

What is a robot?

Robot Institute of America (RIA):

“A robot is a reprogrammable multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks.”

Characterized by:

SMEI –

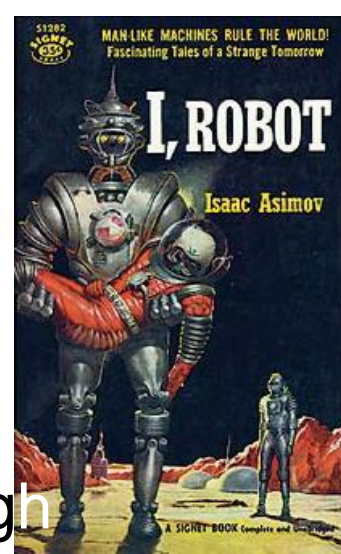
Sensing

Motion

Energy

Intelligence

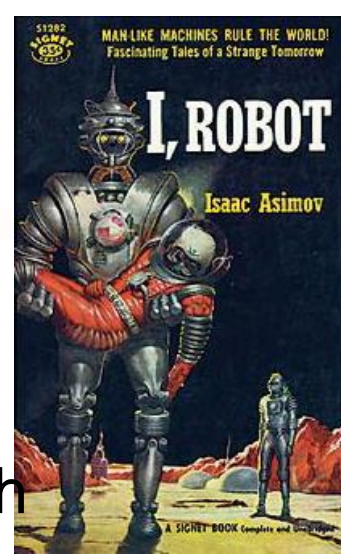
Robot laws



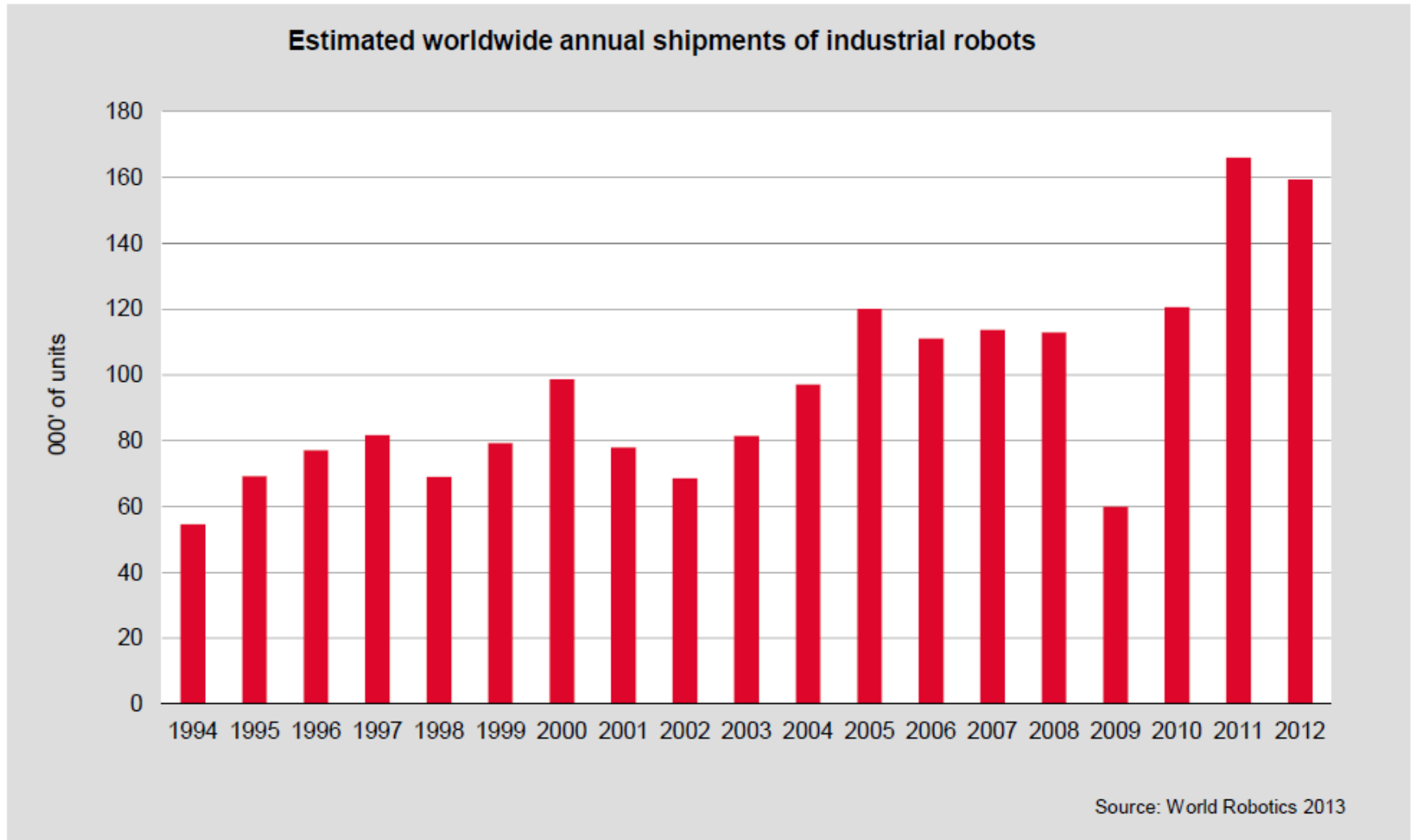
1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Robot laws

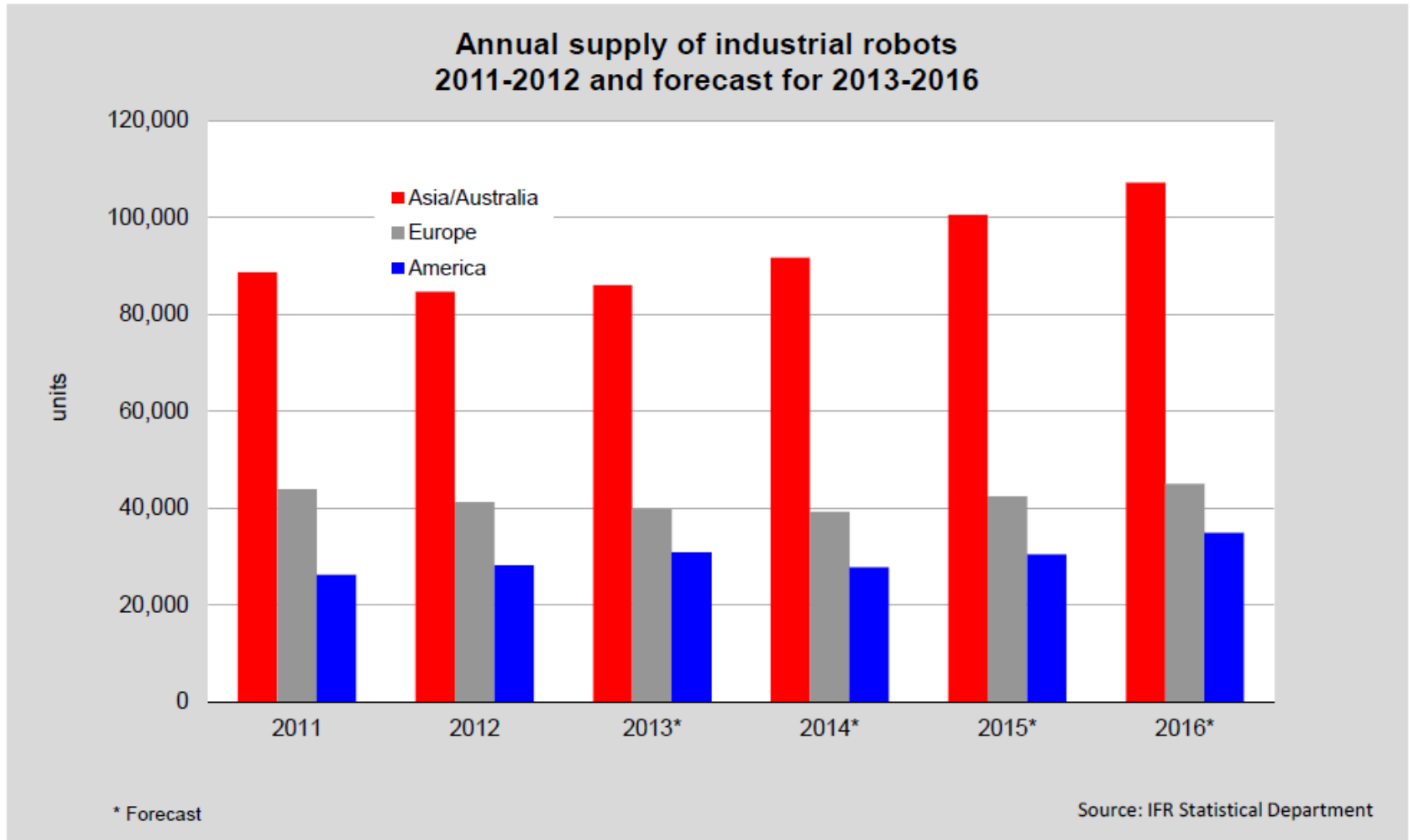
- 0 A robot may not harm humanity, or, by inaction, allow humanity to come to harm
1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.



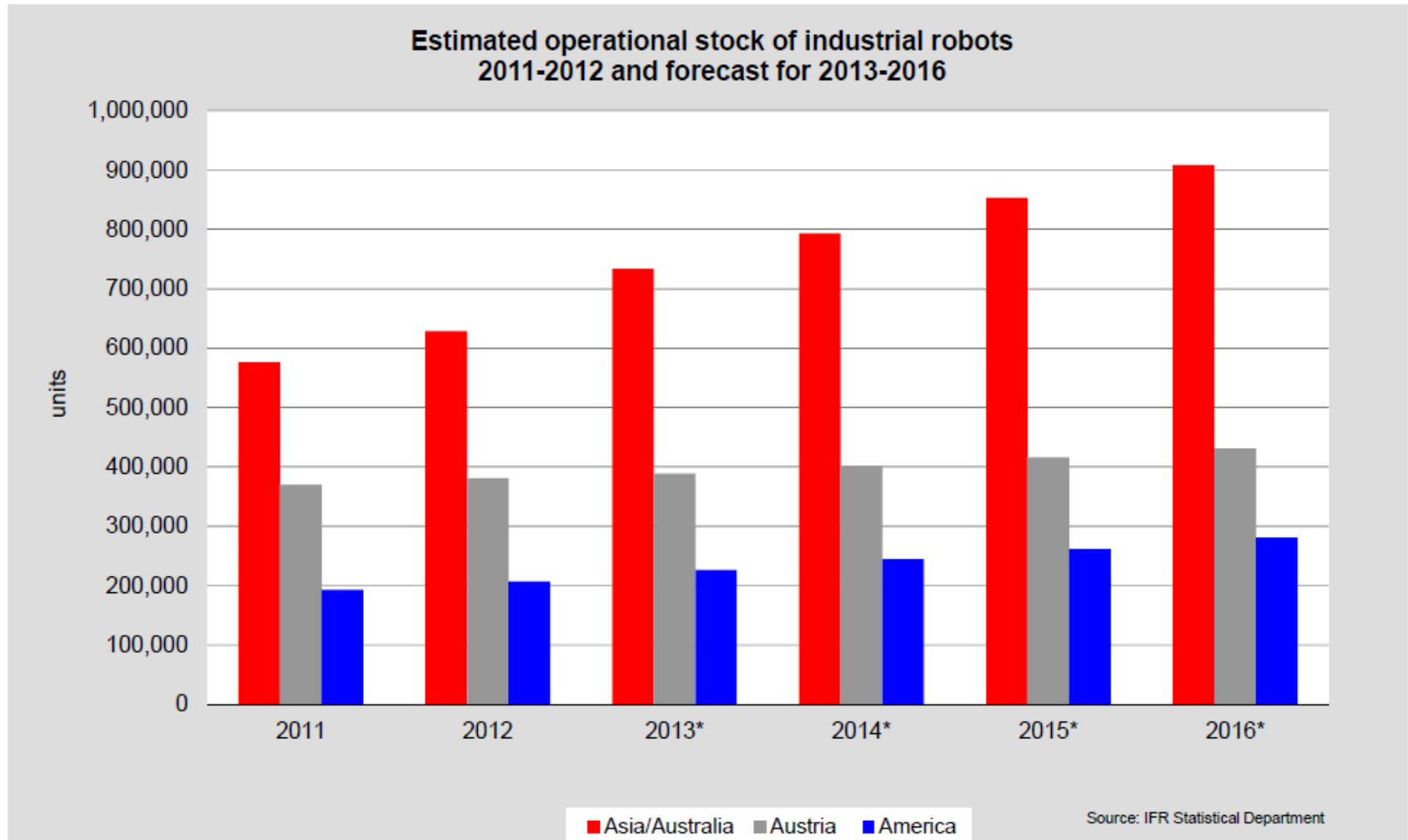
Industrial robotics



Industrial robotics



Industrial robotics



Estimated operational stock of multipurpose industrial robots at year-end in selected countries. Number of units

Country	2011	2012	2013*	2016*
America	192,966	207,017	226,550	281,000
Brazil	6,971	7,576	9,170	17,400
North America (Canada, Mexico, USA)	184,679	197,962	215,650	260,800
Other America	1,316	1,479	1,730	2,800
Asia/Australia	576,545	628,889	733,500	908,500
China	74,317	96,924	121,200	215,800
India	6,352	7,840	9,300	16,300
Japan	307,201	310,508	309,400	312,900
Republic of Korea	124,190	138,883	155,300	201,700
Taiwan	29,837	32,455	35,800	43,000
Thailand	13,088	17,116	20,600	32,600
other Asia/Australia	21,560	25,163	81,900	86,200
Europe	369,965	380,546	388,800	431,700
Czech Rep.	5,890	6,830	7,800	11,000
France	34,461	33,624	33,000	33,200
Germany	157,241	161,988	165,800	177,900
Italy	62,245	60,750	58,600	55,400
Spain	29,847	28,911	27,300	27,100
United Kingdom	13,641	15,046	15,500	20,000
other Europe	66,640	73,397	80,800	107,100
Africa	2,495	2,858	3,300	4,900
not specified by countries**	11,126	16,079	20,850	33,400
Total	1,153,097	1,235,389	1,373,000	1,659,500

Sources: IFR, national robot associations.

*forecast

** reported and estimated sales which could not be specified by countries

Segments



Automotive



Plastics



Foundry



Metal
Fabrication



Food &
Beverage



Chemical &
Pharmacy



Machine Tools



Wood



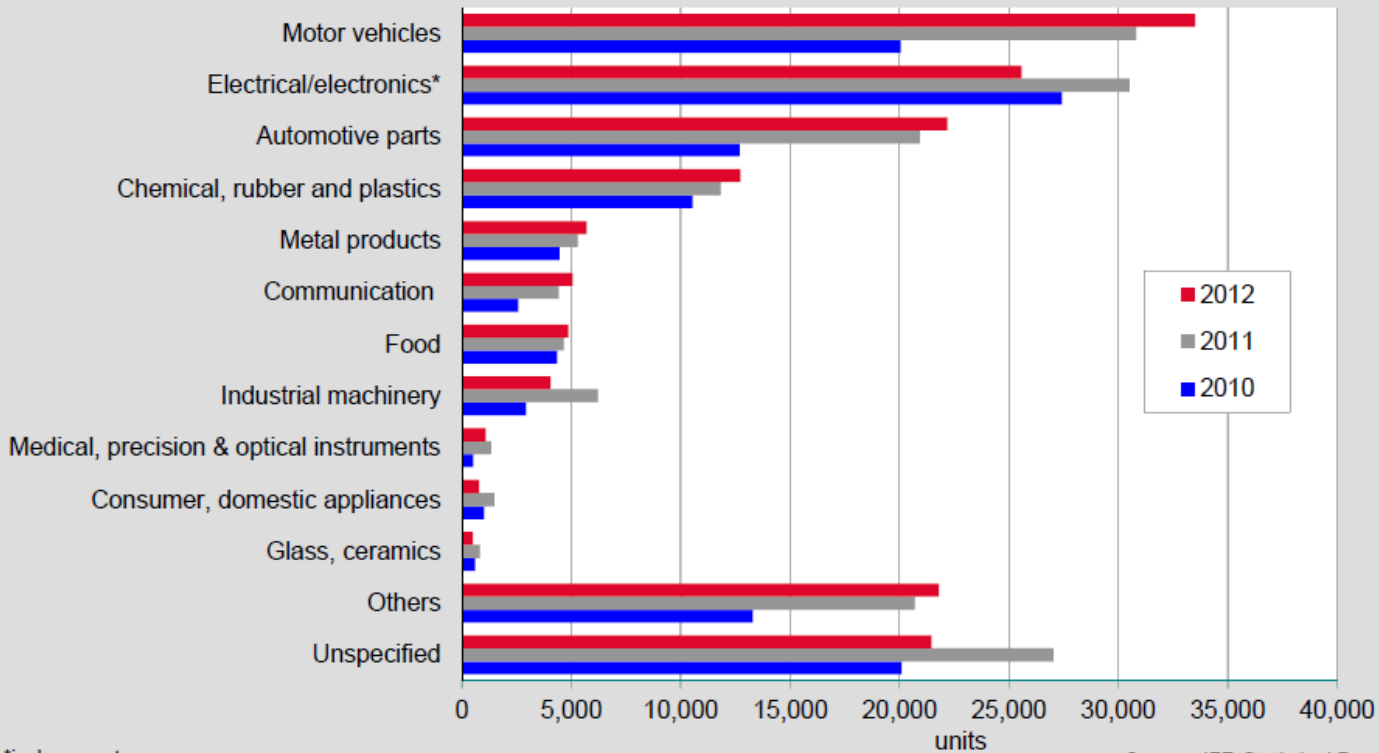
Consumer
Electronics



Solar

Segments Served - Overview

Estimated worldwide annual supply of industrial robots at year-end by industries 2010 - 2012

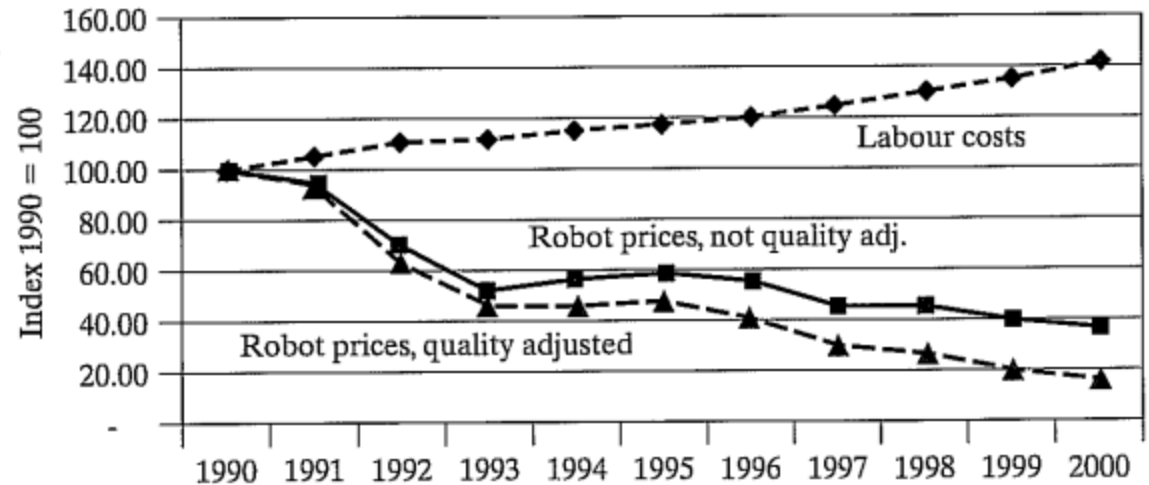


*incl. computers

Source: IFR Statistical Department

Trends

- Automation trends
- Cost reduction
- Labor cost increase
- Increased volume



Some examples from robotics



Some examples from robotics



The screenshot shows the White House website header with the logo and navigation menu. The main content area features the title "We The Geeks" and a paragraph describing the event. A sidebar on the right contains a call-to-action "WHAT SHOULD WE TALK ABOUT NEXT? TELL US" and a photo of President Obama cutting a ribbon.

the WHITE HOUSE PRESIDENT BARACK OBAMA ★ ★ ★ ★ THE WHITE HOUSE WASHINGTON ★ ★ ★ ★ Get Email Updates | Contact Us

USA BLOG PHOTOS & VIDEO BRIEFING ROOM ISSUES *the* ADMINISTRATION *the* WHITE HOUSE *our* GOVERNMENT

[Home](#) • [We The Geeks](#) Search WhiteHouse.gov Search

We The Geeks

"We the Geeks" is a new series of Google+ Hangouts to highlight the future of science, technology, and innovation here in the United States. Topics such as commercial space exploration, science, technology, engineering, and math (STEM) education, turning science fiction to science fact, and others will be discussed with Administration officials and key private sector contributors. Join the conversation using the hashtag [#WeTheGeeks](#) and be sure to sign up for email updates about future "We the Geeks" hangouts.

Don't Be Bored, Make Something

Update: We the Geeks: "Don't Be Bored, Make Something" has been rescheduled for this Friday, November 15th at 1:00 pm ET. You can watch the event live on WhiteHouse.gov/WeTheGeeks and the [White House Google+](#) page and join the conversation using the hashtag [#WeTheGeeks](#).

WHAT SHOULD WE TALK ABOUT NEXT?
TELL US



0-2min, 13min-

Some examples from robotics

[Video of Kuka/DLR robot \(and more\)](#)
(go to 3.30 in the film)



Some examples from robotics



[Asimo Robot](#)

Some examples from robotics

- [Fotbollsspelande](#)
[NAO](#)
- [Reconfiguring robots](#)
- [Cubelets](#)
- [Rehabilitation](#)

Some examples from robotics



Challenges in robotics

- By “design” an integration of different fields
 - Mechanics
 - Electronics
 - Computer Science
 - Mathematics
 - Industrial design
 - Manufacturing
 - Economics
 - Psychology
 - ...