THESIS DEFENSE ACCOMPANYING HANDOUTS

SOFTWARE INTERNATIONALIZATION: A FRAMEWORK VALIDATED AGAINST

INDUSTRY REQUIREMENTS FOR COMPUTER SCIENCE AND

SOFTWARE ENGINEERING PROGRAMS

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in

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by

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TITLE: **Software Internationalization: A Framework Validated Against Industry Requirements for Computer Science and Software Engineering Programs**

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ABSTRACT

Software Internationalization: A Framework Validated Against Industry Requirements

for Computer Science and Software Engineering Programs

John Huân Vũ

In 2001, the ACM and IEEE Computing Curriculum stated that it was necessary to address "the need to develop implementation models that are international in scope and could be practiced in universities around the world" [1]. With increasing connectivity through the internet, the move towards a global economy and growing use of technology places software internationalization as a more important concern for developers [2]. However, there has been a "clear shortage in terms of numbers of trained persons applying for entry-level positions" in this area [3]. Eric Brechner, Director of Microsoft Development Training, suggested five new courses to add to the computer science curriculum due to the growing "gap between what college graduates in any field are taught and what they need to know to work in industry" [4]. He concludes that "globalization and accessibility should be part of any course of introductory programming," stating [4]:

> *A course on globalization and accessibility is long overdue on college campuses. It is embarrassing to take graduates from a college with a diverse student population and have to teach them how to write software for a diverse set of customers. This should be part of introductory software development. Anything less is insulting to students, their family, and the peoples of the world.*

There is very little research into how the subject of software internationalization should be taught to meet the major requirements of the industry [4]. The research question of the thesis is thus, "*Is there a framework for software internationalization that has been validated against industry requirements?*" The answer is no. The framework "would promote communication between academia and industry … that could serve as a common reference point in discussions" [3]. Since no such framework for software internationalization currently exists, one will be developed here. The contribution of this thesis includes a provisional framework to prepare graduates to internationalize software and a validation of the framework against industry requirements. The requirement of this framework is to provide a portable and standardized set of requirements for computer science and software engineering programs to teach future graduates.

Culture	Red	Blue	Green	Yellow	White
China	Happiness	Heavens, Clouds	Ming Dynasty, Heavens, Clouds	Birth, Wealth, Power	Death, Purity
Egypt	Death	Virtue, Faith, Truth	Fertility, Strength	Happiness, Prosperity	Joy
France	Aristocracy	Freedom, Peace	Criminality	Temporary	Neutrality
India	Life, Creativity		Fertility, Prosperity	Success	Death, Purity
Japan	Anger, Danger	Villainy	Future, Youth, Energy	Grace, Nobility	Death
United States	Danger	Masculinity	Safety	Cowardice	Purity

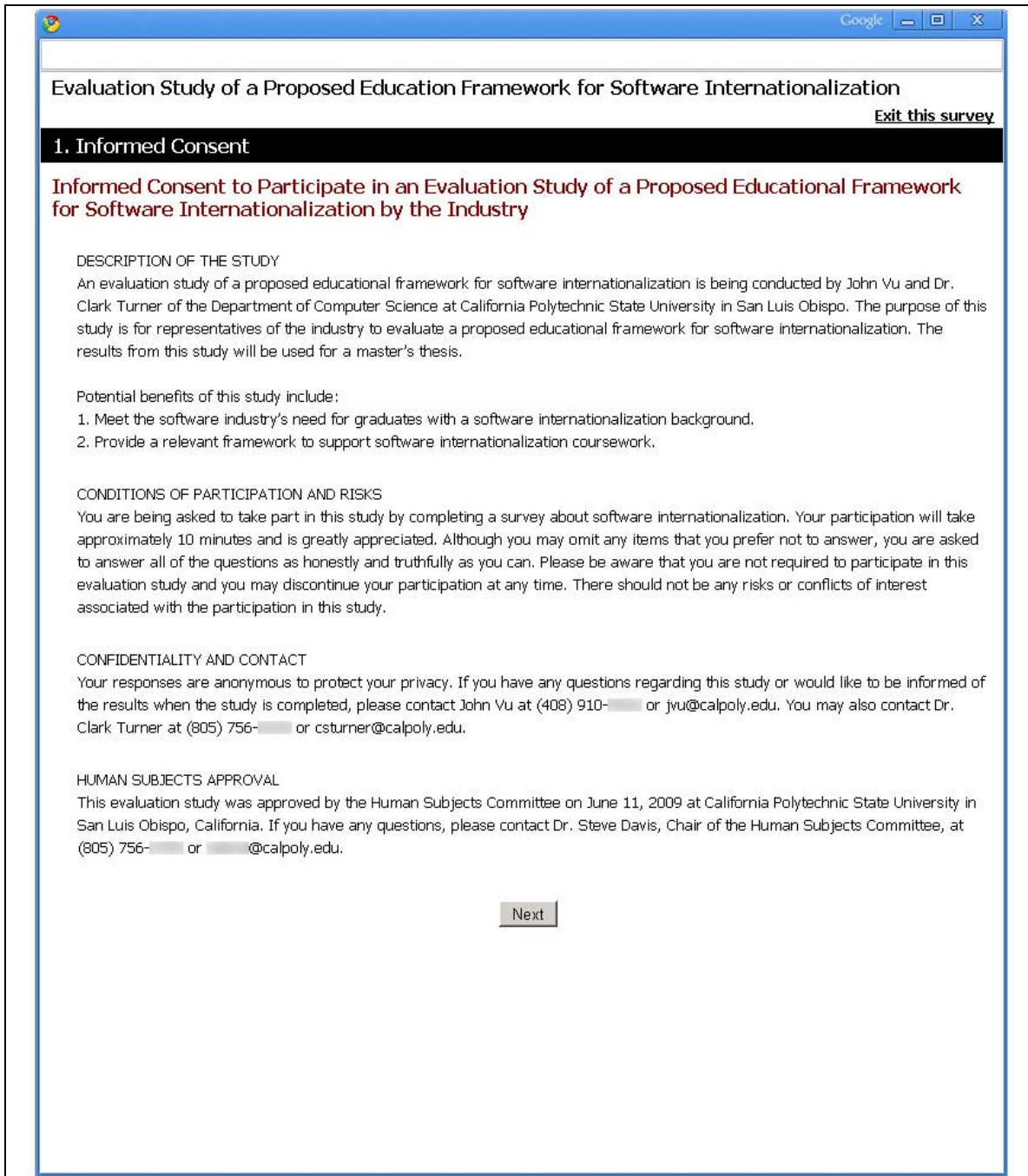*Table 1 - Cultural associations of color [34].*

Abbreviation	Statements in the industry survey questionnaire starting with *"In order for computer science and software engineering graduates to be prepared for industry, students must …"*
Learn	… learn software internationalization through lecture, reading, and writing
Apply	... apply software internationalization through laboratory assignments, projects, and activities
Integrate	... learn about software internationalization by integrating the subject into existing courses
Course	... learn about software internationalization by taking an entire course devoted to the subject
Abroad	... learn about software internationalization by studying abroad
Technology-Aware	... be aware of possible technologies and tools for creating software that supports internationalization
Technology-Apply	... apply the possible technologies and tools for creating software that supports internationalization
Definitions	... define and distinguish between software internationalization, localization, and globalization
Standards	... define and distinguish various industry standards on software internationalization (ISO, W3C, LISA)
Colors	... be aware of how particular colors are viewed differently among various countries
Visual	... be aware of how particular visual elements are viewed differently among various countries
Noise	... be aware of how particular noise elements are viewed differently among various countries
Laws	... be aware of how laws of various countries can affect the software that supports internationalization
Translation-Aware	... be aware of possible technologies and tools used for language translation and text representation
Translation-Apply	... apply the possible technologies and tools used for language translation and text representation
Direction-Aware	... be aware the possible technologies and tools to represent the direction of text in various languages
Direction-Apply	... apply the possible technologies and tools to represent the direction of text in various languages
Collation-Aware	... be aware of how text is sorted in various languages
Collation-Apply	... apply the possible technologies and tools to sort text in various languages
Dates-Aware	... be aware of how dates and times are used in various cultures and countries
Dates-Apply	... apply the possible technologies and tools to decipher the date and time for various cultures and countries
Currency-Aware	... be aware of how the number/currency systems are different for various cultures and countries
Currency-Apply	... apply the possible technologies for the number/currency systems for various cultures and countries
Ethics	... be aware of the social responsibilities and ethics of producing software that supports internationalization

Table 2 - Abbreviations for the statements used in the industry survey questionnaire.

Order of importance	Statements in the industry survey questionnaire starting with "*In order for computer science and software engineering graduates to be prepared for industry, students must …*"
1	... be aware of possible technologies and tools used for language translation and text representation (Section 3.5)
2	... be aware of how dates and times are used in various cultures and countries (Section 3.5.3)
3	... be aware of how the number/currency systems are different for various cultures and countries (Section 3.5.4)
4	... be aware the possible technologies and tools to represent the direction of text in various languages (Section 3.4)
5	... define and distinguish between software internationalization, localization, and globalization (Section 3.3)
6	... apply software internationalization through laboratory assignments, projects, and activities (Section 3.2, 3.4)
7	... be aware of how text is sorted in various languages (Section 3.5.2)
8	... be aware of possible technologies and tools used for language translation and text representation (Section 3.5)
9	... apply the possible technologies and tools for creating software that supports internationalization (Section 3.4)
10	… learn software internationalization through lecture, reading, and writing (Section 3.2)
11	... apply the possible technologies and tools to decipher the date and time for various cultures and countries (Section 3.4, 3.5.3)
12	... apply the possible technologies for the number/currency systems for various cultures and countries (Section 3.4, 3.5.4)
13	... be aware of how laws of various countries can affect the software that supports internationalization (Section 3.7.4)
14	... apply the possible technologies and tools to represent the direction of text in various languages (Section 3.4, 3.5.1)
15	... be aware of the social responsibilities and ethics of producing software that supports internationalization (Section 3.6)
16	... apply the possible technologies and tools to sort text in various languages (Section 3.4, 3.5.2)
17	... be aware of how particular visual elements are viewed differently among various countries (Section 3.7.2)
18	... define and distinguish various industry standards on software internationalization (ISO, W3C, LISA) (Section 3.3)
19	... apply the possible technologies and tools used for language translation and text representation (Section 3.4, 3.5)
20	... be aware of how particular colors are viewed differently among various countries (Section 3.7.1)

Table 6 - Framework of requirements the industry overall agree listed in order of importance.

H.1. Figures

Figure 43 - Informed consent page of the industry survey.

Evaluation Study of a Proposed Education Framework for Software Internationalization

2. Demographics

The following questions will be used primarily for comparative analysis with others in the industry. Although you may omit any items that you prefer not to answer, you are asked to answer all of the questions as honestly and truthfully as you can. If you do not understand a question, please omit the item.

1. Company and Location (Optional)

2. Years Working in the Industry (Optional)

3. Title (Optional)

4. Highest Level of Education (Optional)

- High School Diploma, No Degree
- Associate's Degree, Vocational
- Bachelor's Degree
- Master's Degree
- Doctor of Philosophy

Other (please specify)

5. Group (Optional)

- Corporate, Executive
- Manager, Supervisor
- Internationalization, Localization
- Experience Design, Usability
- Development, Engineering, Research
- Quality Assurance, Testing
- Human Resources

Other (please specify)

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Figure 44 - Demographics page of the industry survey.

Evaluation Study of a Proposed Education Framework for Software Internationalization

3. Survey (Page 1)

The following questions will be used primarily for comparative analysis with others in the industry. Although you may omit any items that you prefer not to answer, you are asked to answer all of the questions as honestly and truthfully as you can. If you do not understand a question, please omit the item.

DEFINITIONS:

"Software Internationalization" is the process of producing an application that can be localized for a particular country without making any changes to the program code.

"Localization" is the process of adapting software for a particular geographical region.

1. In order for computer science and software engineering graduates to be prepared for industry, students ...

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
Must LEARN software internationalization through lecture, reading, and writing	○	○	○	○	○
Must APPLY software internationalization through laboratory assignments, projects, and activities	○	○	○	○	○
Must LEARN about software internationalization by integrating the subject into existing courses	○	○	○	○	○
Must LEARN about software internationalization by taking an entire course devoted to the subject	○	○	○	○	○
Must LEARN about software internationalization by studying abroad	○	○	○	○	○
Must BE AWARE of possible technologies and tools for creating software that supports internationalization	○	○	○	○	○
Must APPLY the possible technologies and tools for creating software that supports internationalization	○	○	○	○	○
Must DEFINE and DISTINGUISH between software internationalization, localization, and globalization	○	○	○	○	○
Must DEFINE and DISTINGUISH various industry standards on software internationalization (ISO, W3C, LISA)	○	○	○	○	○
Must BE AWARE of how particular colors are viewed differently among various countries	○	○	○	○	○
Must BE AWARE of how particular visual elements are viewed differently among various countries	○	○	○	○	○
Must BE AWARE of how particular noise elements are viewed differently among various countries	○	○	○	○	○
Must BE AWARE of how laws of various countries can affect the software that supports internationalization	○	○	○	○	○

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Figure 45 - First page of the industry survey.

Evaluation Study of a Proposed Education Framework for Software Internationalization

4. Survey (Page 2)

The following questions will be used primarily for comparative analysis with others in the industry. Although you may omit any items that you prefer not to answer, you are asked to answer all of the questions as honestly and truthfully as you can. If you do not understand a question, please omit the item.

DEFINITIONS:
"Software Internationalization" is the process of producing an application that can be localized for a particular country without making any changes to the program code.
"Localization" is the process of adapting software for a particular geographical region.

1. In order for computer science and software engineering graduates to be prepared for industry, students ...

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
Must BE AWARE of possible technologies and tools used for language translation and text representation	○	○	○	○	○
Must APPLY the possible technologies and tools used for language translation and text representation	○	○	○	○	○
Must BE AWARE of how the direction of text is represented in various languages	○	○	○	○	○
Must APPLY the possible technologies and tools to represent the direction of text in various languages	○	○	○	○	○
Must BE AWARE of how text is sorted in various languages	○	○	○	○	○
Must APPLY the possible technologies and tools to sort text in various languages	○	○	○	○	○
Must BE AWARE of how dates and times are used in various cultures and countries	○	○	○	○	○
Must APPLY the possible technologies and tools to decipher the date and time for various cultures and countries	○	○	○	○	○
Must BE AWARE of how the number/currency systems are different for various cultures and countries	○	○	○	○	○
Must APPLY the possible technologies for the number/currency systems for various cultures and countries	○	○	○	○	○
Must BE AWARE of the social responsibilities and ethics of producing software that supports internationalization	○	○	○	○	○

[Prev] [Next]

Figure 46 - Second page of the industry survey.
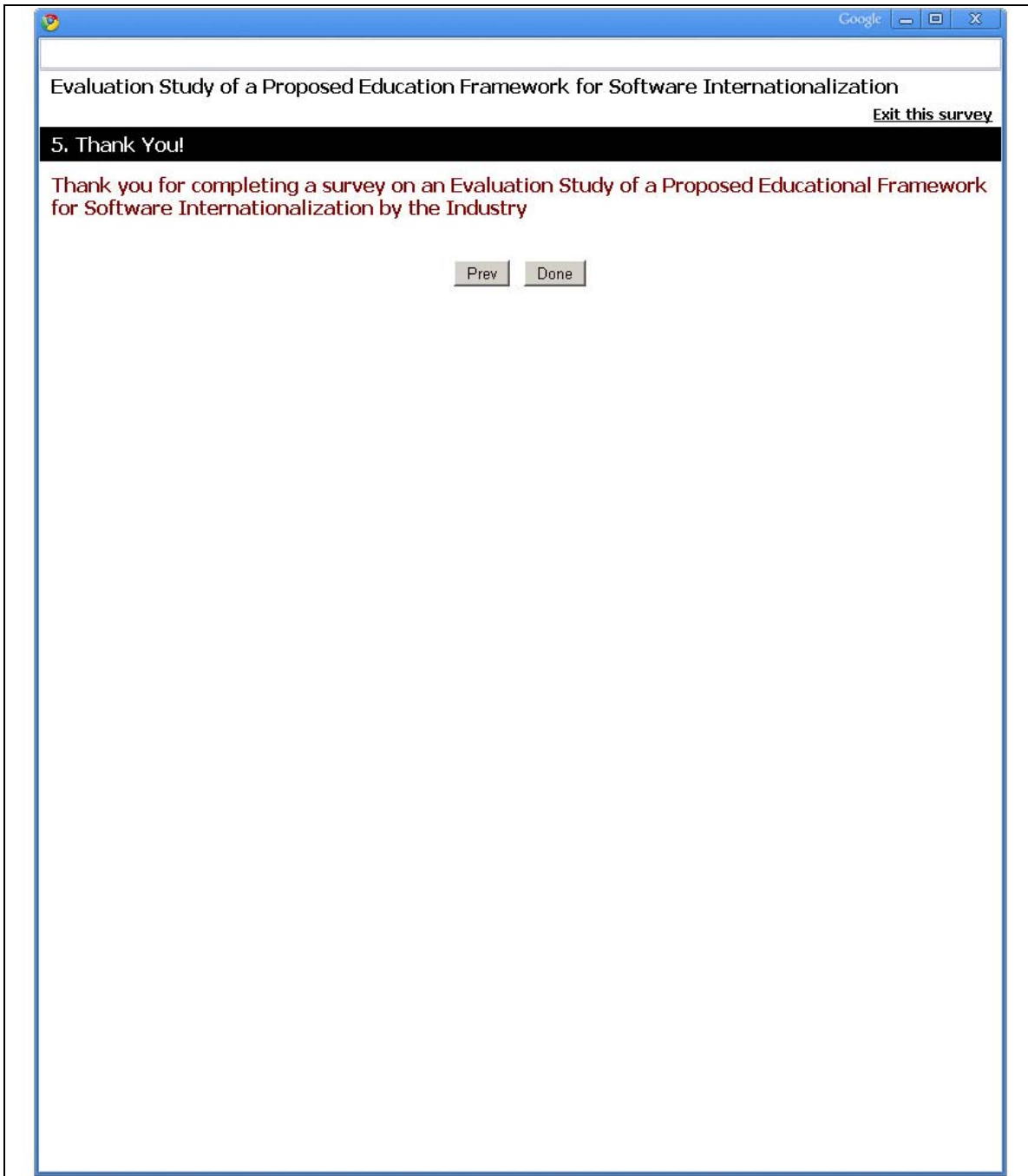
Figure 47 - Confirmation page of the industry survey.

H.2. Tables

Abbreviation	Effect Size (w) Observed	Type of Effect	Non-Centrality Parameter for a Chi-Square Distribution	Sample size required for a power effect of .9
Learn	0.95575	Large	252.116	16.42101633
Apply	0.97055	Large	260.924	15.9241657
Integrate	0.85613	Large	202.297	20.46494967
Course	0.46022	Medium	58.4565	70.82186687
Abroad	0.49619	Medium	67.4599	60.92512443
Technology-Aware	1.16629	Large	371.341	11.02761009
Technology-Apply	0.8813	Large	212.037	19.31270083
Definitions	0.99116	Large	269.175	15.26886677
Standards	0.7121	Large	137.926	29.58097878
Colors	0.60794	Large	101.636	40.58586762
Visual	0.69234	Large	132.297	31.29320261
Noise	0.57883	Large	91.8029	44.76981792
Laws	0.76246	Large	160.449	25.8025472
Translation-Aware	0.94595	Large	232.654	16.76310134
Translation-Apply	0.70171	Large	127.039	30.46314376
Direction-Aware	1.02629	Large	272.795	14.24144422
Direction-Apply	0.78181	Large	157.698	24.54062823
Collation-Aware	0.93999	Large	229.731	16.97639377
Collation-Apply	0.73578	Large	139.674	27.70729271
Dates-Aware	1.10895	Large	318.51	12.19743254
Dates-Apply	0.78155	Large	158.201	24.55740226
Currency-Aware	1.03324	Large	276.502	14.05053481
Currency-Apply	0.78104	Large	157.388	24.588977
Ethics	0.74182	Large	143.077	27.25806452

Table 17 – Results calculated for the power and effect size of the survey results.

City	State	Country	Continent	Count
Bunos Aires		Argentina	South America	1
		Brazil	South America	2

Table 18 - Locations of participants of the industry survey questionnaire in South America.

City	State	Country	Continent	Count
Dalian		China	Asia	1
Hong Kong		China	Asia	1
		China	Asia	1
Bangalore		India	Asia	1
		Israel	Asia	1
Tokyo		Japan	Asia	1
		Japan	Asia	2
Lahore		Pakistan	Asia	1
		Pakistan	Asia	1
Colombo		Sri Lanka	Asia	1
		Thailand	Asia	1

Table 19 - Locations of participants of the industry survey questionnaire in Asia.

City	State	Country	Continent	Count
		Austria	Europe	1
Prague		Czech Republic	Europe	1
		Denmark	Europe	1
		Estonia	Europe	1
		France	Europe	1
		Germany	Europe	4
Szeged		Hungary	Europe	1
		Hungary	Europe	1
Dublin		Ireland	Europe	3
Limerick		Ireland	Europe	1
Eindhoven		Netherlands	Europe	1
		Netherlands	Europe	1
Oslo		Norway	Europe	1
		Norway	Europe	1
		Romania	Europe	1
Saint Petersburg		Russia	Europe	1
		Russia	Europe	1
Madrid		Spain	Europe	1
		Spain	Europe	1
		Sweden	Europe	2
Basel		Switzerland	Europe	1
		Switzerland	Europe	3
Bristol		UK	Europe	1
London		UK	Europe	1
		UK	Europe	2
		Ukraine	Europe	1

Table 20 - Locations of participants of the industry survey questionnaire in Europe.

City	State	Country	Continent	Count
Vancouver	BC	Canada	North America	1
Montreal		Canada	North America	1
Ottawa		Canada	North America	1
		Canada	North America	1
Huntsville	AL	USA	North America	1
Berkeley	CA	USA	North America	1
Brisbane	CA	USA	North America	1
Cupertino	CA	USA	North America	2
Goleta	CA	USA	North America	1
Irvine	CA	USA	North America	1
Livermore	CA	USA	North America	1
Los Angeles	CA	USA	North America	2
Menlo Park	CA	USA	North America	1
Mountain View	CA	USA	North America	2
Palo Alto	CA	USA	North America	1
Redwood City	CA	USA	North America	1
San Bruno	CA	USA	North America	1
San Diego	CA	USA	North America	2
San Francisco	CA	USA	North America	7
San Jose	CA	USA	North America	3
San Leandro	CA	USA	North America	1
San Mateo	CA	USA	North America	2
San Ramon	CA	USA	North America	1
Santa Barbara	CA	USA	North America	1
Santa Clara	CA	USA	North America	2
Silicon Valley	CA	USA	North America	2
Thousand Oaks	CA	USA	North America	1
	CA	USA	North America	4
Stamford	CT	USA	North America	1
Atlanta	GA	USA	North America	3
Boise	ID	USA	North America	1
Chicago	IL	USA	North America	1
Boston	MA	USA	North America	1
Burlington	MA	USA	North America	1
Cambridge	MA	USA	North America	1
Okemos	MI	USA	North America	1
Eden Prairie	MN	USA	North America	1
New York	NY	USA	North America	2
Malvern	PA	USA	North America	1
	SC	USA	North America	1
Austin	TX	USA	North America	2
Dallas	TX	USA	North America	1
Bellevue	WA	USA	North America	2
Redmond	WA	USA	North America	4
Seattle	WA	USA	North America	3
		USA	North America	3

Table 21 - Locations of participants of the industry survey questionnaire in North America.

Abbreviation	Chi-Square Value	P-Value	Result with $\alpha = .05$	Result with $\alpha = (.05/24)$
Learn	252.115942	0.00000	Proportions different	Proportions different
Apply	260.9241877	0.00000	Proportions different	Proportions different
Integrate	202.2971014	0.00000	Proportions different	Proportions different
Course	58.45652174	0.00000	Proportions different	Proportions different
Abroad	67.45985401	0.00000	Proportions different	Proportions different
Technology-Aware	371.3406593	0.00000	Proportions different	Proportions different
Technology-Apply	212.03663	0.00000	Proportions different	Proportions different
Definitions	269.1751825	0.00000	Proportions different	Proportions different
Standards	137.9264706	0.00000	Proportions different	Proportions different
Colors	101.6363636	0.00000	Proportions different	Proportions different
Visual	132.2971014	0.00000	Proportions different	Proportions different
Noise	91.80291971	0.00000	Proportions different	Proportions different
Laws	160.4492754	0.00000	Proportions different	Proportions different
Translation-Aware	232.6538462	0.00000	Proportions different	Proportions different
Translation-Apply	127.0387597	0.00000	Proportions different	Proportions different
Direction-Aware	272.7953668	0.00000	Proportions different	Proportions different
Direction-Apply	157.6976744	0.00000	Proportions different	Proportions different
Collation-Aware	229.7307692	0.00000	Proportions different	Proportions different
Collation-Apply	139.6744186	0.00000	Proportions different	Proportions different
Dates-Aware	318.5096525	0.00000	Proportions different	Proportions different
Dates-Apply	158.2007722	0.00000	Proportions different	Proportions different
Currency-Aware	276.5019305	0.00000	Proportions different	Proportions different
Currency-Apply	157.3875969	0.00000	Proportions different	Proportions different
Ethics	143.0769231	0.00000	Proportions different	Proportions different

Table 22 - Results for Test for Equal Proportions

Abbreviation	Strongly Agree Z Value	Overall Agree Z Value	Overall Disagree Z Value	Strongly Disagree Z Value
Learn	-5.177	11.557	-14.687	-15.771
Apply	0.421	11.716	-14.841	-16.042
Integrate	-3.973	10.233	-14.567	-15.891
Course	-11.798	-0.120	-7.584	-14.085
Abroad	-15.466	-9.787	-0.121	-10.149
Technology-Aware	1.755	15.191	-16.039	-16.402
Technology-Apply	-3.813	10.470	-15.070	-16.160
Definitions	0.604	11.962	-15.103	-16.190
Standards	-7.640	6.548	-12.854	-15.644
Colors	-8.744	4.281	-11.638	-15.498
Visual	-7.223	6.501	-12.761	-16.011
Noise	-8.941	2.779	-11.720	-15.828
Laws	-5.658	8.186	-13.844	-16.132
Translation-Aware	-2.481	11.535	-14.760	-15.752
Translation-Apply	-7.720	6.101	-12.078	-15.440
Direction-Aware	1.056	12.117	-14.975	-15.845
Direction-Apply	-5.852	8.093	-13.448	-15.689
Collation-Aware	-0.744	11.163	-14.636	-15.752
Collation-Apply	-6.475	6.848	-13.448	-15.689
Dates-Aware	2.423	13.111	-15.224	-15.845
Dates-Apply	-5.157	8.388	-13.484	-15.596
Currency-Aware	0.932	12.241	-15.472	-15.845
Currency-Apply	-5.479	8.093	-13.821	-15.564
Ethics	-5.706	6.946	-14.140	-15.380

Table 23 - Results of Z Values for Test for Significant Majority

Abbreviation	Strongly Agree P-Value	Overall Agree P-Value	Overall Disagree P-Value	Strongly Disagree P-Value
Learn	1.000	0.000	1.000	1.000
Apply	0.337	0.000	1.000	1.000
Integrate	1.000	0.000	1.000	1.000
Course	1.000	0.548	1.000	1.000
Abroad	1.000	1.000	0.548	1.000
Technology-Aware	0.040	0.000	1.000	1.000
Technology-Apply	1.000	0.000	1.000	1.000
Definitions	0.273	0.000	1.000	1.000
Standards	1.000	0.000	1.000	1.000
Colors	1.000	0.000	1.000	1.000
Visual	1.000	0.000	1.000	1.000
Noise	1.000	0.003	1.000	1.000
Laws	1.000	0.000	1.000	1.000
Translation-Aware	0.993	0.000	1.000	1.000
Translation-Apply	1.000	0.000	1.000	1.000
Direction-Aware	0.145	0.000	1.000	1.000
Direction-Apply	1.000	0.000	1.000	1.000
Collation-Aware	0.772	0.000	1.000	1.000
Collation-Apply	1.000	0.000	1.000	1.000
Dates-Aware	0.008	0.000	1.000	1.000
Dates-Apply	1.000	0.000	1.000	1.000
Currency-Aware	0.176	0.000	1.000	1.000
Currency-Apply	1.000	0.000	1.000	1.000
Ethics	1.000	0.000	1.000	1.000

Table 24 - Results of P-Values for Test for Significant Majority

Years	Count		Years	Count		Years	Count		Years	Count		Years	Count
1	3		9	6		17	2		25	16		35	1
2	4		10	25		18	10		26	3		39	2
3	8		11	8		19	5		27	2		40	3
4	6		12	12		20	21		28	1		42	1
5	15		13	6		21	3		29	3		58	1
6	5		14	6		22	2		30	9			
7	2		15	22		23	4		31	1			
8	5		16	8		24	5		32	1			

Table 25 - Industry responses on number of years working in the industry.

H.3. Titles

Among the respondents that indicated their titles, the following are the data extracted exactly from the database. Titles that are marked with an asterisk (*) were edited for the following reasons:

- Title that could be linked to an organization or to a person

- Errors with spelling or capitalization problems

- Invalid titles such as the abbreviation for "Doctor", "Mister", or "Miss".

- Account Executive
- Administrator*
- Applications Engineer, Italian Localization
- Architect
- Associate IS
- Bidi Architect
- Business Developer (Sales and Marketing Department)
- Business Development/ Project Manager
- Campus Program Manager
- CEO *
- CEO
- CEO
- CEO
- CEO
- Chief Architect
- Chief Globalization Architect
- Chief Software Architect
- Chief Technology Officer
- CMS and Language Technologies Manager
- cofounder
- Co-founder & CTO
- Communication Manager
- Computer Applications Developer *
- Computer Scientist
- Consultant
- Consultant
- COO
- Copy Manager
- CTO
- CTO
- CTO
- CTO
- CTO
- CTO
- CTO
- CTO/GM
- Curriculum Manager

- Development Testing Manger
- Director
- Director
- Director
- Director *
- Director
- Director
- Director - Business Development
- Director of Human Resources
- Director of Information Technology
- Director of Localization
- Director of Marketing
- Director of Recruiting and HR
- Director of Sales
- Director of Web Development
- Director, External Research Office
- Director, Global Academic & Certification Programs
- Director, Product Development
- Division President *
- Documentation manager
- Economic Advisor *
- Education Manager
- Engineering Manager
- Engineering VP
- European Localization Director *
- Executive Officer *
- Founder
- Founder & Chief Architect *
- Founder and Chie Linguist
- Freelance translator
- General Manager *
- General Manager
- Global Director*
- Globalization Educator & Consultant
- Globalization Executive

- Globalization Test Architect
- GM
- Head of Localization Department
- Head Software Development Unit
- Information Architect
- Information Development Lead
- Internationalization Architect
- Language Technology Specialist, Business Development Manager
- Linguist
- Linguist *
- Linguist
- Localization Manager *
- Localization Coordinator
- Localization coordinator
- Localization Engineer
- Localization Engineer
- Localization Manager
- Localization Manager
- Localization Manager
- Localization Program Manager
- Localization Project Manager
- Localization Project Manager
- Localization Project Manager and Advisory IT Specialist
- Localization PM *
- Manager
- Manager
- Manager of Software Development
- Manager Operations
- Manager, Consumer Technical Publications
- Managing Director
- Managing Editor
- Marketing manager
- MD

- MD
- Operations Manager
- Owner
- Owner
- Postgrad Student
- President
- President
- President
- President
- Principal
- Principal development manager *
- Principal Software Engineer
- Principal Technology Architect
- Principal *
- Product Manager
- Product Marketing Manager
- Program director, globalization requirements
- Program Manager
- Program Manager
- Program Manager
- Program Manager
- Programmer
- Project Coordinator
- Project Manager
- Project manager *
- QA Engineer
- QA Manager
- Quality manager
- Research
- Sales Engineer
- Security Analyst
- Senior Business Development Manager *
- Senior Director
- Senior Engineer
- Senior I18n Engineering Manager
- Senior Language Manager
- Senior Language Technology Specialist
- Senior Manager, Campus Recruiting
- Senior Product Manager
- Senior Project Manager
- Senior Research Director
- Senior Software Development Engineer
- Senior Software Engineer
- Senior Terminology Researcher
- Software Development Engineer
- Software Engineer
- Software Engineer
- Software Engineer
- Software localization manager
- Software Localizer
- Sr. Director - Engineering
- Sr. Director Service Delivery
- Sr. Director, Community Marketing
- Sr. International Program Manager
- Sr. Manager of Strategic Alliances
- Sr. Manager, User Experience
- Sr. Product Manager, Globalization
- Sr. Software Engineer
- SVP
- SVP
- SVP Product Development
- Technical Manager
- Technical Writer
- Technical Writing & Localization
- Test Analyst
- Test Lead
- Training and Implementation Specialist
- Translator
- Translator, Localization Professional
- Unicode Software Engineer
- Vice President Technology
- Vice President, Global IT
- Vice President, Localization
- VP
- VP Global Business Development
- VP Marketing
- VP Marketing
- VP marketing
- VP of Engineering
- VP of Engineering
- VP Products
- VP Software Development
- VP, Engineering
- VP, Strategic Accounts

H.4. Participating companies

- 3TERA
- Achievo Corporation
- ADAPT Localization Services
- Adaquest
- ADC
- ADERANT Holdings
- Adobe
- Advanced Micro Devices
- Albanian Translations
- Alchemy
- Algeron
- Alpha CRC
- Alterian
- Altova
- Amgen
- Anchiva Systems
- Appistry
- Asia Online
- ACM
- Atlassian
- Atlus
- Atypon Systems
- Autodesk
- Avaya
- Avocent
- B2B Technologies
- Balihoo
- Batutis
- Bayer Healthcare
- Bentley
- CA
- CaridianBCT
- Centrify
- Chevron
- Cisco
- Clearswift
- CLS Communication AG
- CollabNet
- Continuous Computing
- Corvallis
- Coupa
- Covario
- CreateSpace
- Diebold
- eBay
- eDT
- ELEKS Software
- Embarcadero Technologies
- Envision
- EQHO Communications
- Eurus
- Excel GITS
- Exigen Services
- Expedia
- Ficorp
- Fog Creek Software
- Formtek
- Fortify Software
- FreedomPay
- Funambol
- Gemini Mobile
- Glovia
- Google
- Handango
- HP
- IBM
- IER
- Infosys
- Ingo International Investments
- InMage
- InnerWorkings
- IntelePeer
- Intelliworks
- Intergraph
- INVITEC
- Jonckers
- Jungle Communications
- Kaseya
- Keonnected.com
- Kilgray Translation
- Kx
- Langix
- Lawrence Livermore National
- LISA
- Localisation Research Centre
- Logon
- LUZ
- Mastercard
- MEDIO Systems
- Mentor Graphics
- MGO-Traducciones
- Micro Focus / Borland
- MicroLink
- Microsoft
- NVIDIA
- OpenTable
- Opera
- OSIsoft
- Overhead
- Parasoft
- Paypal
- Playtech Bingames
- Prisma International
- Protegrity
- PTC (Parametric Tech. Corp)
- Qualcomm
- Qumu
- Raytheon
- Really Strategies
- Right Hemisphere
- Rosetta Stone
- RoyaltyShare
- Rubric
- Salesforce
- SAP
- SAS Institute
- Saylent Technologies
- Scania
- SDL
- Siemens
- SignalDemand
- Signiant
- SMobile Systems
- SolarWinds
- STAR Group
- SteelEye
- SugarCRM
- Sun
- Symantec
- Synopsys
- TechSmith
- Tektronix
- Telltale Games
- TIBCO Software
- Tivoli Software
- TOIN
- TotalView Technologies
- Trading Technologies
- Translatewiki.net
- Trend Micro
- VersionOne
- Vizrt
- Vocera Communications
- Warelords
- Welocalize
- WHP
- Yahoo!
- YouMail

H.5. Survey results

Abbreviation	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree	Sample Size
Learn	95	139	26	9	7	276
Apply	142	94	26	10	5	277
Integrate	105	118	36	11	6	276
Course	40	97	64	54	21	276
Abroad	9	47	82	83	53	274
Technology-Aware	151	111	7	3	1	273
Technology-Apply	105	118	38	9	3	273
Definitions	142	94	26	9	3	274
Standards	73	117	52	23	7	272
Colors	65	108	61	32	9	275
Visual	78	114	52	27	5	276
Noise	63	97	74	34	6	274
Laws	91	115	47	19	4	276
Translation-Aware	110	113	26	8	3	260
Translation-Apply	67	111	48	27	5	258
Direction-Aware	138	89	23	7	2	259
Direction-Apply	82	112	43	18	3	258
Collation-Aware	124	96	28	9	3	260
Collation-Apply	77	107	53	18	3	258
Dates-Aware	149	86	17	5	2	259
Dates-Apply	88	109	41	17	4	259
Currency-Aware	137	91	26	3	2	259
Currency-Apply	85	109	46	14	4	258
Ethics	84	102	58	10	6	260

Table 26 - Summary of survey results.

H.6. Graphs of the survey results
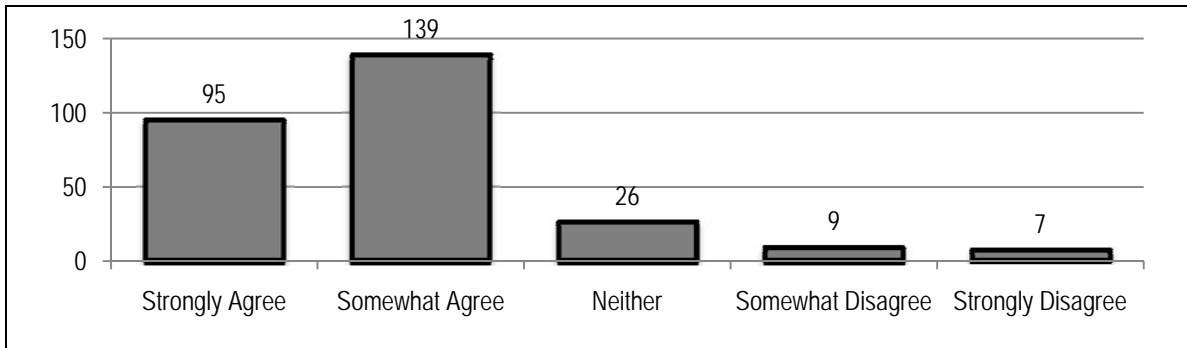
Figure 51 - Industry responses to "Learn."'
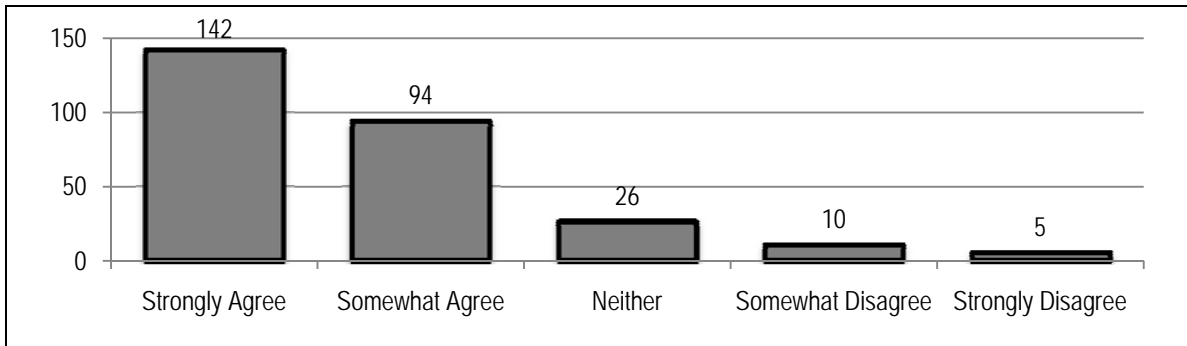
Figure 52 - Industry responses to "Apply."
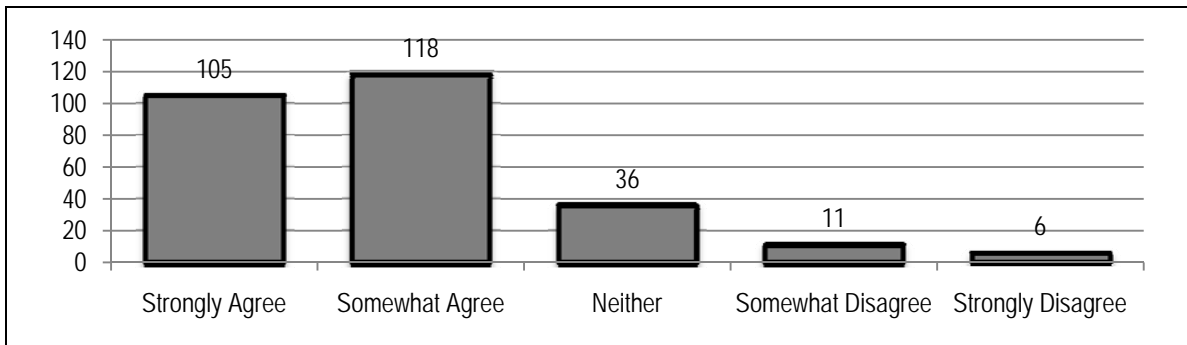
Figure 53 - Industry responses to "Integrate."
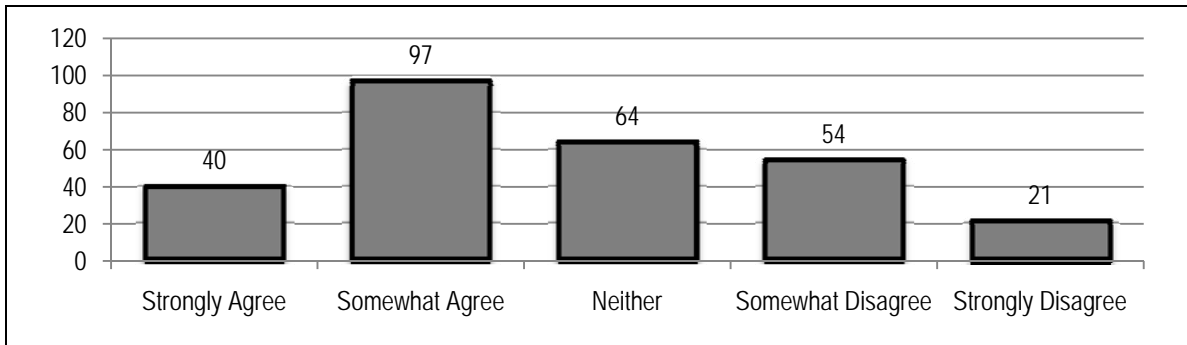
Figure 54 - Industry responses to "Course."
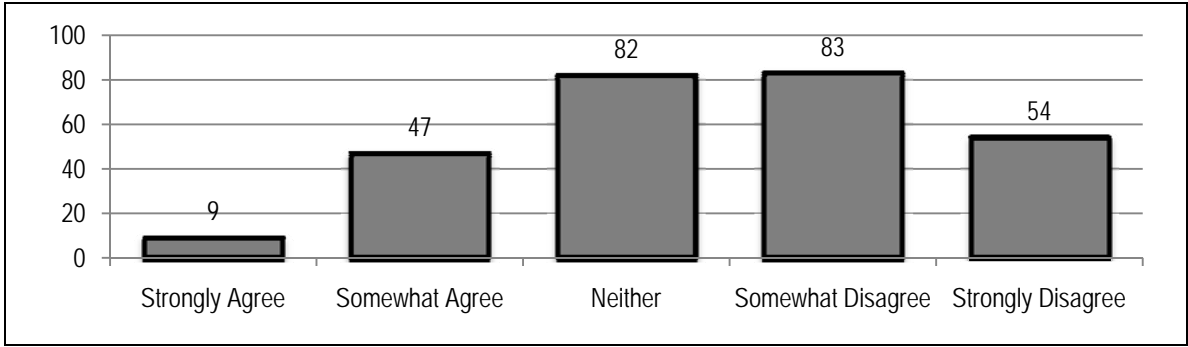
Figure 55 - Industry responses to "Abroad."
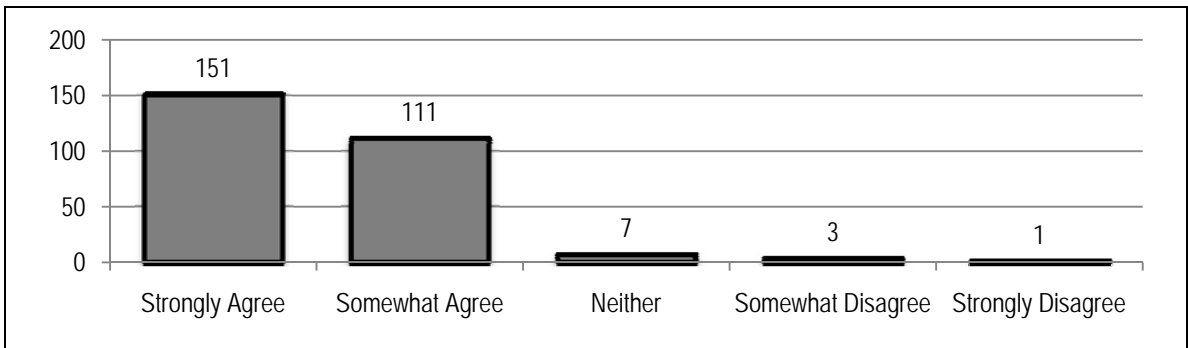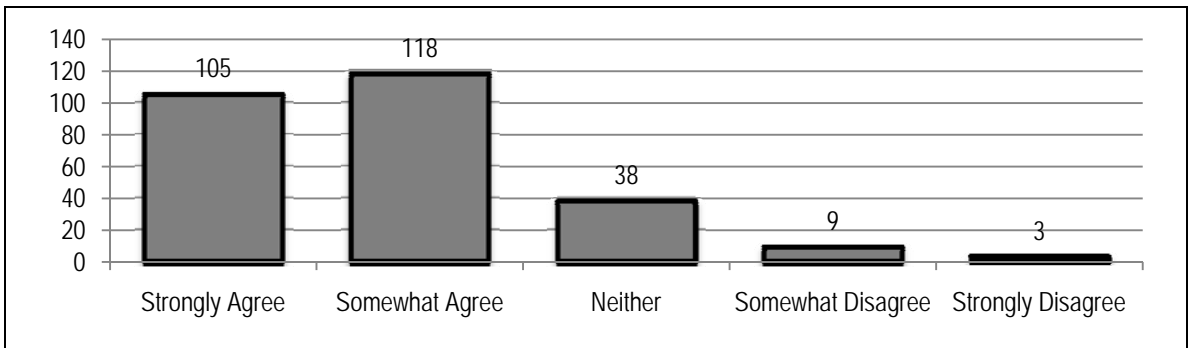

Figure 56 - Industry responses to "Technology-Aware."

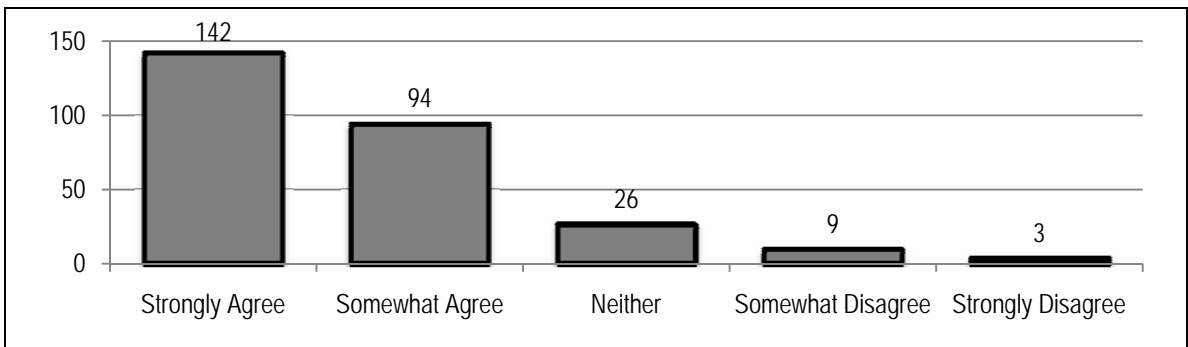*Figure 57 - Industry responses to "Technology-Apply."*
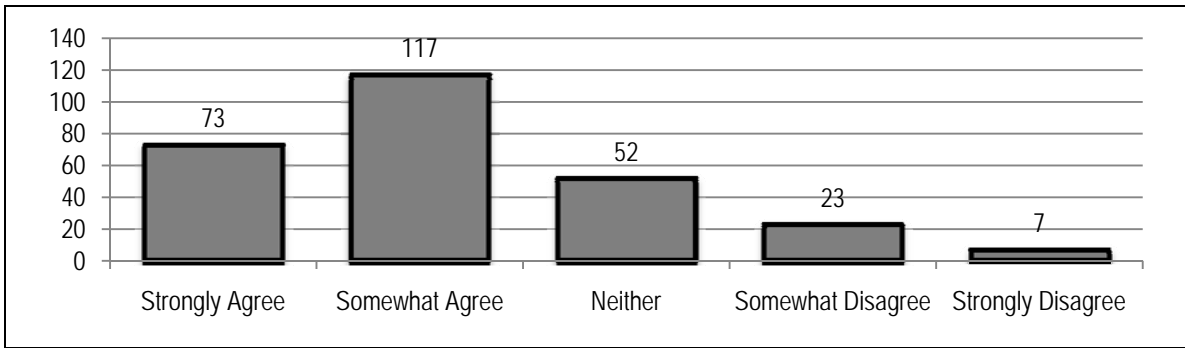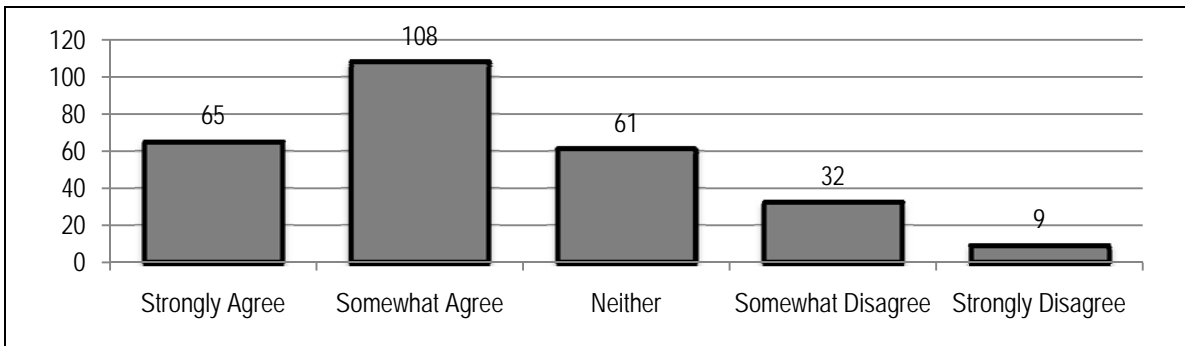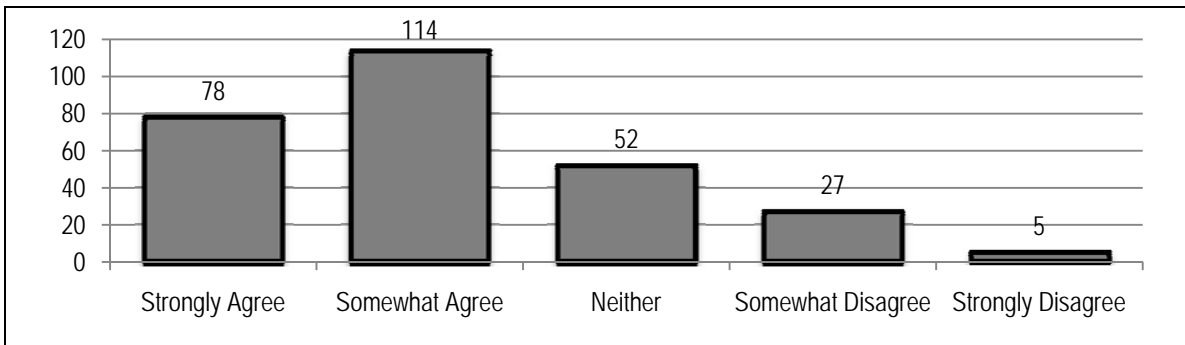

Figure 58 - Industry responses to "Definitions."

Figure 59 - Industry responses to "Standards."

Figure 60 - Industry responses to "Colors."

Figure 61 - Industry responses to "Visual."
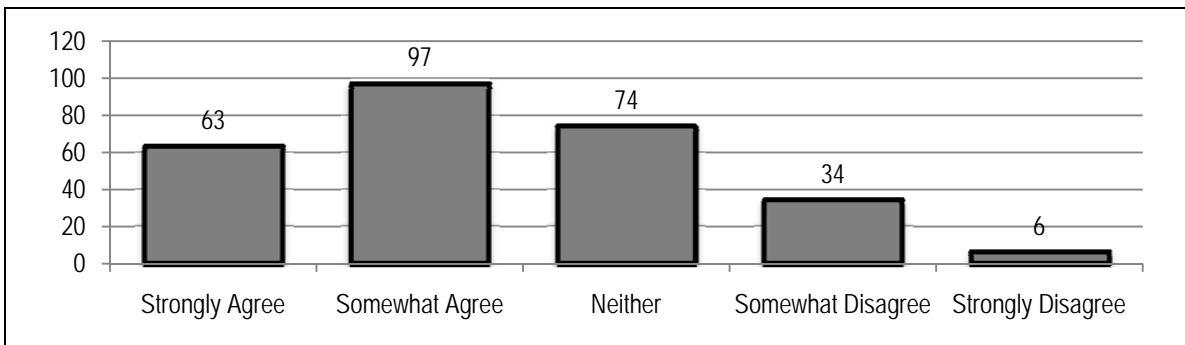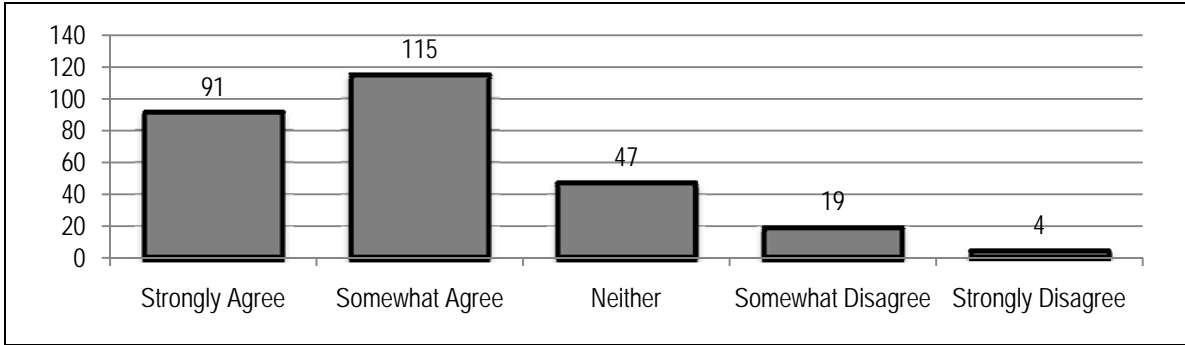

Figure 62 - Industry responses to "Noise."
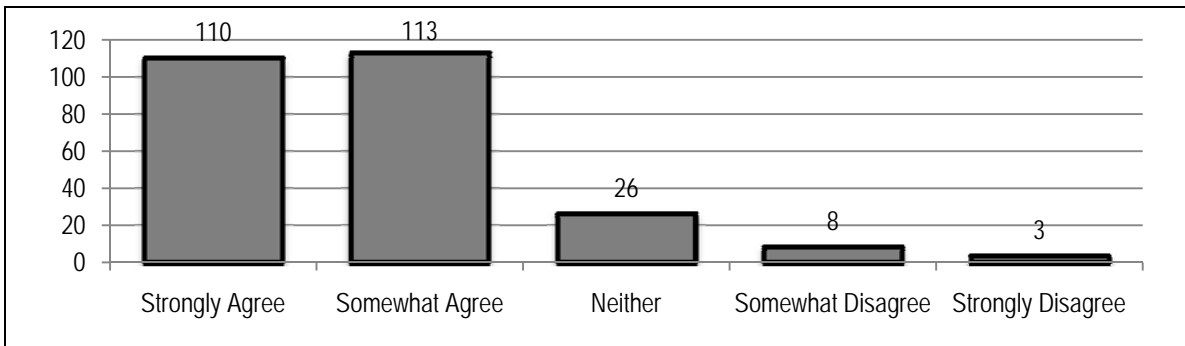
Figure 63 - Industry responses to "Laws."

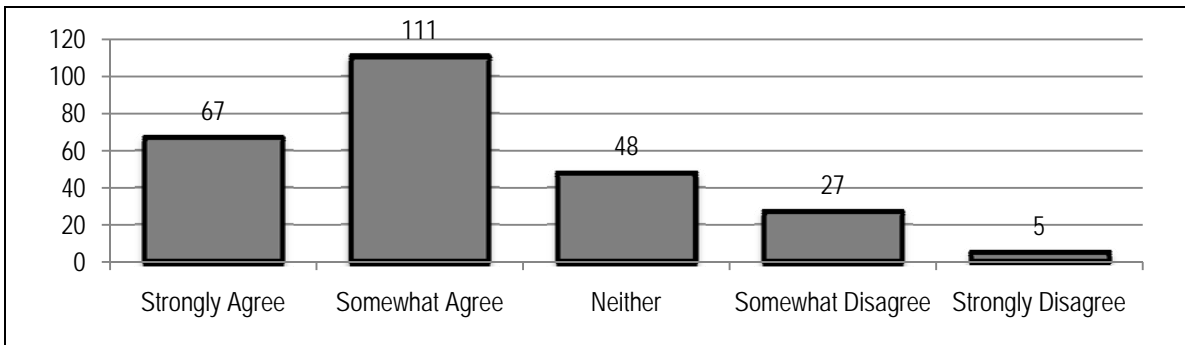*Figure 64 - Industry responses to "Translation-Aware."*

Figure 65 - Industry responses to "Translation-Apply."
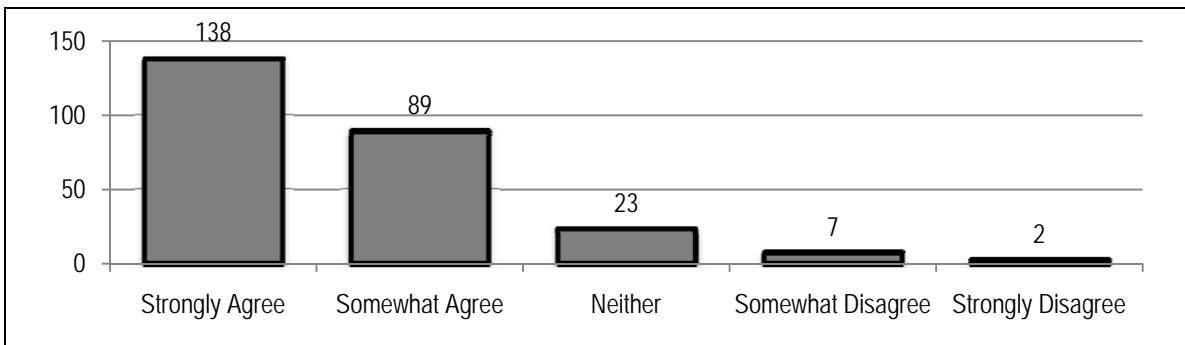

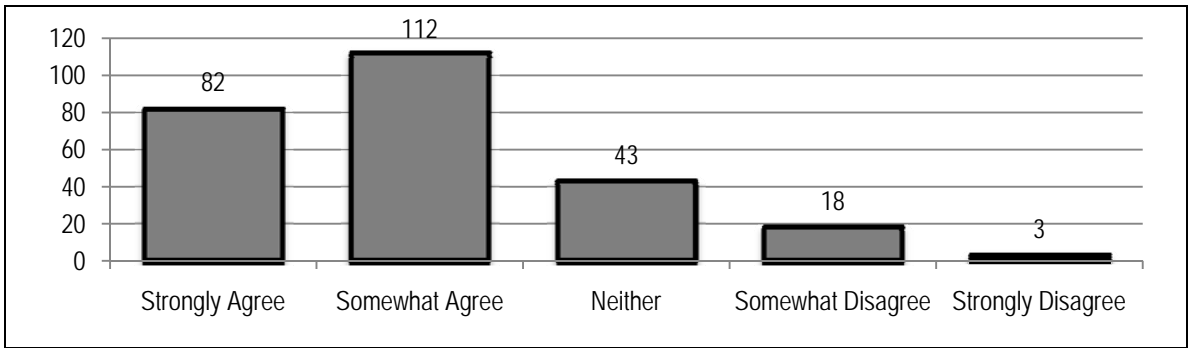*Figure 66 - Industry responses to "Direction-Aware."*

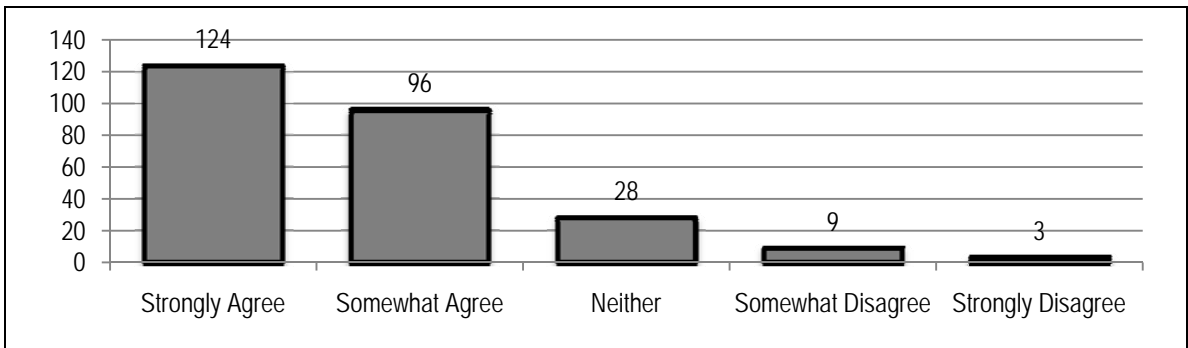*Figure 67 - Industry responses to "Direction-Apply."*

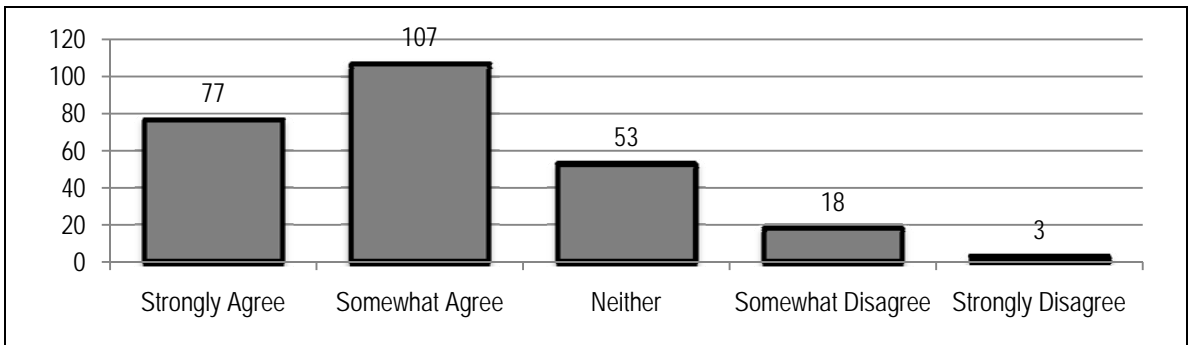*Figure 68 - Industry responses to "Collation-Aware."*

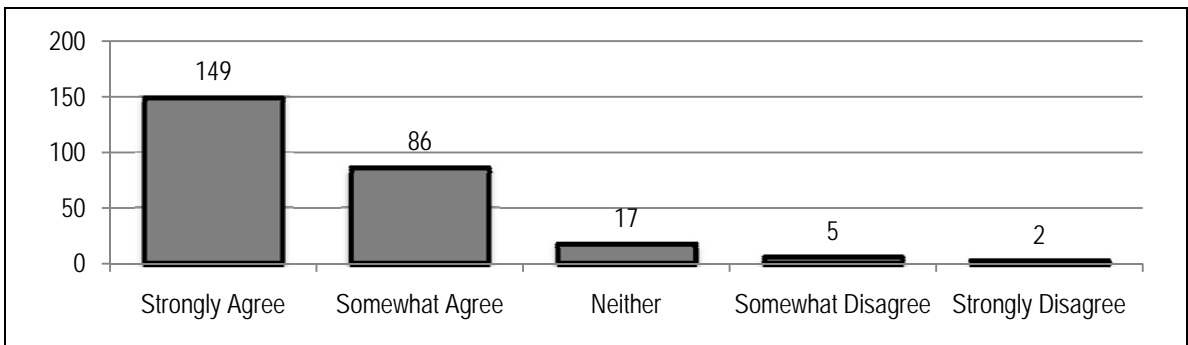*Figure 69 - Industry responses to "Collation-Apply."*

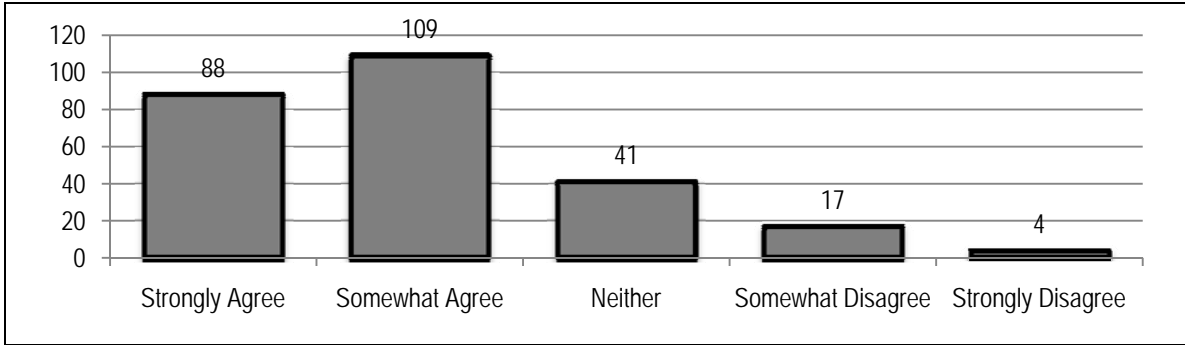*Figure 70 - Industry responses to "Dates-Aware."*

Figure 71 - Industry responses to "Dates-Apply."
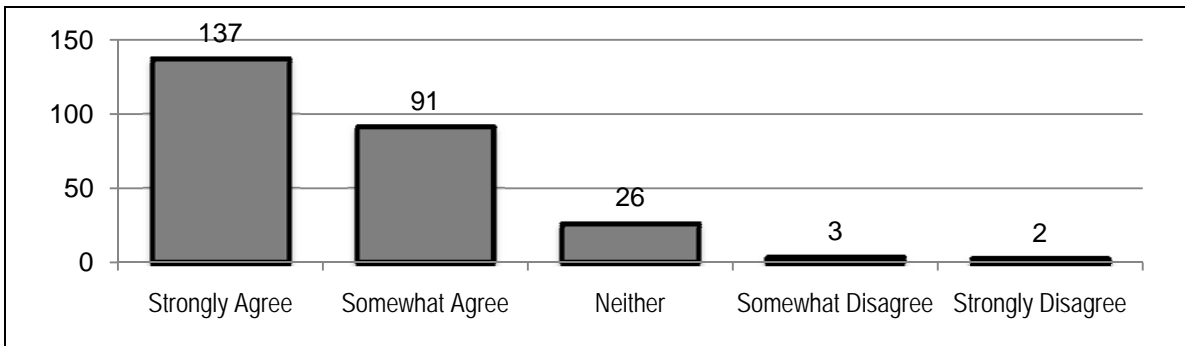

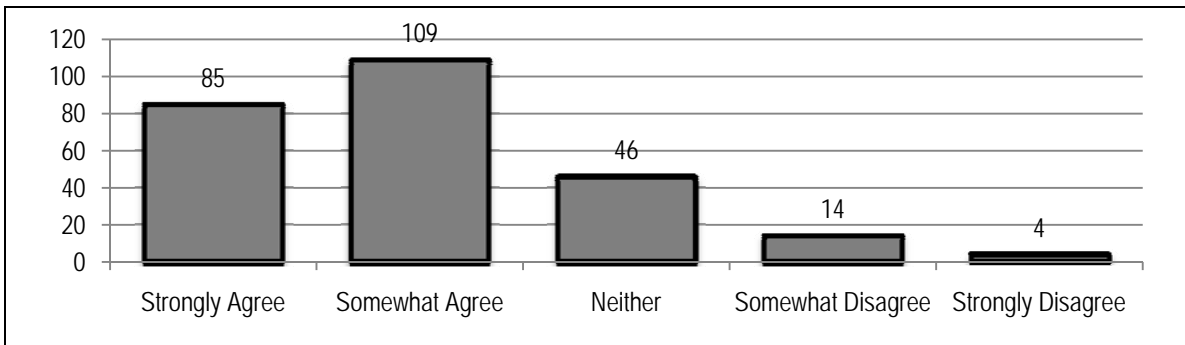*Figure 72 - Industry responses to "Currency-Aware."*

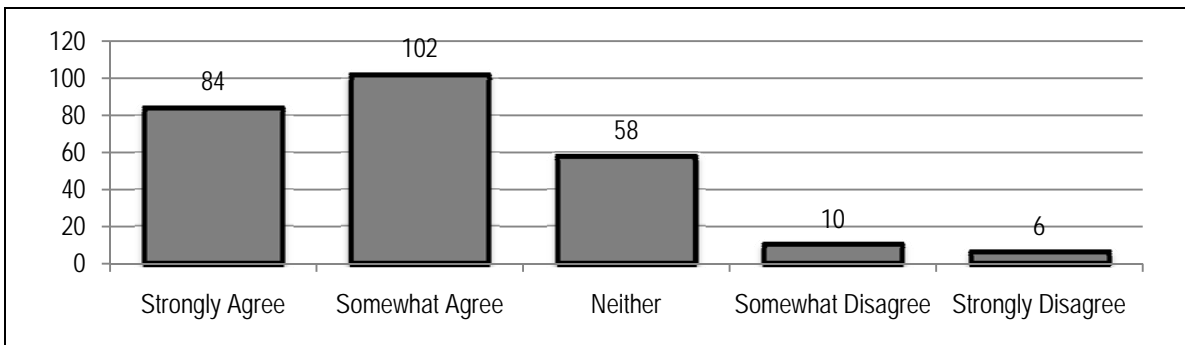*Figure 73 - Industry responses to "Currency-Apply."*

Figure 74 - Industry responses to "Ethics."

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