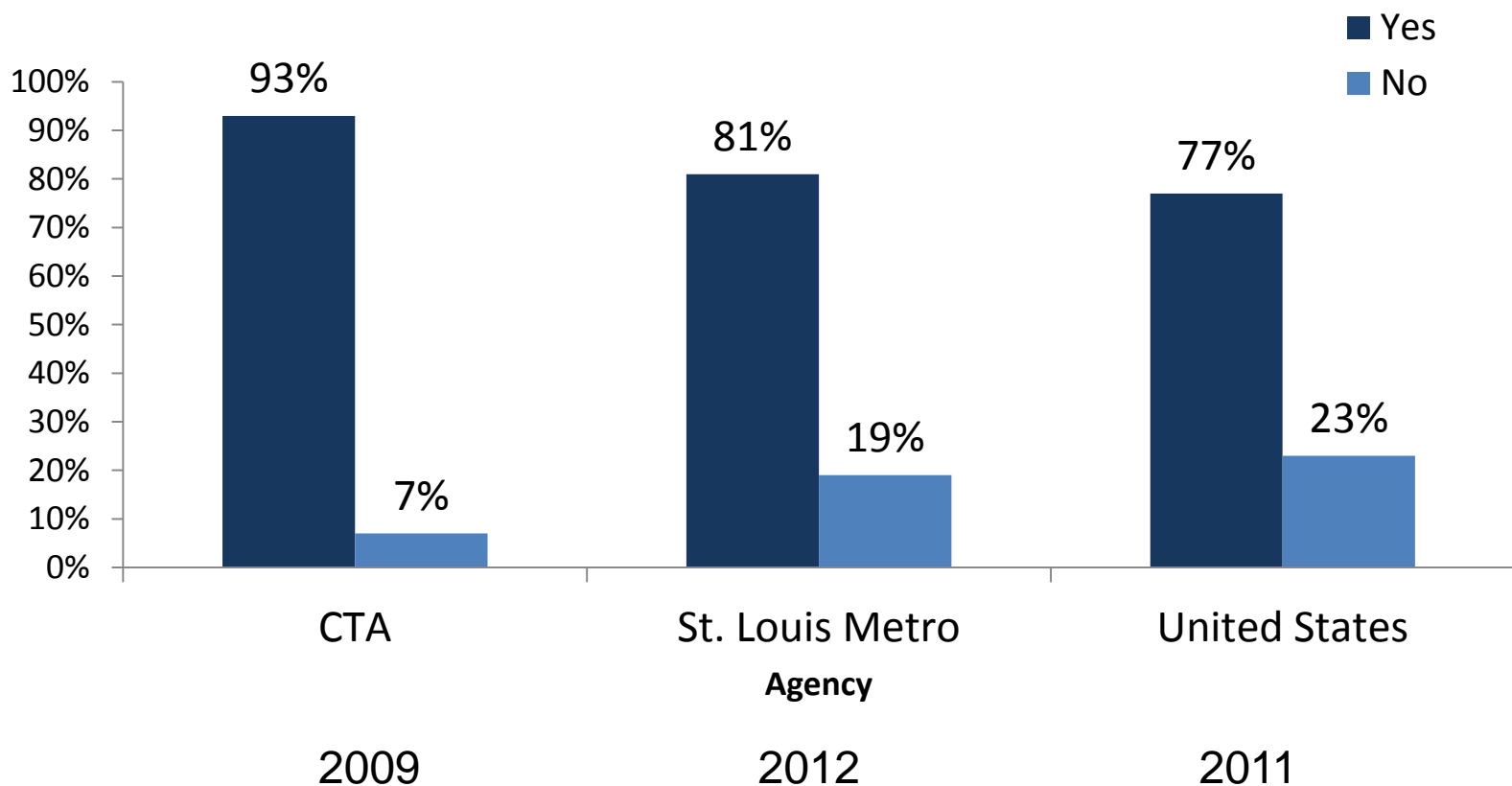
Legend: ■ Yes ■ No

Agency	Yes	No
CTA	93%	7%
St. Louis Metro	81%	19%
United States	77%	23%

2009 (CTA)   2012 (St. Louis Metro)   2011 (United States)
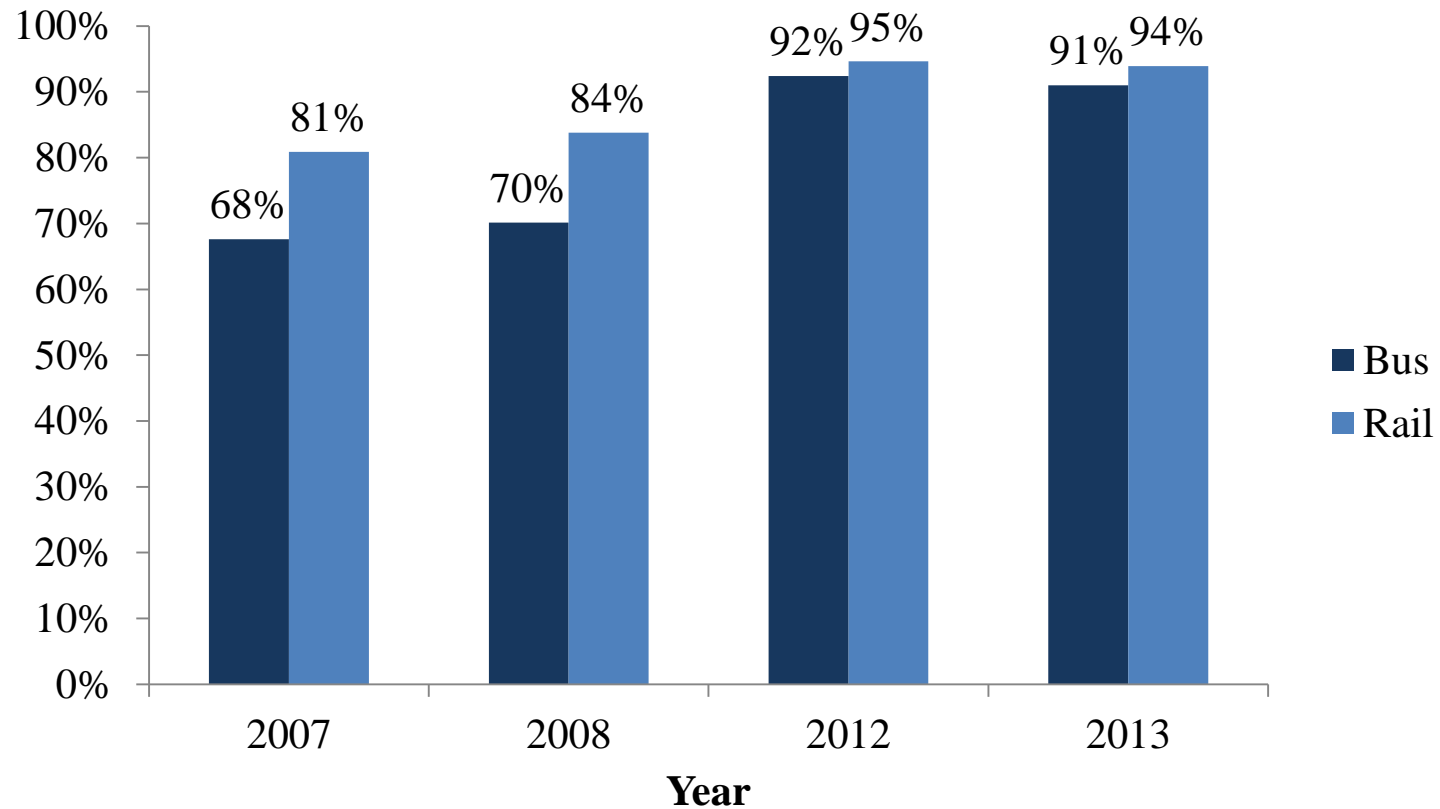
Mobile Technology Trend

Cell Phone Ownership

Mobile Technology Trend

Smartphone Ownership
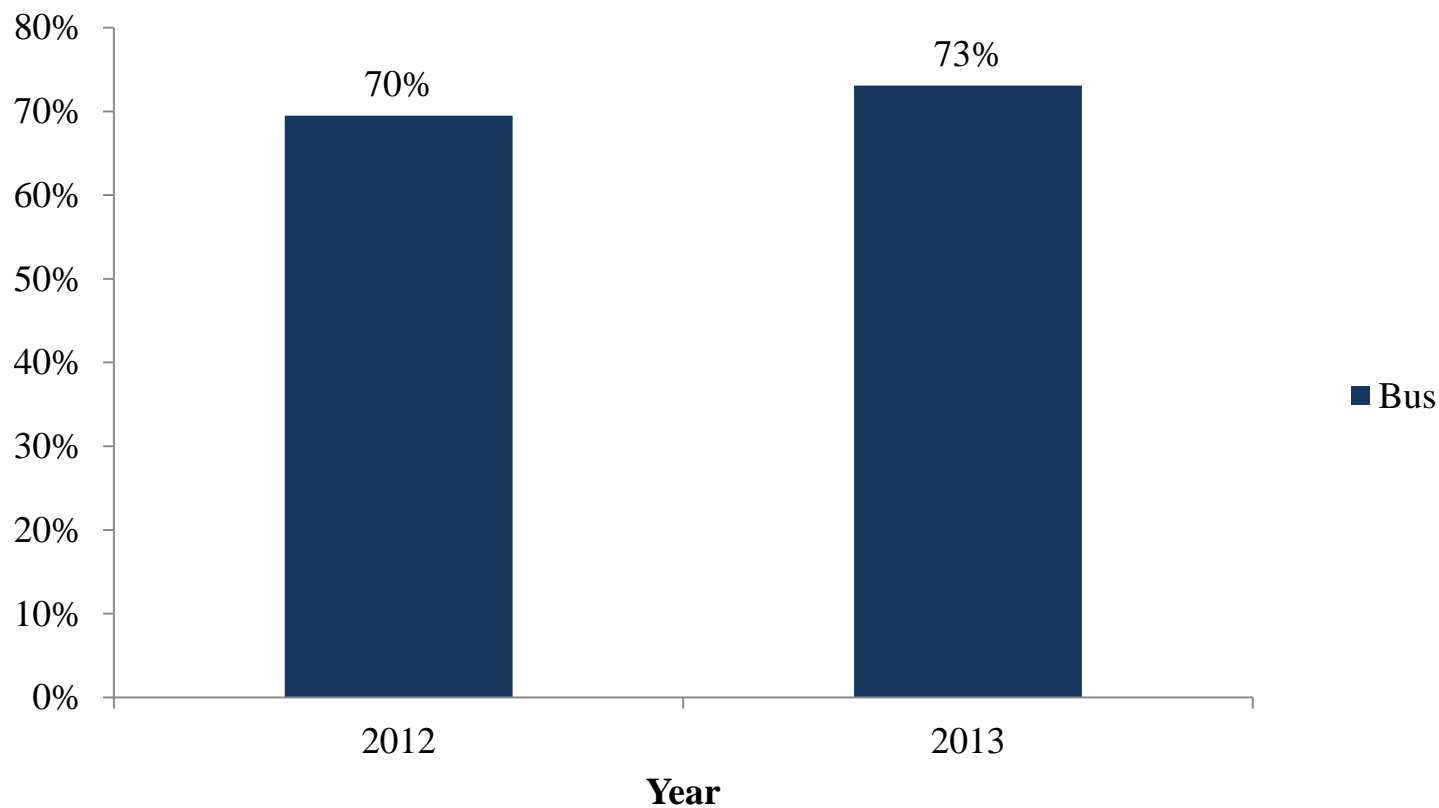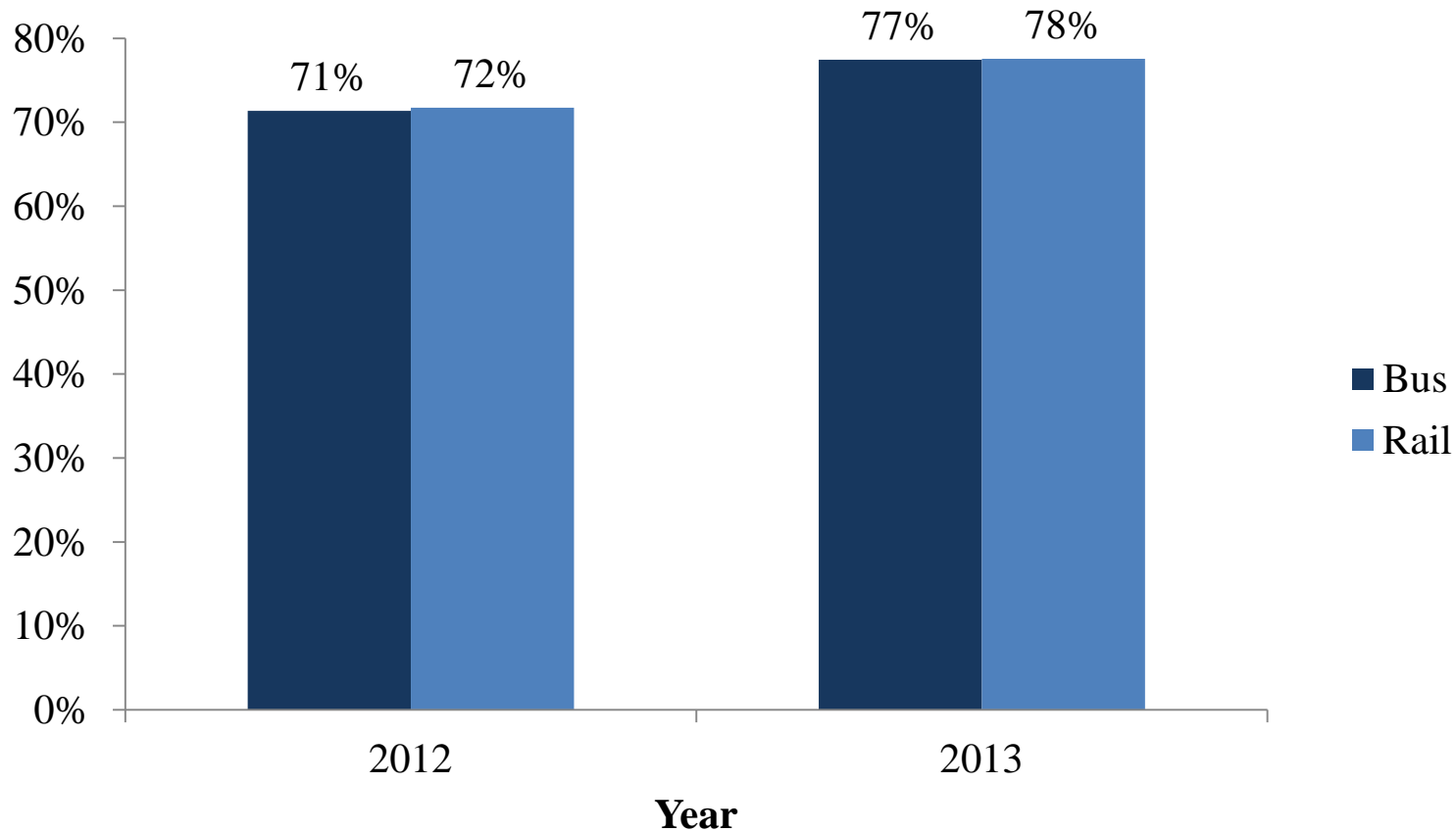
Mobile Technology Trend

Cell Phone Owners with Text Messaging on Device
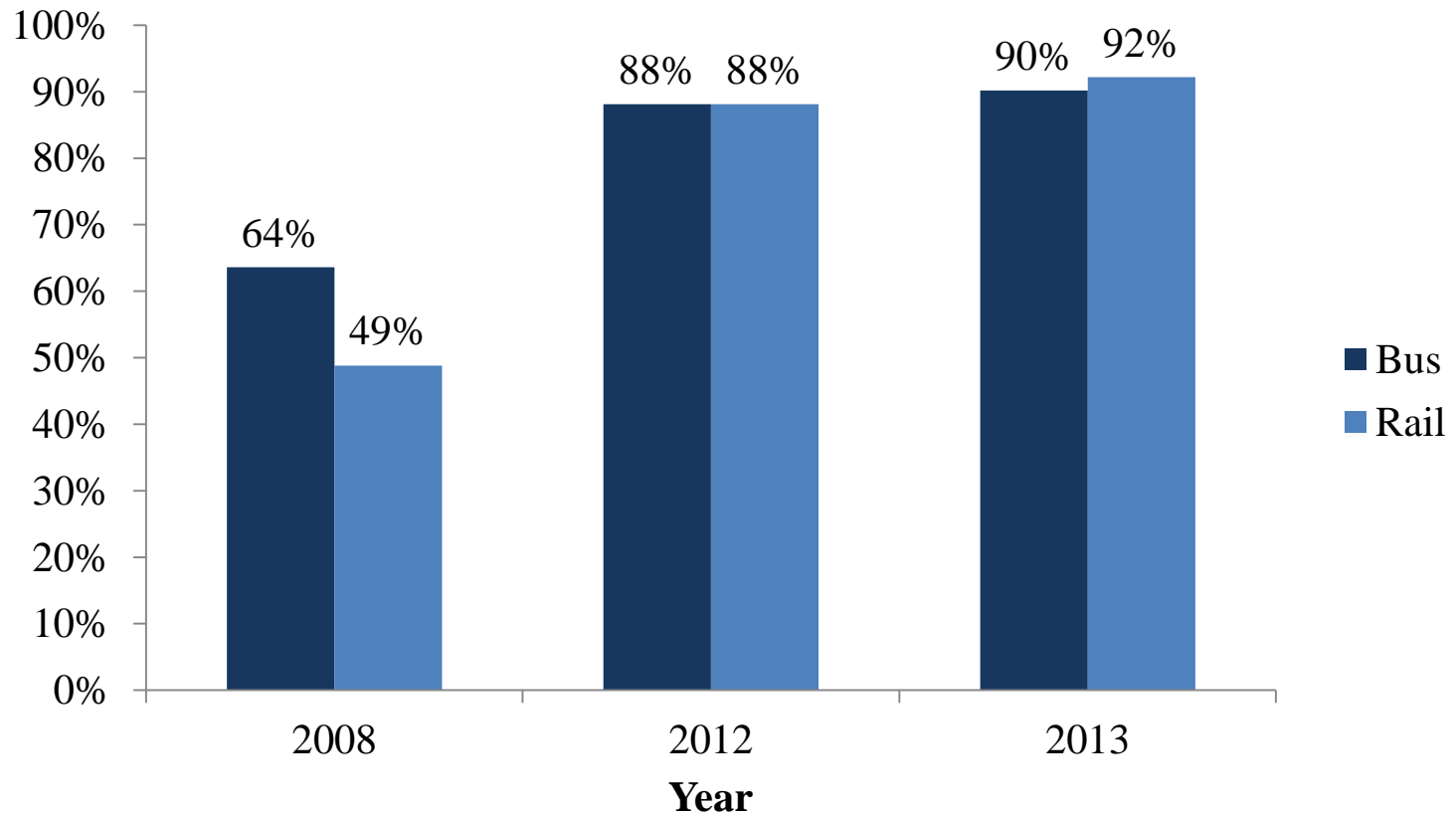
- Bus
- Rail

Year	Bus	Rail
2008	64%	49%
2012	88%	88%
2013	90%	92%

Mobile Technology Trend

Riders with Computer Internet Access

Chart showing percentage of riders with computer internet access by year for Bus and Rail:

Year	Bus	Rail
2007	69%	84%
2008	61%	77%
2012	81%	85%
2013	76%	86%

X-axis: Year

Background | National Trend | **Technology Utilization** | Trend Analysis | Implications