

Interrelation between Technological, Social  
and Economic Trends

## DELPHI SURVEY ROUND 1 RESULTS

**SMART 2008/0049**

Oxford Internet Institute

Ian Brown

Malte Ziewitz

With

SCF Associates Ltd

Simon Forge

and Individual Experts:

Karmen Guevara

Colin Blackman

Lara Srivastava

Motohiro Tsuchiya

Jonathan Cave

Ian Miles

The Delphi Survey was implemented and analysed by  
Rafael Popper of Manchester Institute of Innovation  
Research

Date 15 MARCH 2010

for DG Information Society and Media

Contract	EC Service Contract, SMART 2008/0049
Document date	15 MARCH 2010, version 1
Document reference	Results of Round 1 of Delphi Survey
Contractor	Oxford Internet Institute
Project manager	Ian Brown, OII
Workpackage manager	Simon Forge, SCF Associates Ltd
Delphi Survey team	Simon Forge, Karmen Guevara, Lara Srivastava, Colin Blackman, Ian Miles and Rafael Popper (Survey Implementation and Analysis)
Delphi Survey Round 1 Results authors	Rafael Popper and Simon Forge



## Table of Contents

<b>Introduction to the First Round results and to the Second Round of the Delphi survey...</b>	<b>4</b>
<b>The First Round</b> .....	<b>4</b>
<b>The Second Round</b> .....	<b>4</b>
<b>Section 1: Usage, users and expectations</b> .....	<b>5</b>
<b>General usage</b> .....	<b>5</b>
By 2020, the Internet will become vital for the vast majority of people .....	5
By 2020, between 11-50% of a person's day will be directly influenced by the Internet .....	5
By 2020, the Internet will permeate most aspects of our lives.....	6
By 2020, socio-economic use of the Internet will by far exceed political usage.....	7
By 2020, most government services will use the Internet to interact with people .....	7
By 2020, the Internet will impact most stages of learning and education processes .....	8
By 2020, politicians and governments will significantly use the Internet to influence politics ..	8
<b>Business usage</b> .....	<b>9</b>
By 2020, the Internet will become vital for the vast majority of business functions.....	9
<b>Users</b> .....	<b>10</b>
By 2020, wealth and education level will remain important causes of the digital divide .....	10
By 2020, Internet use will reach 75% of the EU population.....	10
By 2020, low cost and user-friendliness are key issues for a "socially-positive" Internet.....	11
<b>Functionality and human interface expectations</b> .....	<b>12</b>
By 2020, mobile Internet will be available throughout the EU.....	12
By 2020, most citizens will trust online transactions and financial services .....	12
By 2020, the Internet will not achieve acceptable levels of privacy or crime prevention .....	13
By 2020, the Internet will not be secure and reliable enough for vital services.....	13
By 2020, average Internet use across the EU will exceed watching broadcast TV.....	14
By 2020, Internet may become the main TV channel.....	14
By 2020, image recognition and gesture detection may be widely used in the Internet.....	15
By 2020, the Internet will not be protected from critical failures or cyber-attacks.....	15
<b>Section 2: Exclusion, behaviours, global issues and governance</b> .....	<b>16</b>
<b>Exclusion</b> .....	<b>16</b>
By 2020, the Internet may or may not contribute to lessen the Exclusion Gap.....	16
By 2020, access costs and complexity will be key contributors to the Digital Poverty .....	16
<b>Sociological and psychological behaviours</b> .....	<b>17</b>
By 2020, Internet cultures will tend to be creative .....	17
By 2020, the Internet will form new adjunct to society with increased social interactions .....	17
By 2020, jobs and the economy are more likely to be dependent on the Internet .....	18
<b>Global issues</b> .....	<b>19</b>
By 2020, attempts will be made to apply more political control to the Internet.....	19
By 2020, global and economic conditions will accelerate Internet usage in many areas .....	19
By 2020, the Internet may or may not challenge capitalism and the corporate economy .....	20
By 2020, the Internet may or may not challenge the global balance in trade and power .....	20
<b>Governance</b> .....	<b>21</b>
By 2020, new governance structures will be needed for the Internet .....	21
By 2020, the Internet governance may not need to go to United Nations levels.....	21

<b>Section 3: Evolution, drivers and inhibitors.....</b>	<b>22</b>
<b>Evolution.....</b>	<b>22</b>
By 2020, the Internet may or may not see revolutionary changes.....	22
By 2020, the Internet will be a convenience, lifestyle and information management tool.....	22
By 2020, the appearance of multiple “Internets” will certainly surprise many .....	23
By 2020, the Internet may have tiers of value and privacy/security .....	23
By 2020, user generated content may dominate the Internet.....	24
By 2020, the “Internet of things” will become increasingly dominant .....	24
By 2020, Internet services will not be mainly paid for by subscription and advertising .....	25
By 2020, the Internet may be able to understand users’ requirements (using semantics) ....	25
By 2020, charging for Internet applications which are "free" today will be controversial .....	26
By 2020, an Internet divided into paid-for and a few free services will be controversial .....	26
By 2020, the Internet will be the TV channel of choice, with a virtual VCR.....	27
<b>Drivers of success.....</b>	<b>27</b>
By 2020, e-literacy will be a key driver of the take up of the Internet.....	27
By 2020, general levels of education will be a key driver in the take up of the Internet .....	28
By 2020, addressing poverty and social inequality will drive the take up of the Internet.....	28
<b>Inhibitors of success.....</b>	<b>29</b>
By 2020, uncertainty over use of personal data and privacy will inhibit Internet use .....	29
By 2020, new and unexpected threats may inhibit Internet use .....	29
By 2020, between 10-20% of the population will refuse to use the Internet .....	30
By 2020, government interventions to neutralize cyber-crime may inhibit Internet success .	31
<b>Appendix 1: Over 200 surprises that could shake the Internet.....</b>	<b>32</b>
<b>Appendix 2: Delphi Survey.....</b>	<b>43</b>
<b>Screenshot of Delphi Survey’s welcoming session.....</b>	<b>43</b>
<b>Screenshot of Delphi Survey’s Section 1 of 3 .....</b>	<b>44</b>
<b>Screenshot of Delphi Survey’s Section 2 of 3.....</b>	<b>45</b>
<b>Screenshot of Delphi Survey’s Section 3 of 3 .....</b>	<b>46</b>
<b>Screenshot of Delphi Survey’s closing session.....</b>	<b>47</b>
<b>Appendix 3: About the 235 Delphi respondents .....</b>	<b>48</b>

## Introduction to the First Round results and to the Second Round of the Delphi survey

### *The First Round*

Here we present the finding for the first round of the Delphi Survey. A total of 235 experts took part in the study (see Appendix 3).

These results have been used for our main project goal, the creation of scenarios about a future internet. Two other major sources were also used to form the scenarios as well as the results of this Delphi Survey First Round:

- Research on the many trends at a socio-economic level that will influence a future internet and also other projects looking at this subject, such as the Stanford 'Clean Slate' project.
- A major two-day workshop in September 2009 in Brussels with some 20 external experts which produced strong debate and helped us to reshape our ideas, in some ways completely.

All of this work has been to put together in an initial analysis, an Interim Report, soon to be released, whose core is a set of early scenarios.

### *The Second Round*

In the second round of this Delphi survey we wish you to analyse this series of early scenarios, based on the first round's results given here plus the extra socio-economic research and our September Brussels workshop. So we will present five scenarios for you to consider and critique. These may seem to be extensions in particular directions but this is to make them identifiably different so that particular characteristics can be clearly seen, although overlaps may exist while combinations of several scenarios may be preferred.

The **survey** and the **report** are available at:

<http://www.4-sight-group.org/oii/futureinternetdelphi>  
<http://www.4-sight-group.org/oii/futureinternetdelphireport.pdf>

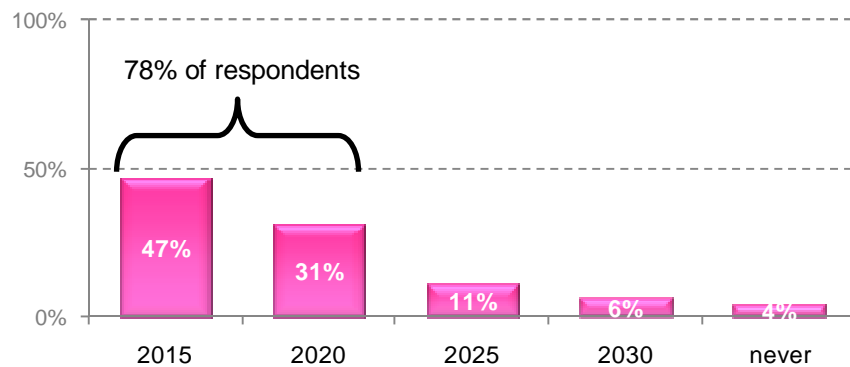
## Section 1: Usage, users and expectations

### General usage

**By 2020, the Internet will become vital for the vast majority of people**

**Question 1.1.1**

*When will the Internet become vital for the vast majority of people in ordinary everyday living?*

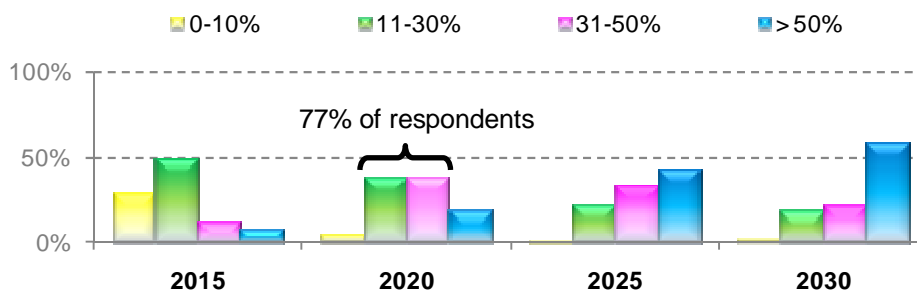


235 respondents

**By 2020, between 11-50% of a person's day will be directly influenced by the Internet**

**Question 1.1.2**

*What percentage of an average person's day will be directly influenced by the Internet, by being online and in other ways associated with the Internet?*

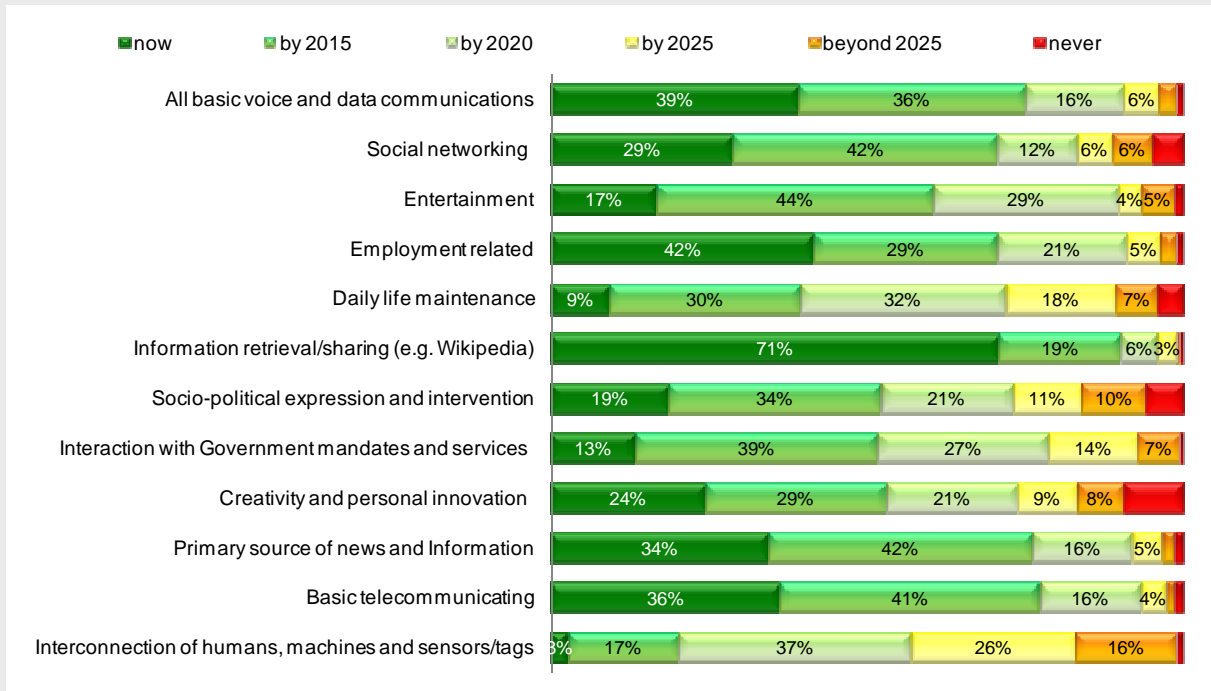


223 respondents

### By 2020, the Internet will permeate most aspects of our lives

**Question 1.1.3**

*Which is, in your view, the most important role of the internet TODAY and in the future in terms of becoming a basic lifestyle/workstyle factor?*

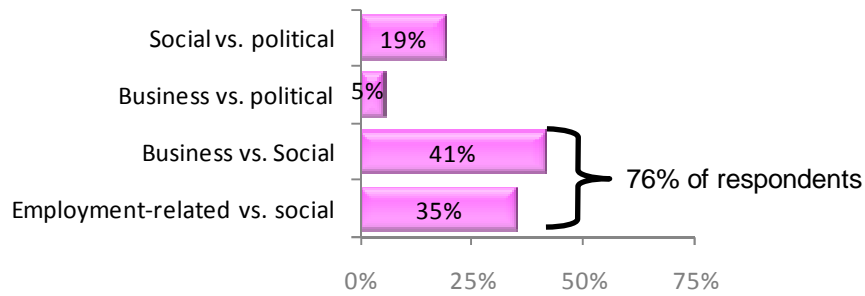


235 respondents

### By 2020, socio-economic use of the Internet will by far exceed political usage

**Question 1.1.4**

*In 10 years time, which will be most important use of the Internet, if we compare them, for most people?*

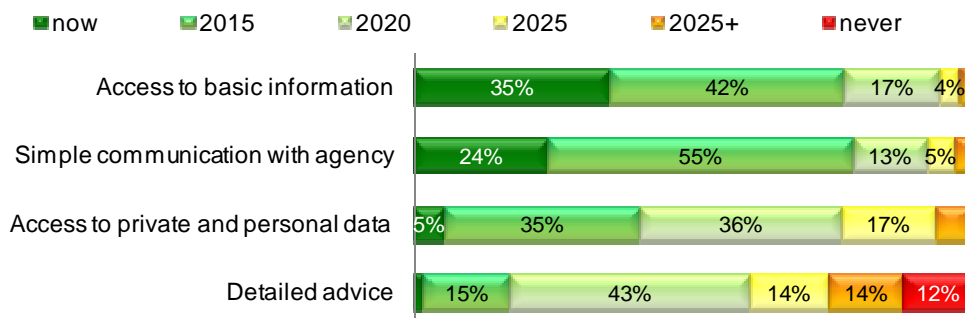


212 respondents

### By 2020, most government services will use the Internet to interact with people

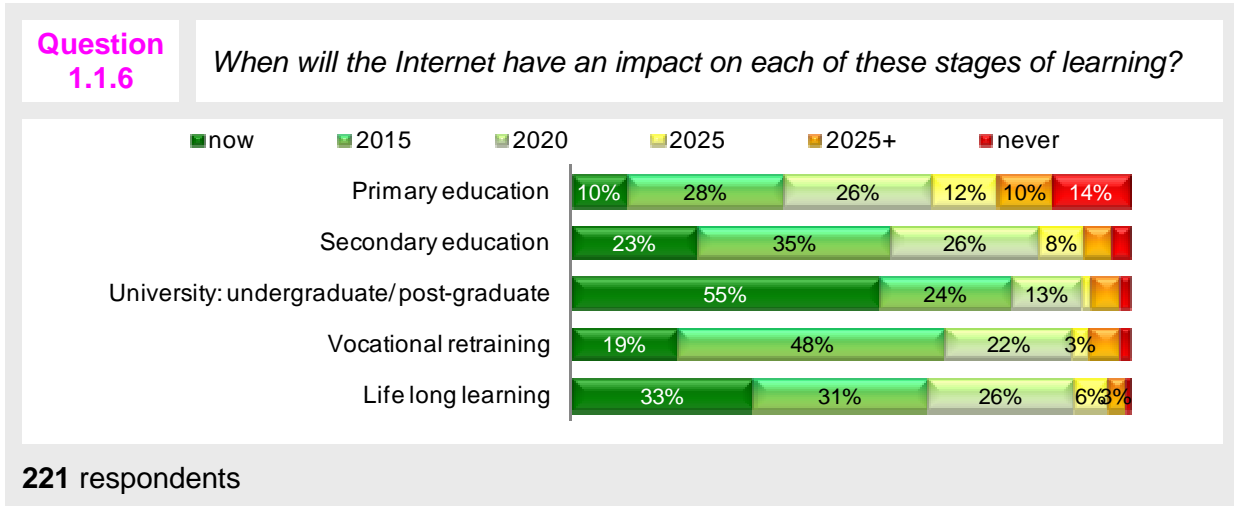
**Question 1.1.5**

*Which of the following forms of government service interaction would future Internet usage entail, and when, for the majority of ordinary people as the MAIN form of interaction?*

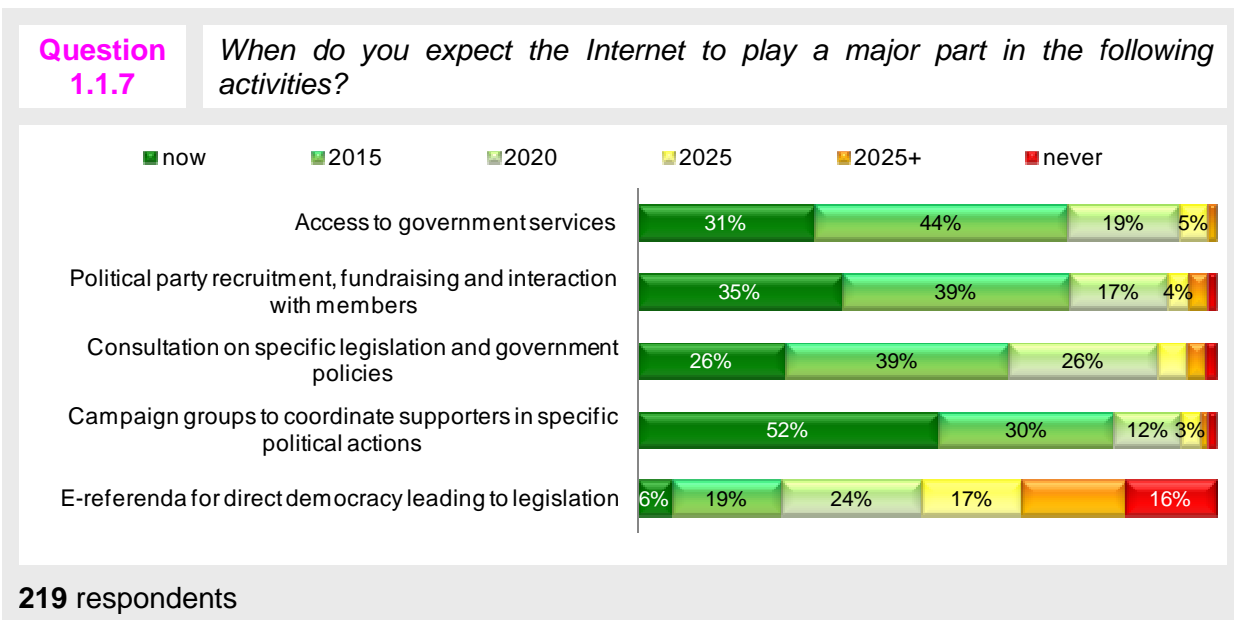


222 respondents

### By 2020, the Internet will impact most stages of learning and education processes



### By 2020, politicians and governments will significantly use the Internet to influence politics

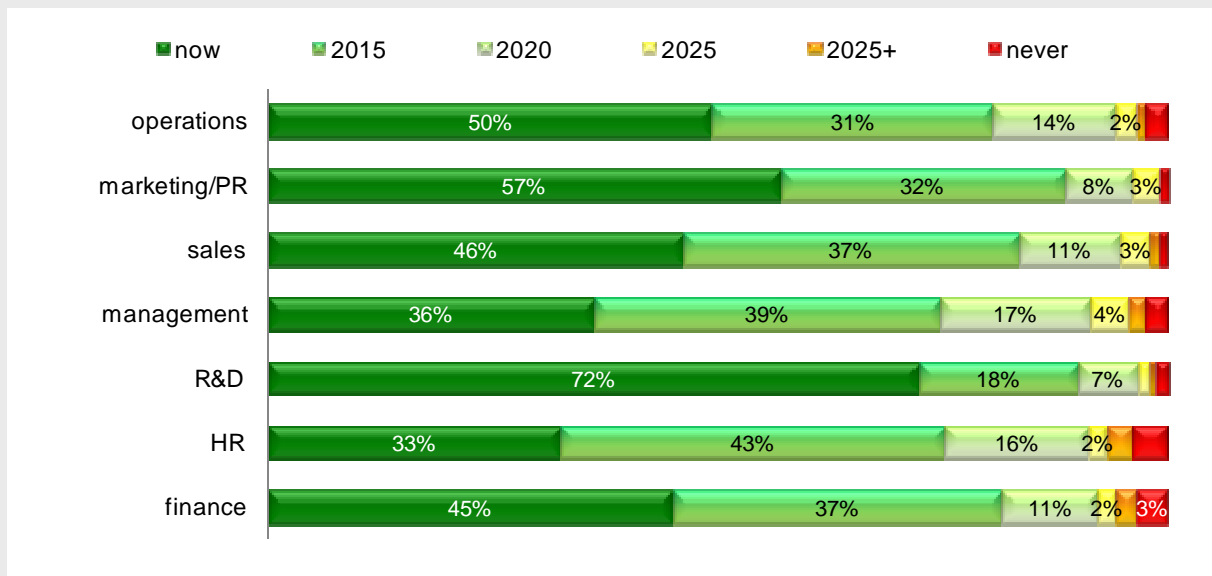


## Business usage

**By 2020, the Internet will become vital for the vast majority of business functions**

**Question 1.2.1**

*When does the Internet become as vital as electricity for each of these business functions?*



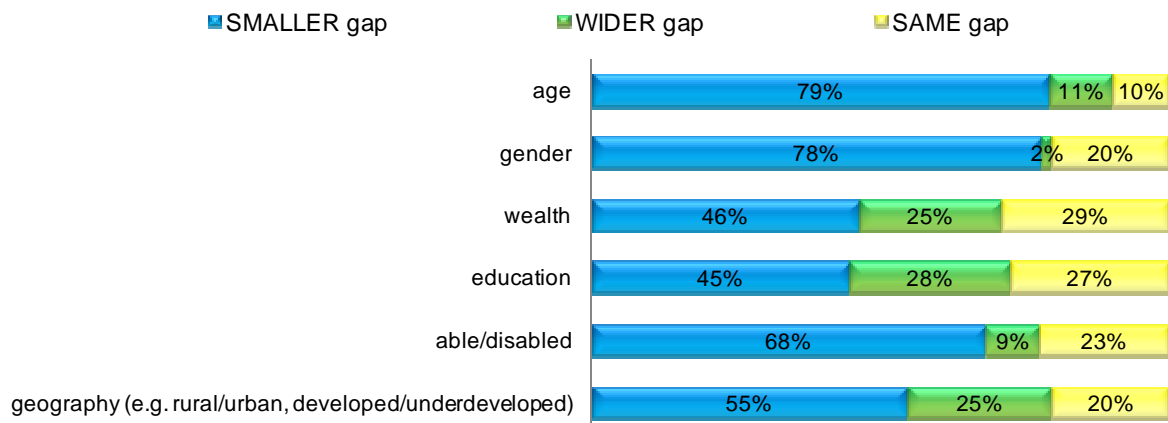
206 respondents

### Users

**By 2020, wealth and education level will remain important causes of the digital divide**

**Question 1.3.1**

*By 2020, will the gaps we see due to each of the current causes of the digital divide be the same as today?*

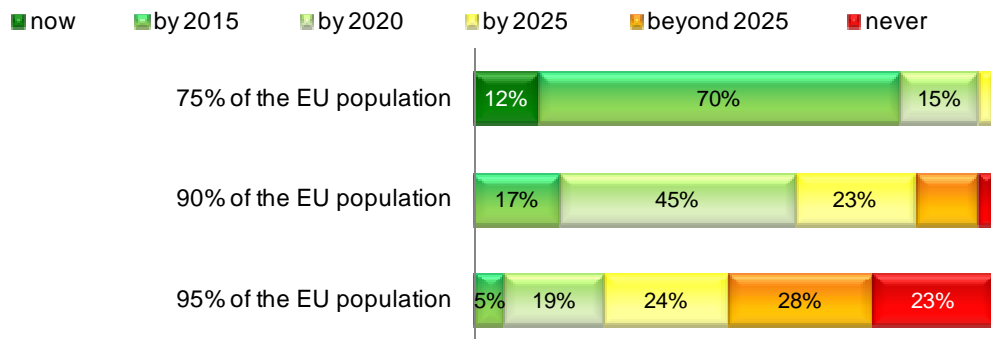


206 respondents

**By 2020, Internet use will reach 75% of the EU population**

**Question 1.3.2**

*The percentage of the EU population currently using the Internet is 60%. When will Internet use reach 75%, 90%, 95% of the EU population?*

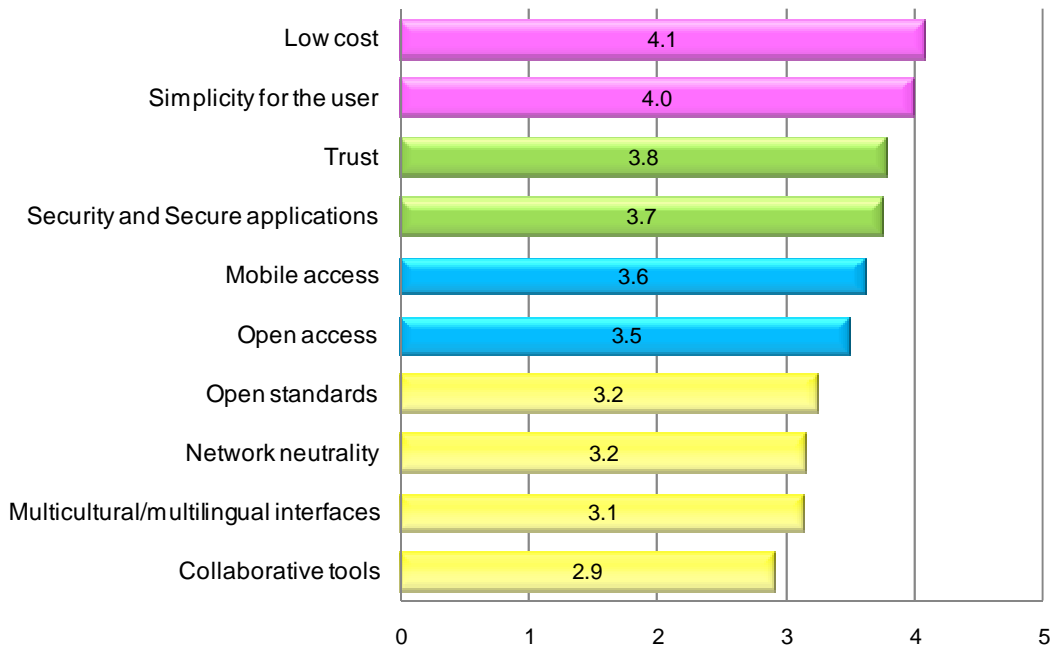


212 respondents

## By 2020, low cost and user-friendliness are key issues for a "socially-positive" Internet

**Question 1.3.3**

*Which of the following issues will be more important for a "socially-positive" development of the internet over the next decade? Please rate them from 5 to 1 with 5 = high impact/important and 1 = low impact/unimportant*



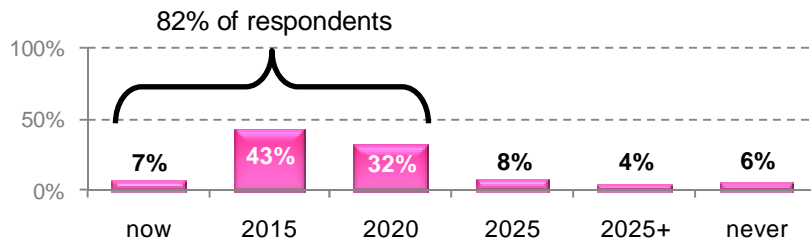
215 respondents

## Functionality and human interface expectations

### By 2020, mobile Internet will be available throughout the EU

**Question 1.4.1**

*When will a mobile Internet be available throughout the EU, via a mobile handset as the most common Internet access mode?*

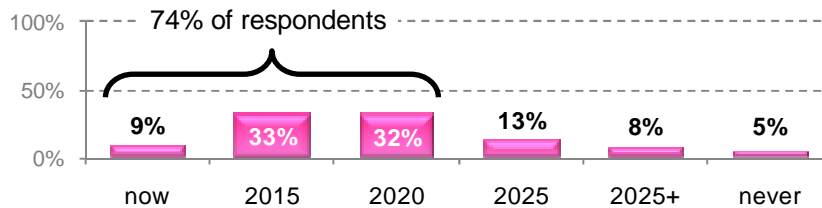


211 respondents

### By 2020, most citizens will trust online transactions and financial services

**Question 1.4.2**

*When will the Internet provide an environment where the majority of citizens feel confident in conducting transactions and using financial services online?*

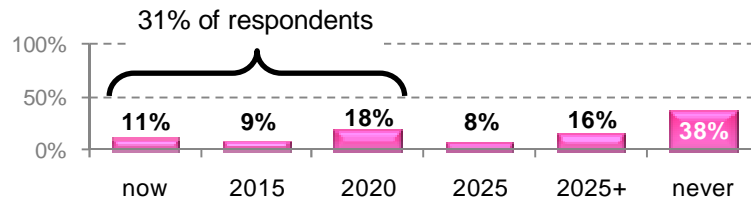


213 respondents

## By 2020, the Internet will not achieve acceptable levels of privacy or crime prevention

**Question  
1.4.3**

*When will the Internet provide acceptable levels of privacy and minimal risks of criminality?*

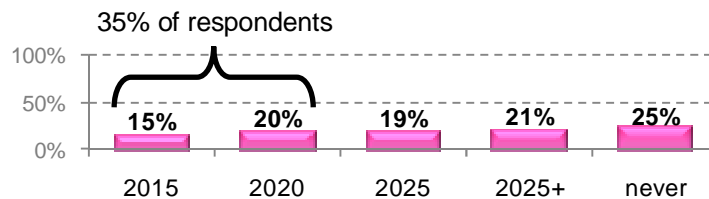


212 respondents

## By 2020, the Internet will not be secure and reliable enough for vital services

**Question  
1.4.4**

*Will the Internet ever be secure and reliable enough for vital services in which lives could be lost (by malware or malfunctioning), e.g. remote tele surgery or air traffic control? If it does become secure enough, when will this be?*

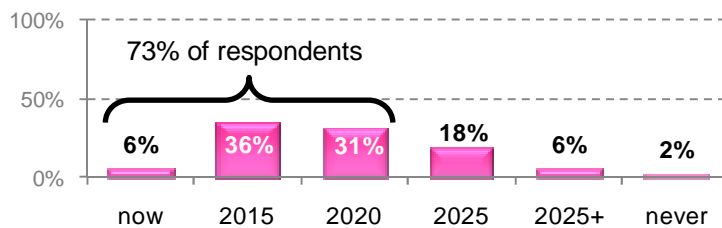


208 respondents

### By 2020, average Internet use across the EU will exceed watching broadcast TV

**Question 1.4.5**

*When will average Internet use across the EU exceed watching broadcast TV? Note: Internet usage includes watching TV over the Internet as well as other pursuits, e.g. games, music, etc.*

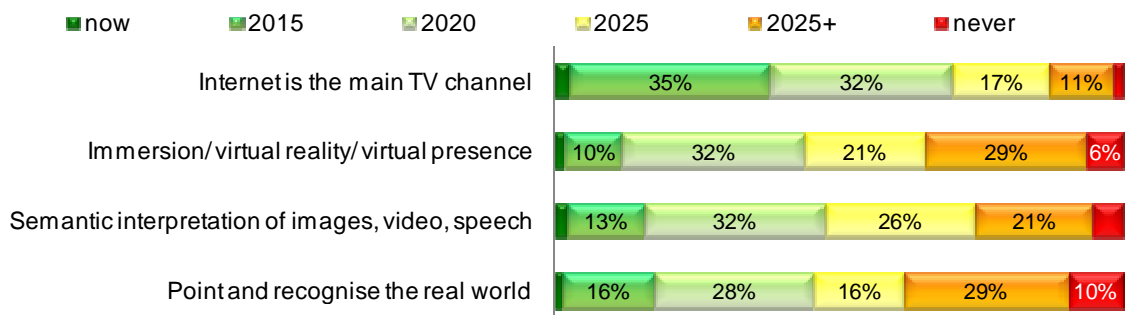


208 respondents

### By 2020, Internet may become the main TV channel

**Question 1.4.6**

*When will a wider capability Internet with more interactive media become available to the majority of the EU population?*

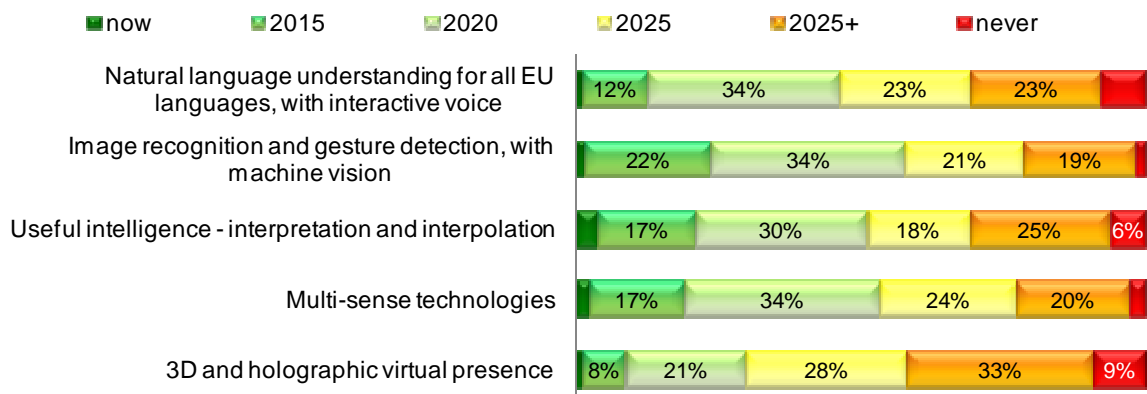


210 respondents

## By 2020, image recognition and gesture detection may be widely used in the Internet

**Question 1.4.7**

*The Internet will become much easier-to-use, as we will interface in increasingly varied, sophisticated and intuitive ways compared to today. When might these interface extensions become widely used?*

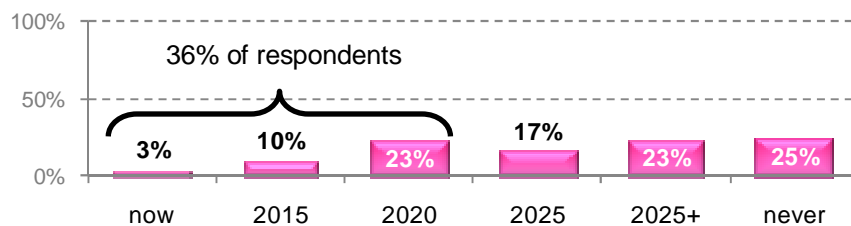


207 respondents

## By 2020, the Internet will not be protected from critical failures or cyber-attacks

**Question 1.4.8**

*When will far better resilience, end to end, and a network infrastructure protected from critical failures and cyber-attacks occur?*



200 respondents

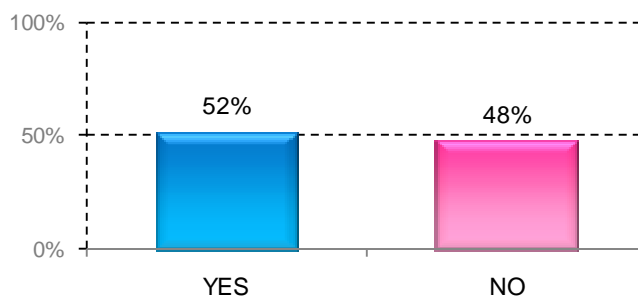
## Section 2: Exclusion, behaviours, global issues and governance

### Exclusion

By 2020, the Internet may or may not contribute to lessen the Exclusion Gap

**Question  
2.1.1**

*Will low cost telecoms and Internet usage bring the poor into the mainstream of the global economy so the gap between the haves and have-nots will diminish?*

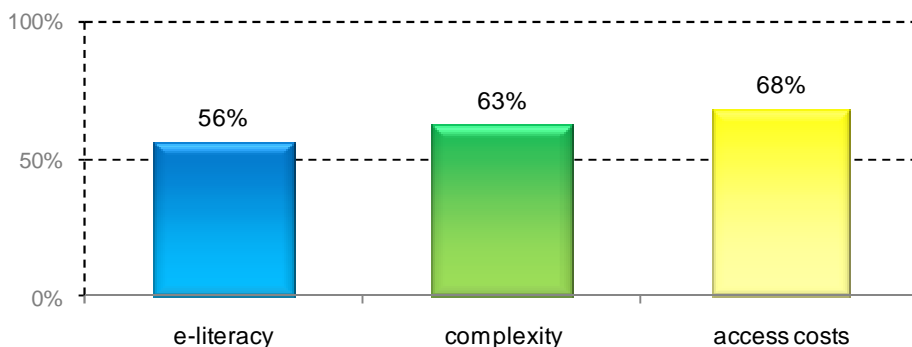


200 respondents

By 2020, access costs and complexity will be key contributors to the Digital Poverty

**Question  
2.1.2**

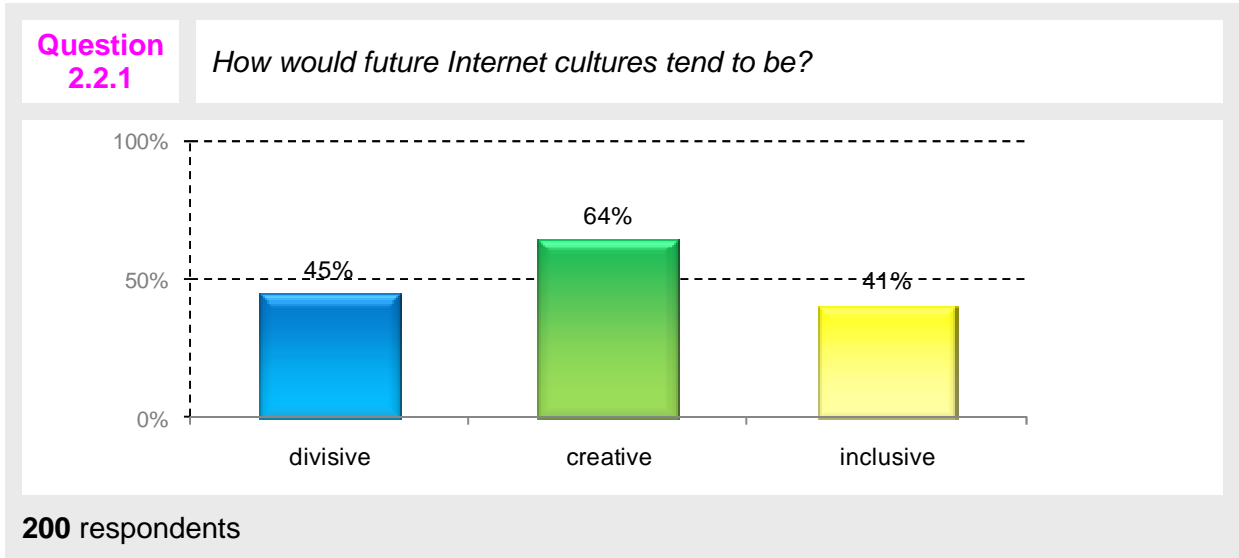
*Which of the following would contribute to creating the digital poor?*



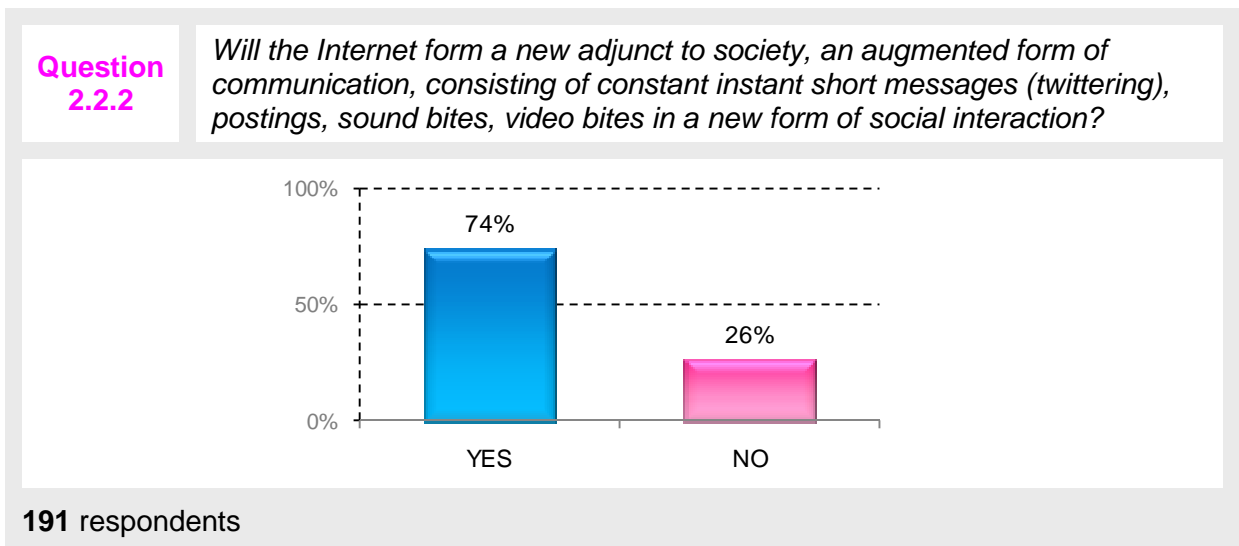
200 respondents

## Sociological and psychological behaviours

**By 2020, Internet cultures will tend to be creative**



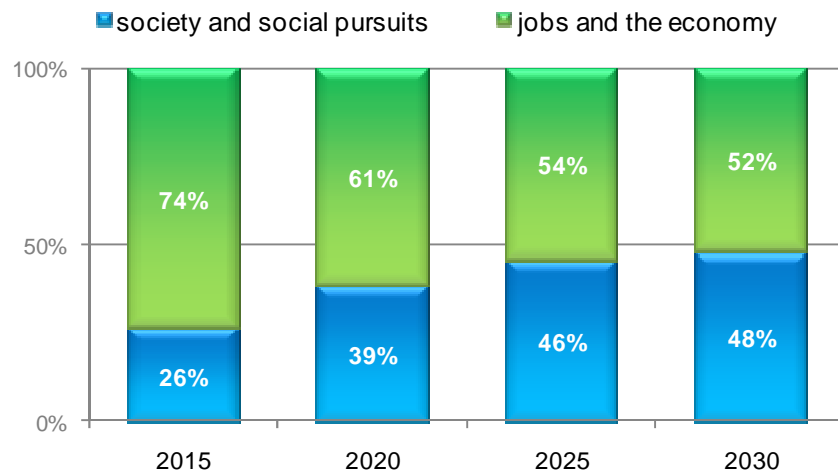
**By 2020, the Internet will form new adjunct to society with increased social interactions**



## By 2020, jobs and the economy are more likely to be dependent on the Internet

**Question  
2.2.3**

*Which part of human existence will be most dependent on the Internet?*



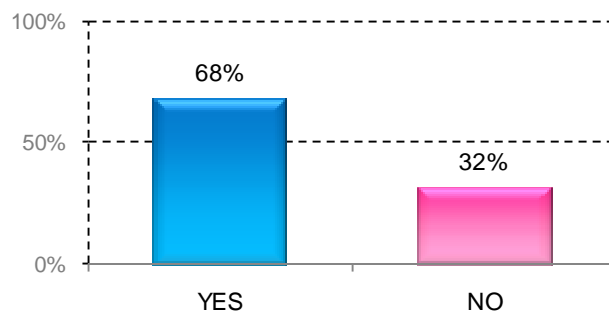
178 respondents

## Global issues

**By 2020, attempts will be made to apply more political control to the Internet**

**Question 2.3.1**

*Attempts will be made to apply more political control to the Internet especially by centralist regimes but will they fail in the face of a global seepage of the true state of affairs and the voice of the individual?*

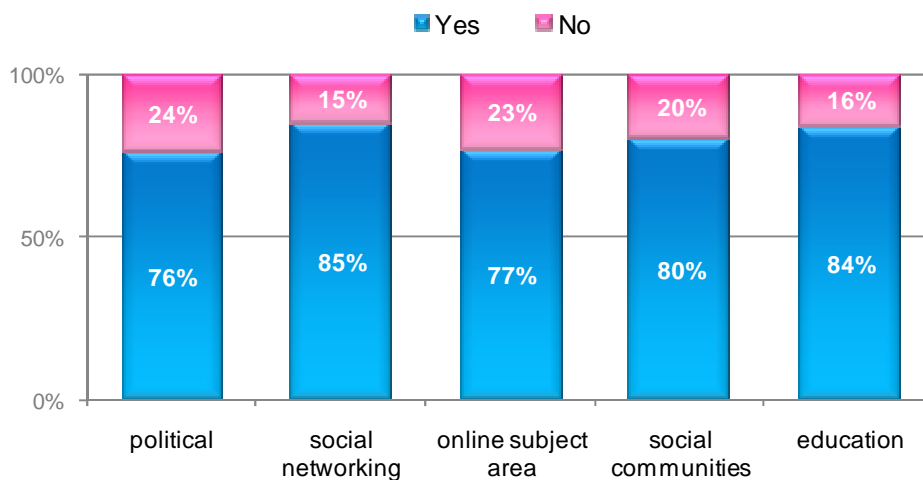


193 respondents

**By 2020, global and economic conditions will accelerate Internet usage in many areas**

**Question 2.3.2**

*Will global and economic conditions accelerate Internet usage in the following areas?*

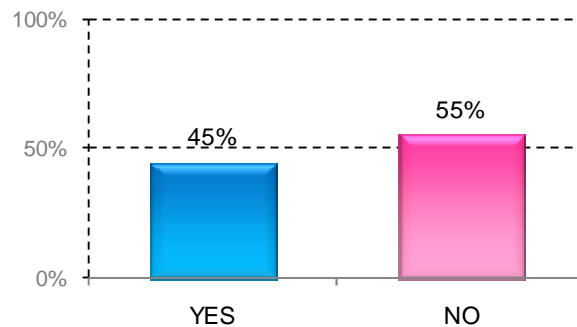


192 respondents

## By 2020, the Internet may or may not challenge capitalism and the corporate economy

**Question  
2.3.3**

*Will the Internet create a new form of capitalism, based more on individuals, SMEs and personal content - a form of post-corporate economy in which the larger organisations have less of a leverage of size?*

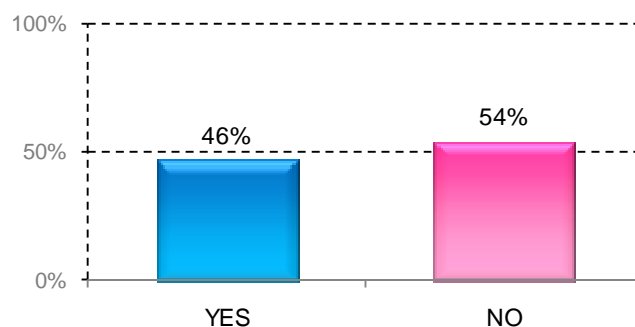


192 respondents

## By 2020, the Internet may or may not challenge the global balance in trade and power

**Question  
2.3.4**

*Will a new world balance in trade and power appear, using the Internet as a trading platform, that returns somewhat to the economic balance of 1800, with Europe and the USA as lesser players, while some more surprising players in Asia and LA come to the fore perhaps?*



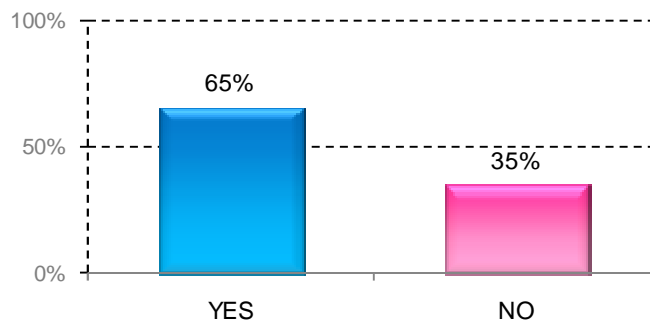
192 respondents

## Governance

### By 2020, new governance structures will be needed for the Internet

**Question  
2.4.1**

*Are new governance structures – federated global structures needed as the mass of users moves from the under a billion potential users in the EU and the USA to the 5 billion users elsewhere?*

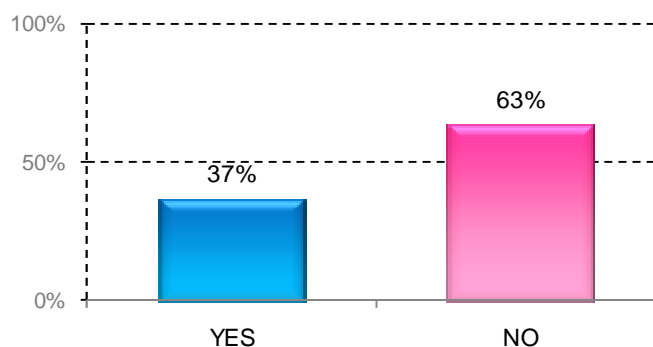


191 respondents

### By 2020, the Internet governance may not need to go to United Nations levels

**Question  
2.4.2**

*If spreading governance more widely than today is justified, then should it not go to UN levels, taking into account that there is a risk of lack of effective control?*

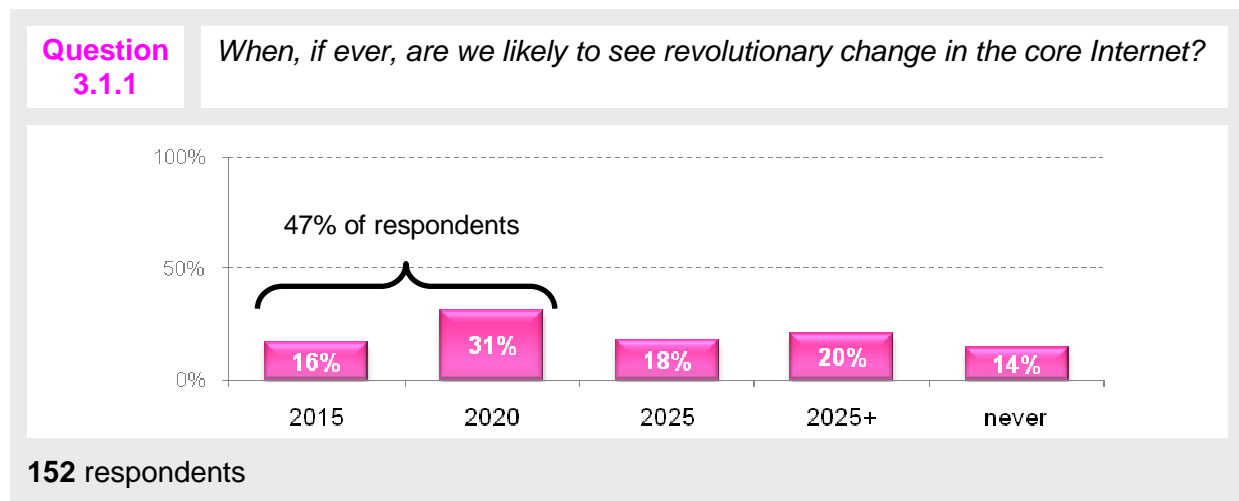


188 respondents

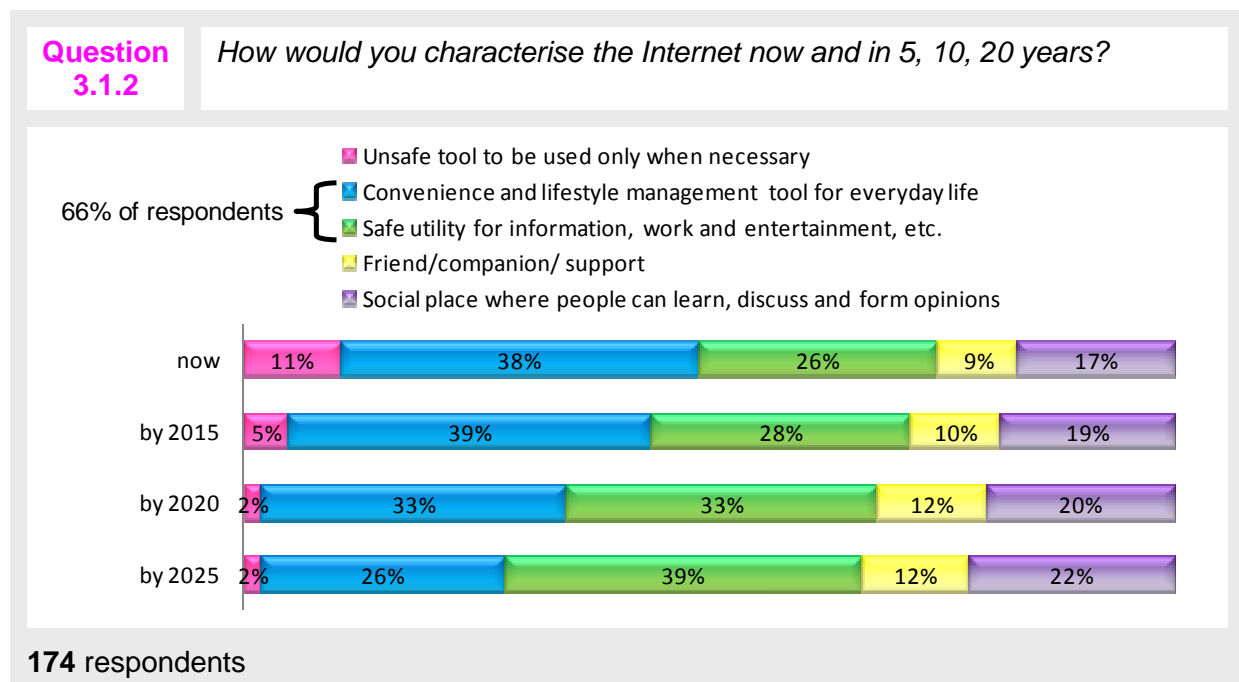
## Section 3: Evolution, drivers and inhibitors

### Evolution

#### By 2020, the Internet may or may not see revolutionary changes



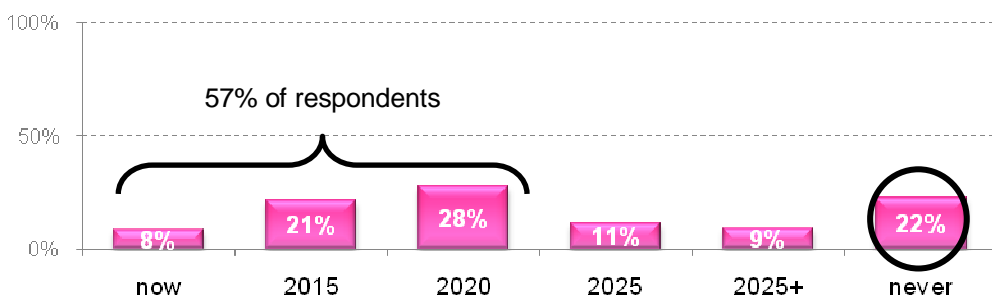
#### By 2020, the Internet will be a convenience, lifestyle and information management tool



### By 2020, the appearance of multiple “Internets” will certainly surprise many

**Question 3.1.3**

*Do you envisage the Internet evolution into separate more specific “Internets” with special attributes by usage – e.g. a secure e-commerce version, and/or a real-time safer/more resilient form for vital functions such as surgery, and/or a social networking Internet with privacy functions? If so, when do you envisage multiple Internets may occur?*



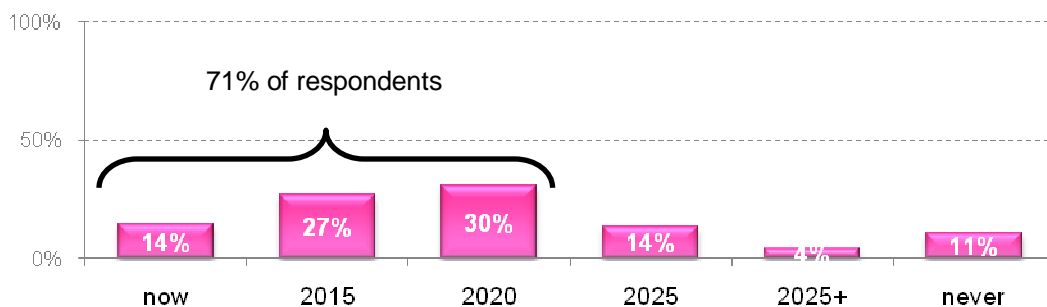
169 respondents

### By 2020, the Internet may have tiers of value and privacy/security

**Question 3.1.4**

*If there is a single Internet, will it have tiers of value and privacy/security? If YES, when might a tiered Internet appear?*

By tiers of value we mean that the Internet may be divided to offer content and applications of various levels of demand in terms of perceived quality - e.g. of popular acclaim, monetary value, fashion, etc. and also in terms of how private (and safe) usage is – thus we may have the tiered offering of cable TV or satellite premium channels. The differences between tiering and specific types of Internet are comparable to the differences between different modes of travel and different classes of travel, within each mode. Different Internets would have distinct limits, freedoms, advantages and attributes. Tiering implies premium services against standard offerings.

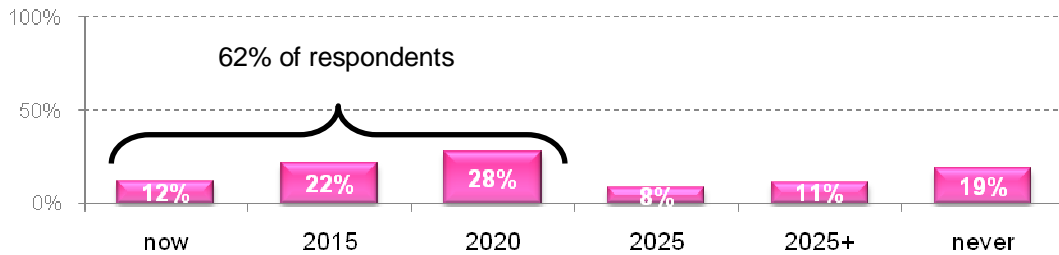


161 respondents

### By 2020, user generated content may dominate the Internet

**Question 3.1.5**

*User generated content could well be a major driver of Internet usage. When will user generated content become dominant, be it via broadcast (one-to-many push), or peer to peer, or via user-controlled pull?*

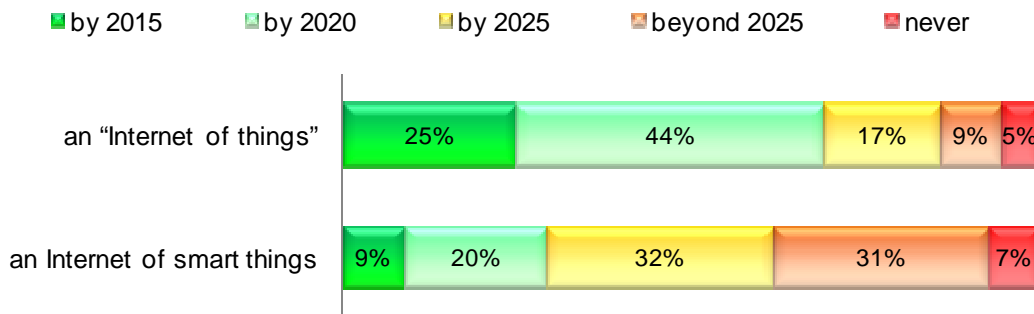


166 respondents

### By 2020, the “Internet of things” will become increasingly dominant

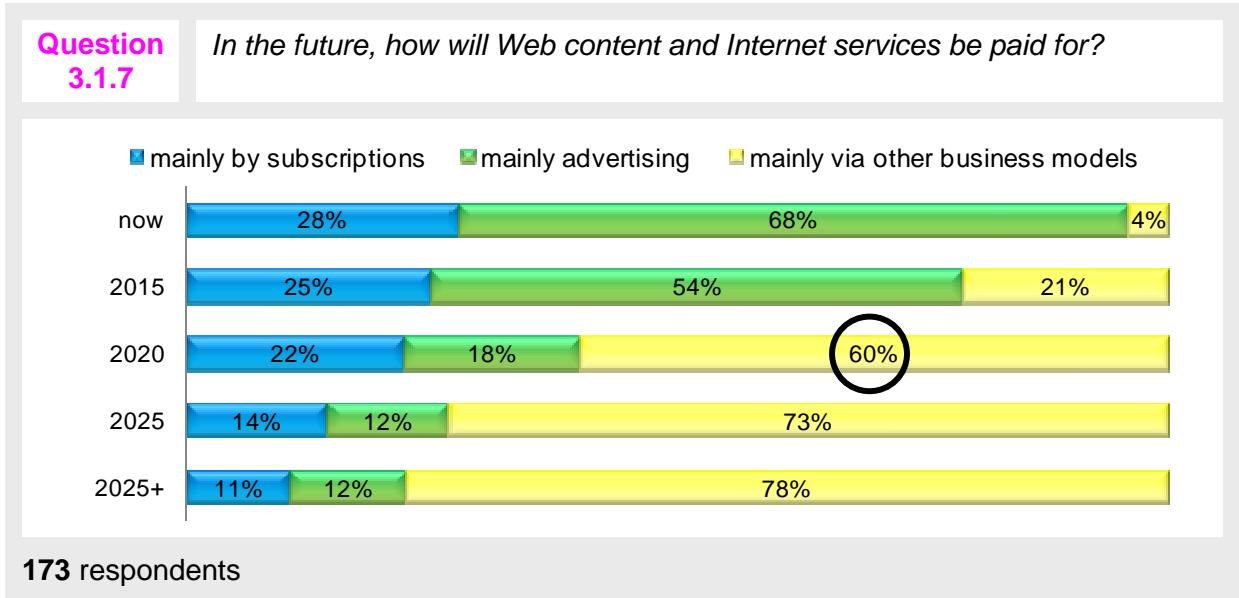
**Question 3.1.6**

*The Internet could become increasingly dominated by non-human users. Many see technologies such as RFID tags leading to an "Internet of things", with billions of objects reachable through the Internet. When could these alternative Internet user communities become significant in the overall Internet environment?*

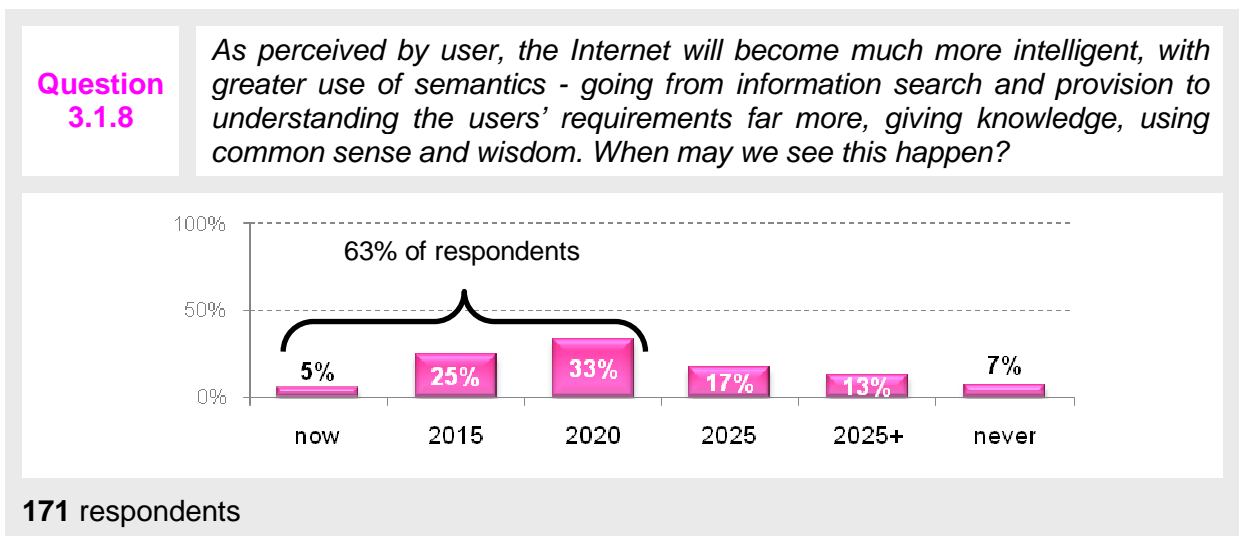


168 respondents

## By 2020, Internet services will not be mainly paid for by subscription and advertising



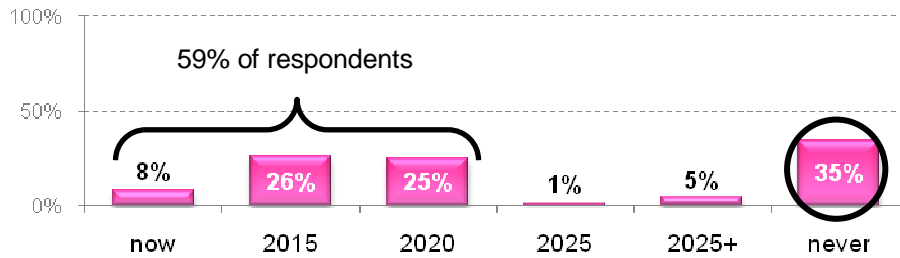
## By 2020, the Internet may be able to understand users' requirements (using semantics)



### By 2020, charging for Internet applications which are "free" today will be controversial

**Question 3.1.9**

*Will charging for using applications over the Internet which are "free" today become general - e.g. for news wires, search, social networking sites, etc?*

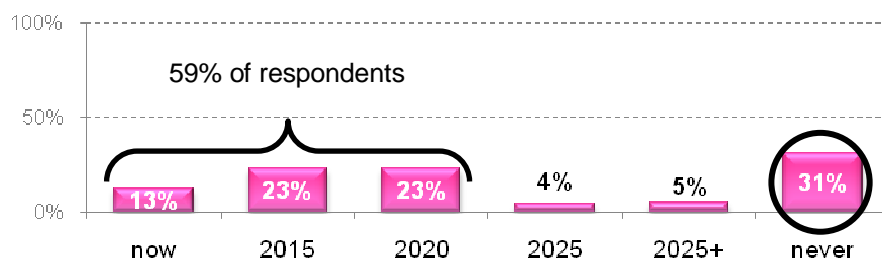


172 respondents

### By 2020, an Internet divided into paid-for and a few free services will be controversial

**Question 3.1.10**

*Will the Internet divide into two – firstly paid-for content and secondly a few selected essential but free services for education and health plus a social networking environment constructed by the users themselves without any intermediary ISP (like Facebook)?*

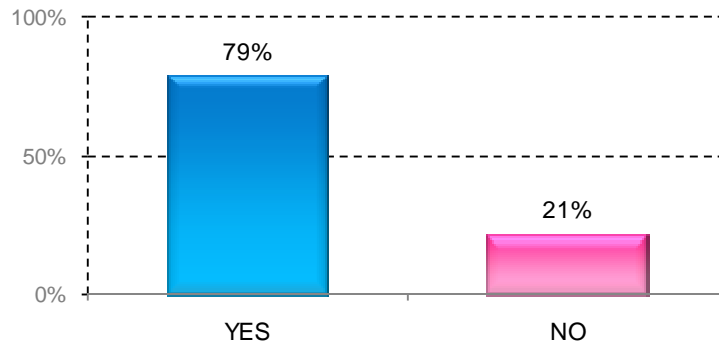


159 respondents

## By 2020, the Internet will be the TV channel of choice, with a virtual VCR

**Question 3.1.11**

*Will the Internet also be the TV channel of choice, with a virtual VCR?*



169 respondents

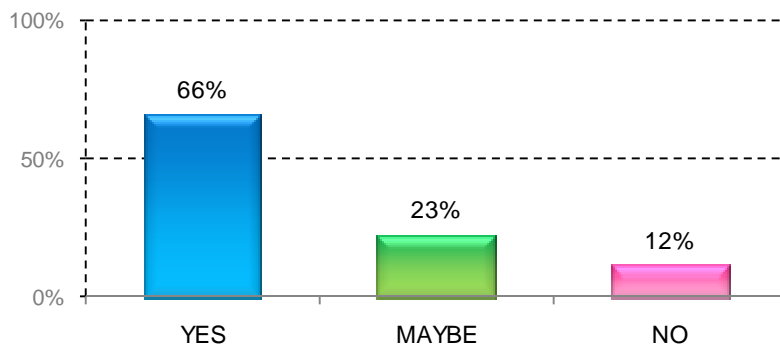
## Drivers of success

## By 2020, e-literacy will be a key driver of the take up of the Internet

**Question 3.2.1**

*Will e-literacy be a critical determining factor in the take up of the Internet?*

By e-literacy we mean firstly that people feel at home with digital technology - more specifically that they can comprehend information on a display and use it - and secondly they can have the skills needed to interact with a user device (mobile handset or computer) and can perform basic user tasks by manipulating the Internet services as they require.

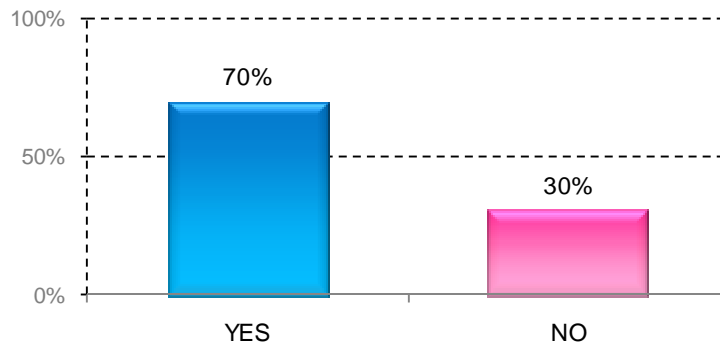


173 respondents

## By 2020, general levels of education will be a key driver in the take up of the Internet

**Question 3.2.2**

*Is Internet take-up and increasingly sophisticated use connected to general levels of education?*

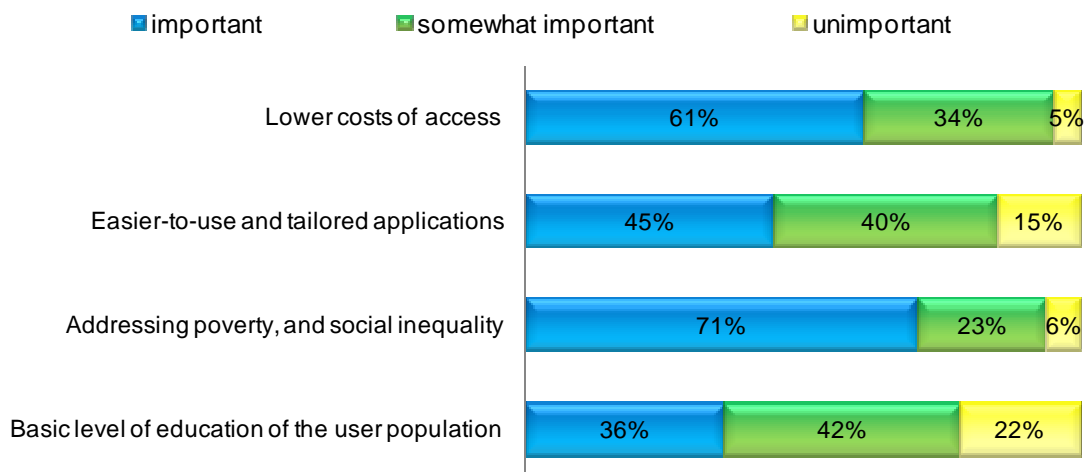


173 respondents

## By 2020, addressing poverty and social inequality will drive the take up of the Internet

**Question 3.2.3**

*Which factors are most important to drive Internet take-up from among the following?*



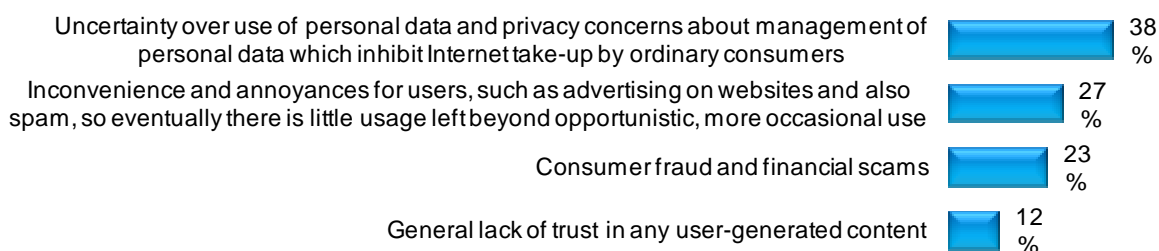
170 respondents

### Inhibitors of success

**By 2020, uncertainty over use of personal data and privacy will inhibit Internet use**

**Question 3.3.1**

*What are the major inhibitors of future Internet use?*



169 respondents

**By 2020, new and unexpected threats may inhibit Internet use**

**Question 3.3.2**

*Please rate the impact of each of these potential inhibitors to Internet success.*

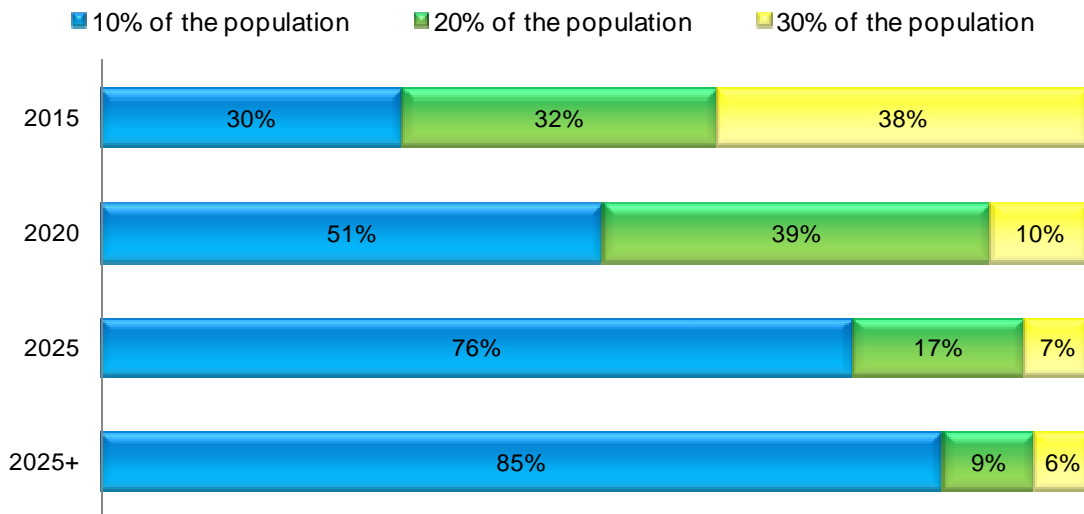
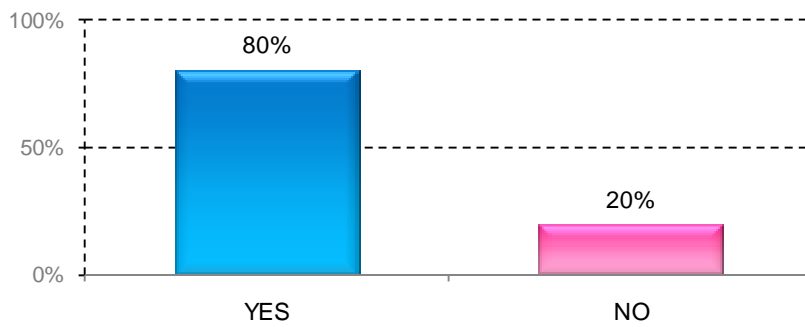


165 respondents

## By 2020, between 10-20% of the population will refuse to use the Internet

**Question 3.2.2**

*Will there always a segment of the population that refuses to use the Internet as it is considered as an unnecessary imposition? If so, please indicate the proportion.*

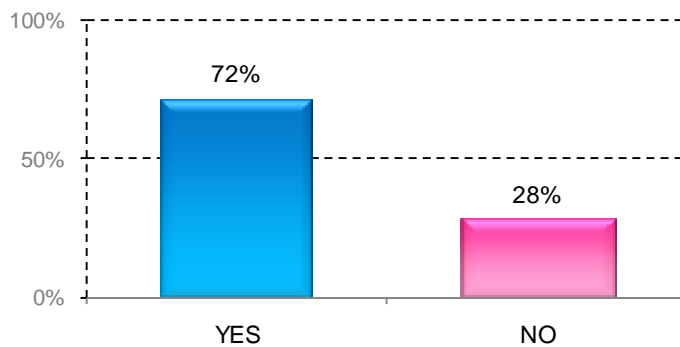


174 respondents

## By 2020, government interventions to neutralize cyber-crime may inhibit Internet success

### Question 3.3.1

*Cyber-crime and military cyber-attacks - for instance using zombies and botnets – may eventually incite governments to deliberately limit Internet capabilities and degree of use in the general economy and everyday life to protect citizens and infrastructures. Could government intervention inhibit the success of the future Internet in order to counteract such threats?*



169 respondents

## Appendix 1: Over 200 surprises that could shake the Internet

**NOTE:** The following Wild Cards and associated Weak Signals have been developed in cooperation with another European Commission funded initiative called **iKNOW**. For further information on this Blue Sky research project please visit [www.iknowfutures.eu](http://www.iknowfutures.eu)

Wild Cards	Associated (Weak) Signals
A critical factor could result when a 51% of the shares of an internet supplier company were in the power of a Sovereign fund belonging to anonymous hidden investors	Odd/strange stock exchange movements
A "snow crash" type of viruses in "internet of things" and virtual reality that is actually "virtual drug"	Genius outside the mainstream, an attack coming from terrorist cells
A huge problem of representativity: a very male, young, white domination of Internet control / standards organisation... Are standards an evidence of democratic activity?	An industry with less than 5% women! Have you ever been to a BarCamp, Hackathon, etc? + A few people are creating standards for the rest of the world...
A major virus bringing down the global transport layer for a sustained period of time.	Viruses from quasi-hostile locations of the globe where disaffected educated youth live (this is already happening with the connection of Eastern Europe, and it is getting worse as the poorer parts of the Muslim world get on line).
A new secure web emerges on the basis of abolished anonymity	Moves to introduce secure email
A new unforeseen service (such as WWW was)	Earlier publication of the work in research papers
A new world war with use of cyber warfare to disrupt internet communications	Growth of DDOS style attacks in conflict zones
A win on the side that favours governmental control of the Internet, causing major disruption while the Internet routes around this obstacle.	Disruption of the evolution of the Internet by appearance of control points in countries like China that decrease the ability of users to access resources and each other.
Accelerate W3 development (semantic web)	W3 consortium activities/protocols widely accepted
Act of war that broadly crashes Internet and associated computers using it	N/A
Administrative Gordian knots affiliated with lack of new IP addresses as IPv6 fails to diffuse.	Hoarding of IP addresses, and lack of consensus about what to do about it (This is already happening, of course).
After cities have evolved very differently from now as result of diffusion of telework (similar to effect of railways in early 20thC) then there is a sudden crisis including cost of internet plumbing	High volatility in 'cost of intangibles' league tables indexes such as residence location attractiveness indexes
An effective cryptographic/engineering solution to DDOS attacks which does not undermine privacy (i.e. an antidote to clamour for "accountability")	It would likely have to be viral, because of officialdom's distaste for strong PETS
Armed conflict between two players with important Internet infrastructures	N/A

Wild Cards	Associated (Weak) Signals
Attacks from countries with totally different ethical positions i.e. basic principles of honesty do not apply	N/A
Augmented reality becoming viable, with increasing miniaturisation and mobility, the Internet could be literally all around us	Smaller mobile devices, increased wireless coverage, emergence of new interface hardware (Minority Report devices)
Availability of affordable high speed satellite broadband service	Low cost launches
Avoiding taxation and central monitoring	Human history repeats itself. When the system becomes too intrusive, people will barter locally to avoid taxes and government controls.
Balkanization of Internet service providers into a series of non-interoperable boutique networks	development of alternate roots or competing standards
Battery breakthrough – orders of magnitude improvement in energy/mass	Watch the chemists
Big Brother is Watching You Scenario	Traceability of personal acts and actions.
Bigger Security	Lack of ethical codex
Breakdown of current internet governance structures and movement to government control	Agitation by ITU
Break-through that enables faster/cheaper infrastructure deployment in high-cost (rural, poor, bad-terrain) areas	Out of the R&D community
Business ecosystem where different companies, also in different sectors, do business together.	iPhone Applications
Cheap satellite communications	Increased private investment in satellite communications
China becomes the leading economy of the world	Not weak at all: just read the Economist
Cinema and entertainment crisis?/boom?	N/A
Clamp down by centralist governments trying to maintain social harmony in face of global warming symptoms.	Attempts to censor citizen access
Clearly, Gamma ray bursts would cripple the system. They seem inevitable.	We measure gamma rays and can identify sources close enough to instantly shut down global telecommunications
Climate Change	UK energy tax
Climate changes will lead to restrictions in use of energy	CO2 level in atmosphere
Collapse of internet	Continuous Prevarication in reaching technical architectural decisions
Collapse of the Internet of Things and threat to the entire internet, because of increased hacking and distrust of users	Successful cyber attacks, privacy intrusions
Competition in the Domain Name System (alternative to ICANN)	ICANN's continued unaccountability
Connectivity crisis	Availability

Wild Cards	Associated (Weak) Signals
Consolidation in telecommunications	N/A
Corporate attempts to seize the Internet	More mergers in the telecommunications industry
Cut off/darkening parts of world from global network	System failures
Cyber attack that paralyses the Internet for several weeks/months	Increasing volume of e-crime; recent denial of service activities that are 'state sponsors'
Cyber espionage	Unanticipated economic effects
Cyber terrorism	More attacks
Data overload	Collapse of GPS satellite network
Database security breaches of banks, hospitals, etc.	Transparency, immediate warning of breach
Deadly pandemic / mass population dislocation	Human factors (e.g. disease spread, Islamic terrorism and impact on population centres)
Decentralized economic activities	African and LA countries emerging first in niche economic activities
Decrease in magnetosphere causing increased solar radiation causing massive change in living habits	Drop in strength of magnetic field
Deliberate cyber attack by groups hostile to Western society	Cyber-competent terrorists
Disintegration of the global Internet (emergence of regional Internets)	Current policy in China and other countries
Disintegration of China	Agricultural failures in rural China
Disruptive global event that causes huge flash crowds on, e.g., news sites (like on September 11 <sup>th</sup> , 2001)	Preceding catastrophic event, sudden drastic shifts in traffic flows
Disruptive innovation that makes the present Internet unrecognizable and obsolete; something else will be called the Internet.	Abandonment of the IP protocol.
Distributed cyber attacks	N/A
Dominance of Chinese language on internet.	Quick economic development of China.
Dominational claims of over commercialisations	Selling and buying (with huge expectation on profits) internet "goods" that has been evolved by internet activities/societies... starts to work like locking pins due to claims....
Dramatic unattributed cyber attack/war that compels major countries to close down international Internet architecture.	Growth of low level cyber attack probes/hacking; global turmoil involving technologically skilled populations (i.e. India)
Dumping down of devices and applications.	More 'apps' that give individuals less choices.
Earthquake	1994 Kobe earthquake revealed power of networking among people inside/outside the damaged areas.
E-commerce and transactions management for large Business ecosystems: to manage the complexity of the Business Ecosystem.	Open the business to SMI and individual workers.

Wild Cards	Associated (Weak) Signals
Effective build up and use of saas and cloud based apps and services	Current initial products and services
Emergence of a new situated action paradigm in the design of ICT applications	Some new social computing systems are designed to support collaborative threads
EMP war or/and untrust due to the misusage by intelligent surveillance services	Change on earlier political positions/dominations / ever increasing efforts on issue by governments (not only China)
EMP-like impact that destroy the destroy nodes stores	Continuous failures to prevent harmful attacks on all-important systems connected to the I-Net
End of the present civilization	Global warming and possible pandemia
Energy crisis	Power consumption increase, no money for maintenance of infrastructure
Energy shortages	Rising energy prices
Ensuring as a basic legal principle that citizens/users can access the Internet and the services, applications and information / content that run on it.	N/A
Environmental crisis and need for effective and distributed cooperation (e.g. in environmental sensors or energy production)	Climate change, nuclear waste problems, overpopulation
e-terrorism	N/A
Evidence on harms due to WiFi being propagated (Electro-smog)	First studies producing challengeable results
Excessive surveillance and abuse of personal information and privacy by both government agencies and businesses—'The Numerati'...	"Privacy-get over it," said Scott McNealy, former CEO of Sun Microsystems.
Extreme weather events	Increased extreme weather conditions
Factoring/quantum computers cracking all known cryptography	Advances in cryptographical research
Failure to created renewable energy sources.	Rising energy prices
Far to strong interpretation of intellectual property rights	Downturn of YouTube like broadcasting due to no intended violations
Fast methods to break encryption escape from the NSA or similar government labs	Increased refusal of intelligence agencies to reveal data, and the methods of obtaining it, in court cases
Fragmentation	Ipv4 exhaustion, coupled with uneven adoption of Ipv6 (e.g., China/Japan moving quickly, western countries generally not)
Fragmentation of the Internet so that it is no longer a network of networks	Position of the Chinese government on internet governance/failure of US government to create a legitimate ICANN
Fragmentation of the WWW	Less dependence on the domain name system and more dependence on a proprietary search system
Geological instability	N/A

Wild Cards	Associated (Weak) Signals
Global catastrophes due to global warming	More floods, more storms
Global denial-of-service attack against the entire Internet through infection of large number of end hosts or routers running the same operating system, all featuring the same bugs	Attacks against update systems, proof-of-concept publications, preceding slower-spreading attacks that use the same exploit, further spreading of monoculture in (a) end systems, (b) router/switch manufacturers
Global failure in internet access to financial institutions	Hacking of several financial intranets in less than 6 months
Global organised crime	Increased down time of networks
Global power failure, global war, global water and food shortages, global warming, etc.	Moore's Law fails. Black Swans appear everywhere, prolonged global economic depression and failure of capitalism as we know it...
Global reversion into two major 'spheres of influence' along the lines of the Cold War	Increasing use of low-level info warfare (e.g. botnet) attacks by authoritarian actors to sabotage or control Internet resources; Russia's reassertion of control over eastern European states (e.g. Georgia, Estonia, etc.); Russian willingness to cut off European energy supplies; massive Chinese investment in relatively isolated regions (Africa, e.g.); etc.
Global shut down	N/A
Global stock market shutdowns and compromise through internet based attacks	Market irregularities, bad contracting practices
Global totalitarianism	Increasing secret Surveillance
Global war	Increasing local conflicts
Global-wide communication collapse	e-tribe
Google as a "big brother"	Increasing availability and use of Google tools
Government control over infrastructure and links between continents	GPS system owned by the US, echelon etc.
Government mandated telecommuting to reduce carbon emissions or to cope with rising price of fuel	Willingness of governments to take decisive action on climate change
Greater than expected acceleration of climate change effects, e.g., dislocations of population	More rapid melting of Greenland ice cap
Growth of walled gardens, smaller diffusion of information and increased social digital divide	Continued self-interested support of national incumbent telecom and media companies by individual EU Governments
Hackers interfere in vital processes	Number of attacks by hackers
Hacking	N/A
Harm from radio waves established	N/A
Health care delivered remotely	Adoption of health portals for information sharing
High carbon tax associated to the real calculation of the carbon footprint of Dematerialization	High energy bills associated to the Internet use.

Wild Cards	Associated (Weak) Signals
High energy costs	Reduced oil production
High rise in cost of power	Price of energy
If people develop natural ways of communication or understanding – spiritual shift	Behaviour of people – number of people turning away from traditional religious
If the numbering gets under political or business structure	The process of numbering and the power of international body declining.
Improved method of semiconductor fabrication leading to very low cost internet terminal.	New semiconductor device technology
Inadequate/uneven investment in enabling infrastructures	Power grid fragility in South Africa, Pakistan, etc., SAT-3 cable break in Africa
Income gaps crisis	Poverty
Poverty crisis	Continued e-illiteracy among poorer masses
Increasing control or supervision or massive theft of personal financial or private details	Threats
increasing number and damage of data loss events	Data loss events
International privacy and security vulnerabilities.	Cyber attacks continue and governments' responses are focussed on national security rather than individual security.
Internet becomes a public good run by governments	Public concern over Google dominance
Internet growth slows due to massive unjustified cross-subsidy to stop 'digital divide' in rural locales	N/A
Internet is used for wars which are not held by states – but by terrorists, for example	Misinformation (creation of panic, increase of supporters) Disorders in government networks & structures (army forces, etc.)
Internet under supervision of a big brother.	Contemporary efforts of some authoritarian regimes to control internet under pretext of security strengthening.
International terrorism	Jamming, denial of service attacks
IP mismanagement	Current IP management issues
iPhone-type customer access	Reduced demand for computers as internet can be more effectively access by mobile means
Lack of Internet security and cyber crime and cyber warfare	Recent attacks on major infrastructure databases, electrical grids, etc., & growing online fraud.
Large scale war	N/A
Legal decisions regarding copyright liability for online service providers and other 3 <sup>rd</sup> parties.	Lower court decisions in the EU.
Long range, high bandwidth, wireless (like wi-max but better) threatening national control/censorship of internet infrastructure.	Growth of satellite technology, emergence of wi-fi buoys at sea. Wi-Fi satellites?

Wild Cards	Associated (Weak) Signals
Long-term failure of internet equipment to keep pace with bandwidth demands (we've seen short term problems – need a sustained failure to innovate to higher speeds)	Growth in start-ups offering alternative networking products (e.g. what happened c. 1995 when we just barely innovated in time)
Loss of privacy feeling	Legislation against anonymous internet usage
Major armed conflict	N/A
Major cyber-assault on critical energy/mobility networks	Increasing cyber espionage and illicit action
Major cyber attack on national military defence or utility network, domestically or internationally	Minor security incidents within government of utility companies
Major failure of crypto (e.g. RSA cracked)	Quantum computing breakthroughs
Major internet exchanges crashed/stooped due to impossibility to manage the exponentially growing speeds of transfer	Period of doubling the capacity of exchanges
Malfunction that paralyses the Internet for several weeks/months	N/A
Malware, viruses	Unanticipated financial effects
Mass Advertising replaced by direct one-to-one messages	Slow ramping down of non-interactive advertising
Mass production of low cost laptops under 20\$	Public distribution of laptops to schools in china or India
Mass –sabotage of government sites and services by adolescent anarchist geographically decentralized users	Emergence of alternative social media sites such as 4chan
Massive consumer deception through one or several large organizations such as financial institutions	N/A
Massive security threats to internet	Threats to privacy growth in identity thefts
Massive terrorist hacker attacks, either to maim the internet (bombing nodes, or digital traffic jams) impairing public life etc.	Organisational efforts, hackers conferences etc.
Mayor Internet outage due to cyber war	Distributed denial of service attacks
Measurement of IQ/personality from clickstream + social networking marginalising privacy => unknown emergent properties of machine-filtered social dynamics?	Dating sites integrating behavioural advertising person-to-person. It's a truism that sex drives technology innovation and the Internet in particular
Media market concentration, trust	A wider market with not too big operators owned by different people
Mobile payment	NFC enabled smart phones market share
Mobile walled gardens dominate, due to regulatory failures	N/A
Narrowing human behaviour	More internet usage
Natural disaster	Environmental conditions
New disruptive technology (e.g. digital technology becomes archaic)	Unexpected innovation

Wild Cards	Associated (Weak) Signals
New paradigm for Internet	Lack of legislation
New search engines more accurate in front of billions of matching answers	N/A
New unforeseen technology	Turning up in research labs
News stories of significant impact broadcast by several sources which prove to be incorrect or false.	N/A
Nuclear accident or war	Increased geo-political tensions
Nuclear war	Global arms races, increased Middle East unrest
Nuclear warfare initiated by nations or groups	Iranian nuclear capability; inventory of missing nuclear materials in former USSR and elsewhere
Overload	N/A
People get really upset about losing their privacy online	Foundation of the pirate party across Europe
Political / military north-south division	Overexploitation of natural resources
Political instability	N/A
Power concentration from large organizations.	Concentration of Operators in all the Value Chain: Search engines, Advertising, Telecom Operators, Terminal device manufacturers, software producers, and so on.
Power grid shutdown as acts of terrorism	Power outages
Practical quantum computing breaks all cryptographic methods	Lab experiments with qubits
Privacy crisis	Spam, Intrusion of networks (both technically and socially)
Problems in Asia	N/A
Prolonged climate-related disasters (e.g. widespread flooding)	Increasingly unpredictable and extreme weather
Protectionism of content	Increased restrictions on access to content
Quality of information crisis	Access to information (paid vs free)
Quantum computers which would turn much of our security models upside down	The ceasing of publishing in quantum computing (suggests work has been classified)
Redefinition of the software and hardware markets	Open source software goes to workstations
Reduction of power of incumbent operators.	N/A
Regional power failures	More intense competition between electricity companies underinvestment in electricity networks
Reorganisation of content rights	N/A
Resistance to use	Failure of online business models
Revolt against AI	Problems with AI systems (e.g., drone missiles, automatic control systems, etc.)

Wild Cards	Associated (Weak) Signals
Rising energy costs could push towards cloud computing and more energy-efficient web, perhaps this will encourage the elimination of spam and other Web clutter.	Rising energy prices, confirmation that oil production has peaked, worsening of global warming
Serious loss of productive capacity and loss of life from information infrastructure disruption	Increased covert attacks by nation-states
Several Internet islands will appear. Each island disconnected from the other islands and governed under different models	Increased tendency of controlling the flow of content (political filters, illegal content filters, etc.)
Shortage of storage/servers. People will have no clue what will reliably be kept and what services will be available.	Servers consume %% growing amount of power
Significant privacy/security breaches	Individual incidents
Slow-movements will stress the importance of the “qualitative” aspect compared to the “quantitative” one: quality of information but also of social relations	Decrease of use of Second life, Facebook etc...
Social crisis due to increasing gap between haves and have-nots	political instability, efforts to use internet to manoeuvre voters
Solar activity	Electricity grid failures
Solar Radiation spike	Space station destruction
Solar storm	N/A
Solution of prime factorisation problem for large numbers – i.e. loss of security	N/A
Some kind of “black swan” event that would undermine confidence, e.g., by causing widespread loss of personal stored stuff	Today's bad info security... continuing
Spam & malware destroy the internet	Increasing incidence of spam and malware more organized crime in the internet
Substantially more efficient networking technologies are found.	N/A
Successful cyber terrorist attack on US military installation	It will be a surprise attack!
Successful formation of an alternate root system or address space by a major country	Development and promotion of competing standards to replace TCP/IP
Successful Internet-based attack on financial system	Irregularities at a major international bank by an insider
Successful large-scale systemic cyber-attack on the internet infrastructure in a large and highly internet-using country	Similar attacks on smaller countries; evidence that religiously or politically inspired physical terrorists start to realise that their aims can be pursued more effectively by cyber attacks
Successful terrorist attack on Internet infrastructure	Increasing hacker probes from an organized source (including hostile government)
Super virus	Increasing frequency and impact of current viruses

Wild Cards	Associated (Weak) Signals
System overload breakdown	Slower browsing speeds overall peak time slowdowns
Technical vulnerability eg effective internet wide viruses	Current attacks on nations en government services
Technology for power storage	Stand alone time of mobile internet access devices in combination with increased functionality
Technology for ubiquitous and seamless wireless access	Widespread deployment of FON
Technology innovation replacing TCP/IP	Its not an overthrow but a subversive innovation
Terrorism	Although terrorism is already perceived as a threat, its linkage to Internet can be considered a weak signal
Terrorist attack and growth of terrorist networks based on internet	Reported individual incidents, peak time slowdowns surge of questionable content
Terrorist control of internet	Confickr-like activities; infiltrations of large networks like Twitter, Facebook
The demise of totalitarian regimes	Surge in dissenter activism both on- and offline
The economic crisis	Cut down government operation and corporate cost by new advanced internet-based new ICTs
The growing need for person to person physical contact in daily life	N/A
The ITU will have a greater say in the governance of the Internet.	The ITU will play an increasingly dominant role in Internet governance.
The ITU will play a bigger role in Internet governance	The ITU performs some service for the Internet community that earns it (the ITU) brownie points.
The Technological Singularity	Advances in AI
There will be greater attempts at controlling the Internet in the name of security, national interests, etc.	Watch the rise of cyber security.
There will be the tendency towards greater central control of the Internet in the name of cyber security	Watch the rise of the importance of cyber security
There's nothing left. OK, what happens when there are not 1.5 billion users of the Internet of the Future but rather 5 billion or 7 billion users	Pandemics and global panic. Literacy declines and books (text and prose) disappear.
Trust and safety	Security
Unresolved issues concerning the dominant model of territorial copyright licensing	Postponing technological breakthroughs due to litigation
Very strong hackers counterculture / people living in / using a parallel Internet	Open source and hackers movements...
Virus attack crisis	Complacency and loss of attention arising from widespread diffusion of almost compulsory virus and identity threat insurance schemes creates an opportunity for virus attack which is actively aided by human interventions

Wild Cards	Associated (Weak) Signals
War	Internal economic crisis
War against terror, as it is used for everything	Current law initiatives in the EU
War or non democratic government	cf. recent controls in Asia
Water consumption, management and protection of sources; environment protection; re-forestation and fight against global warming	Warning against severe environmental problems and search for sustainable development and growth models
Widely distributed error in crucial network infrastructure elements (e.g. routers), reacting on a coincidence of data	Increasing complexity of the software of internet networking components, increased sophistication of discovered smaller errors
Widespread penetration of data "beyond the radar" of the privacy and security mechanisms	Leakage of individual "secure" data items from different data collections being administered by different authorities
Wi-max type networks (even if not necessarily the current wimax) at very low cost, possible government subsidized	Reduced demand for fixed line access by consumers. Telecom/internet providers will need to completely rethink backbone technologies and commercial models
Wireless electrical power	Unknown
World war	Terrorist attacks at accelerating pace
World war 3	Nuclear Terrorist attacks
WW3	Cyber attacks between countries

These wild cards and weak signals  
have been produced  
in cooperation  
with



[www.iknowfutures.eu](http://www.iknowfutures.eu)

## Appendix 2: Delphi Survey

### Screenshot of Delphi Survey's welcoming session

DELPHI study for **Towards A Future Internet**, an Oxford Internet Institute study for the European Commission  
For further information, please visit: <http://www.internetfutures.eu>

**Dear respondent,**

Please help us to classify the results of this survey by completing information about yourself below.  
All data will be aggregated and individual responses will be anonymous.

To preserve your anonymity, this survey has been designed to be completed in one session.

<p><b>Your region *</b></p> <p><input type="radio"/> Europe</p> <p><input type="radio"/> Africa</p> <p><input type="radio"/> Asia</p> <p><input type="radio"/> Latin America</p> <p><input type="radio"/> North America</p> <p><input type="radio"/> Oceania</p>	<p>If you selected <b>Europe</b>, please indicate if you are based in one of the following EU27 countries:</p> <p><input type="text" value="Please select..."/></p>	<p>If you selected <b>Asia</b>, please indicate if you are based in one of the following countries:</p> <p><input type="text" value="Please select..."/></p>	<p>If <b>Latin America</b>, please indicate if you are based in one of the following countries:</p> <p><input type="text" value="Please select..."/></p>
<p><b>Age group</b></p> <p><input type="radio"/> under 20</p> <p><input type="radio"/> 20 - 30</p> <p><input type="radio"/> 30 - 40</p> <p><input type="radio"/> 40 - 50</p> <p><input type="radio"/> 50 - 60</p> <p><input type="radio"/> 60 - 70</p> <p><input type="radio"/> over 70 years</p>	<p><b>Gender</b></p> <p><input type="radio"/> female</p> <p><input type="radio"/> male</p> <p><b>Occupation</b></p> <p><input type="checkbox"/> business</p> <p><input type="checkbox"/> education/research</p> <p><input type="checkbox"/> government</p>	<p><b>Specialist area</b></p> <p><input type="checkbox"/> technology</p> <p><input type="checkbox"/> social impacts</p> <p><input type="checkbox"/> business strategy</p> <p><input type="checkbox"/> law, regulation, policy</p>	<p><b>Email (optional)</b> For future access, if needed.</p> <p><input type="text"/></p> <p><b>Navigation tip...</b></p> <p>Click <b>NEXT</b> to save &amp; move forward</p>

**Delphi Structure**

**Section 1: Core Questions** – These questions are core to our understanding of the evolution of the Internet in the future. The completion of this set of questions is essential to our study.

**Section 2: Supplementary Questions** – Questions in this section expand upon the areas explored in Section 1. While the completion of these is not essential to the study, your answers nevertheless would make an important contribution and will be greatly appreciated.

**Section 3: Additional Questions** – Questions in this section expand upon the areas explored in Section 1 and 2.

The **survey** and the **report** are available at:

<http://www.4-sight-group.org/oii/futureinternetdelphi>  
<http://www.4-sight-group.org/oii/futureinternetdelphireport.pdf>

## Screenshot of Delphi Survey's Section 1 of 3

### Section 1 of 3: Core questions

**1.1. We may expect that people will be using the Internet more in the future. For our analysis, it is essential to understand what needs the future Internet will have to meet.**

1.1.1. When will the Internet become **vital for the vast majority of people in ordinary everyday living**?

1.1.2. What percentage of an average person's day will be directly influenced by the Internet, both by being online and in other ways associated with the Internet? [\[Help\]](#)

In 5 years

In 10 years

In 15 years

In 20 years

1.1.3. Internet use will increasingly permeate all aspects of our lives, but for which types of need?

**Which is, in your view, the most important role of the internet TODAY and in the future (5-10-20 years) in terms of becoming a basic lifestyle/workstyle factor?**

<b>All basic voice and data communications</b>	Time for becoming a basic factor
<b>Social networking</b> (i.e. maintaining family links and more diverse social interaction - friends, dating etc.)	<input type="text" value=""/>
<b>Entertainment</b> (including being the main traditional media, eg TV channels, and access to new media, with or without rights, e.g. bit-torrent vs itunes)	<input type="text" value=""/>
<b>Employment related</b> (i.e. workplace, organisation, information, business services)	<div style="border: 1px solid #ccc; padding: 2px;"> <p>now</p> <p style="background-color: #2196f3; color: white;">within 5 years</p> <p>within 10 years</p> <p>within 15 years</p> <p>longer</p> <p>never</p> </div>
<b>Daily life maintenance</b> (e.g. shopping, child care, daily chores, utilities, house, car)	

## Screenshot of Delphi Survey's Section 2 of 3

### Section 2 of 3: Supplementary questions

**2.1. Will the Internet create Digital exclusion and thus social exclusion – i.e. widen or lessen the Exclusion Gap?**

2.1.1. Will low cost telecoms and Internet usage bring the poor into the mainstream of the global economy so the gap between the haves and have-nots will diminish?

YES
  NO

2.1.2. Which of the following would contribute to creating the digital poor?

e-literacy  
 complexity  
 access costs

**2.2. Sociological and psychological Internet behaviours.**

2.2.1. How would future Internet cultures tend to be?

divisive  
 creative  
 inclusive

2.2.2. Will the Internet form a new adjunct to society, an augmented form of communication, consisting of constant instant short messages (twittering), postings, sound bites, video bites in a new form of social interaction?

YES
  NO

2.2.3. Which part of human existence will be most dependent on the Internet?

	society and social pursuits	jobs and the economy
In 5 years	<input type="radio"/>	<input type="radio"/>
In 10 years	<input type="radio"/>	<input type="radio"/>

## Screenshot of Delphi Survey's Section 3 of 3

### Section 3 of 3: Additional questions

#### 3.1. We need to understand what sort of Internet is most likely to evolve.

3.1.1. Much of the change predicted for the Internet over the medium term is evolutionary. So the Internet of the future may be much the same as today as it is too difficult to change, fundamentally. **However, when, if ever, are we likely to see revolutionary change in the core Internet?**

3.1.2. How would you characterise the Internet in 5, 10, 20 years?

now	<input type="text"/> Unsafe tool to be used only when necessary Convenience and lifestyle management tool for everyday life Safe utility for information, work and entertainment, etc.
In 5 years	<input type="text"/> Unsafe tool to be used only when necessary Convenience and lifestyle management tool for everyday life Safe utility for information, work and entertainment, etc.
In 10 years	<input type="text"/> Unsafe tool to be used only when necessary Convenience and lifestyle management tool for everyday life Safe utility for information, work and entertainment, etc.
In 15 years	<input type="text"/> Unsafe tool to be used only when necessary Convenience and lifestyle management tool for everyday life Safe utility for information, work and entertainment, etc.
never	<input type="text"/> Unsafe tool to be used only when necessary Convenience and lifestyle management tool for everyday life Safe utility for information, work and entertainment, etc.

3.1.3. Do you envisage the Internet evolution into separate more specific "Internets" with special attributes by usage – e.g. a secure e-commerce version, and/or a real-time safer/more resilient form for vital functions such as surgery, and/or a social networking Internet with privacy functions?

If so, when do you envisage multiple Internets may occur?

3.1.4. If there is a single Internet, will it have tiers of value and privacy/security?

## Screenshot of Delphi Survey's closing session

**Dear respondent,**

**Many thanks for contributing to the Future Internet Delphi**

The Delphi has been designed by:

**Oxford Internet Institute** Ian Brown, Malte Ziewitz

**SCF Associates** Simon Forge

**Individual Experts** Lara Srivastava, Colin Blackman, Karmen Guevara, Motohiro Tsuchiya, Jonathan Cave

**Advisory Panel** Rudolf van der Berg, Erik Bohlin, Jon Crowcroft, Xavier Dalloz, Jun Murai, Chris Marsden, Ian Miles, Rafael Popper

To find out more about the project, you can view the **animated presentation** (right) or click the **NEXT** button to visit the project website.

This questionnaire is part of a study funded by the EU. For further information about **FIRE** (Future Internet Research & Experimentation), please visit: <http://cordis.europa.eu/fp7/ict/fire>

[Towards a Future Internet](#)



**Towards a Future Internet**

Interrelation between Technological, Social and Economic Trends

A study for DG Information Society and Media

Oxford Internet Institute : Dr Ian Brown, Malte Ziewitz  
 SCF Associates: Simon Forge  
 Individual Experts: Dr Lara Srivastava, Dr Colin Blackman, Dr Karmen Guevara, Dr Motohiro Tsuchiya, Dr Jonathan Cave

View more [documents](#) from [Ian Brown](#).

**To finish your session, just close you browser window.**

## Appendix 3: About the 235 Delphi respondents

