

INSIDERS' GUIDE:

FPGAs, Tools, and Boards



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FPGA Survey Results

What do real users of FPGAs think? Are there hidden “gotchas” amongst FPGAs, tools, and/or boards? How do expert users differ from novices or “newbies?” We polled our e-clips audience, and present herein our survey results from September, 2008.

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- ⊕ SURVEY DEMOGRAPHICS AND FPGA EXPERTISE
- ⊕ VERTICAL INDUSTRIES APPLICABLE TO FPGAS
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FPGAS, TOOLS, AND BOARDS: SURVEY RESULTS

FPGAS: USER SURVEY

What do real users of FPGAs think about FPGAs? Are they a good design choice? Are there hidden “gotchas” in the design process? Do you need to be an “expert” to program them, or are the commercially available design tools sufficient? And what about newbies - people selecting FPGAs for the first time? How do their preconceptions of FPGAs compare and contrast with the “experts” who have at least one FPGA design under their belt?

eg3.com operates one of the largest news services in the embedded systems industry, *e-clips* (<http://www.eg3.com/eclips/>). With 43,000 subscribers, e-clips is a useful community that eg3.com can poll about their pre- and post-design experiences. To that end, we sent out a request in September, 2008, and had 680 willing volunteers take an extensive survey on FPGAs, tools, and boards. This was way up from last year’s 359, perhaps indicating increasing popularity for FPGAs as well as increasing popularity for this guide, itself.

Below we present our analysis and results.

SURVEY DEMOGRAPHICS AND FPGA EXPERTISE

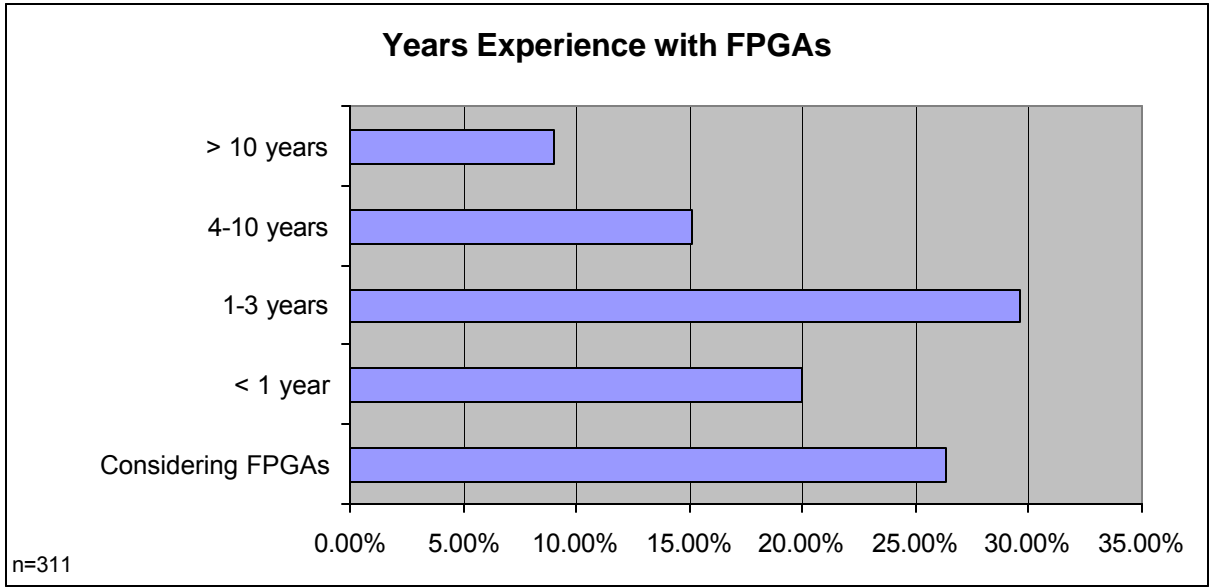
680 persons responded to our survey on their hopes, frustrations, fears, and design experience with FPGAs. 369 of these were students or academics, so in most answers below we have excluded this group from our analysis since we are focused on “commercial” applications. For the questions and graphs below, we indicate how many actual respondents there are for each question, which is a smaller subset as well.

JOB TITLE

What sorts of persons are interested in FPGAs? As is true for most embedded systems, the days of “software” guys vs. “hardware” guys no longer apply. Of the 289 people who provided a job title, 46.00% - a plurality - indicated that they both do hardware and software, followed by 15.2% doing software only, 20.4% doing hardware only, and 18.3% managing an engineering team. With FPGAs providing a choice between running an application in hardware vs. in software, design trade-offs are facilitated by people with expertise in both, as well as design teams that have both software and hardware guys.

EXPERIENCE WITH FPGAS

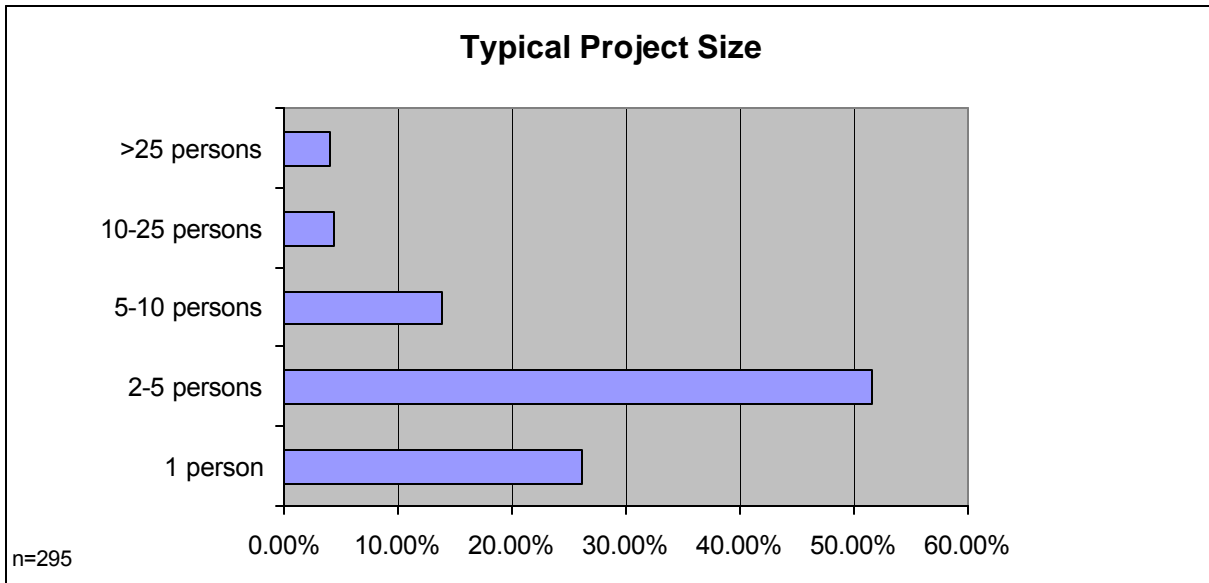
How experienced is this community with FPGAs? Are there a lot of FPGA “experts” out there, or a lot of people coming in to FPGAs for the first time? We were very curious about FPGA experience, and can provide this graph of the total community:



A majority of survey respondents have less than three years with FPGAs, but there are good minorities with over ten years and from 4-10 years. In addition, fully 26.37% indicated that they were “considering” FPGAs - up from 19.65% last year - further indicating that FPGAs are increasing in popularity as a design choice. For the analysis that follows, we designated those with more than one year experience as our “expert” group, and those with no experience our “newby” group. We hope that by comparing “experts” and “newbies,” we can help readers of this guide to learn from the experience of the experts as well as the naivete of the newbies.

PROJECT SIZE

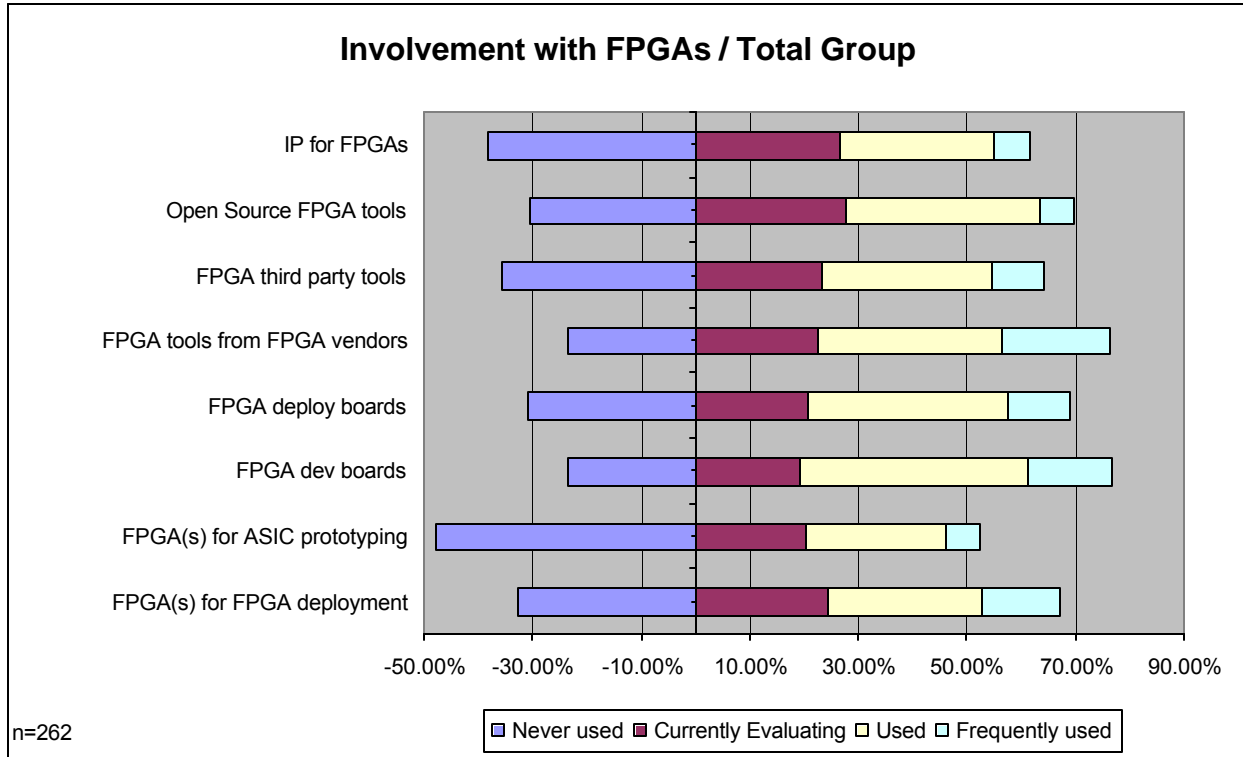
This year we asked about FPGA team size, to get a sense of the big vs. small dynamic in FPGA designs.



Typical project size is 2 -5 persons (51.53%); in all but 26.10% of cases individuals are collaborating in FPGA designs. FPGAs are a “team” project.

INVOLVEMENT WITH FPGAS

How involved are survey respondents with FPGAs and with the various components of the FPGA ecosystem?



We assigned positive percentage values to “current evaluating,” “used” and “frequently used” and a negative percentage value to “never used.” This allowed us to sum the percentages to create a (rough) “score” by which we can measure how many people are most involved with a particular subset. Here are the scores for the total group:

	Score
FPGA dev boards	53.36%
FPGA tools from FPGA vendors	52.89%
Open Source FPGA tools	39.29%
FPGA deploy boards	38.33%
FPGA(s) for FPGA deployment	34.55%
FPGA third party tools	28.77%
IP for FPGAs	23.28%
FPGA(s) for ASIC prototyping	4.63%

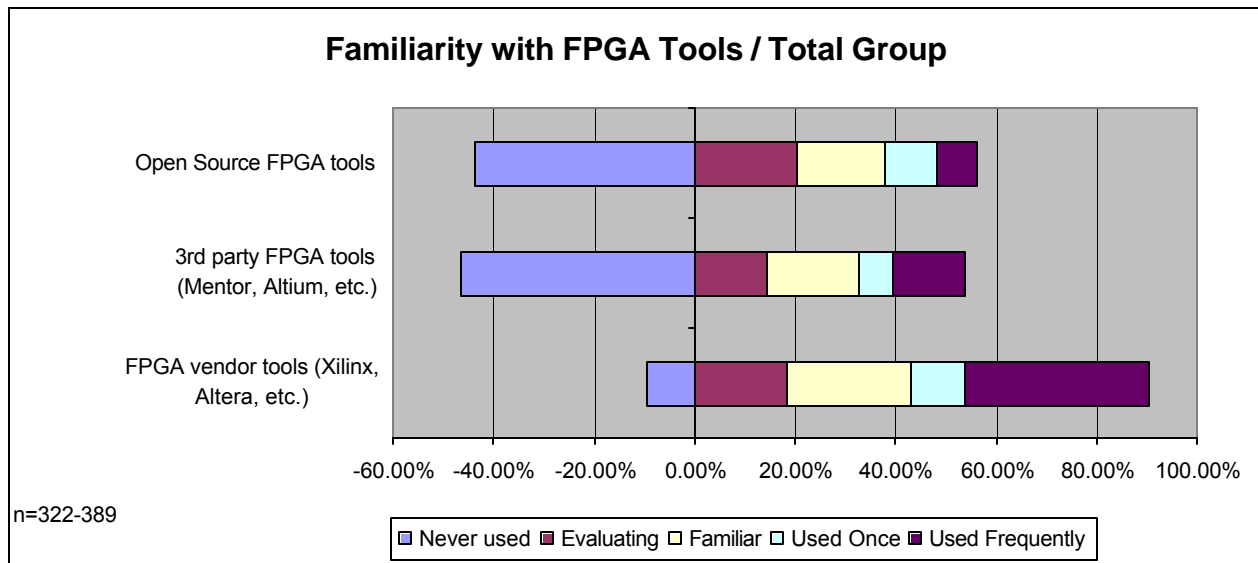
FPGA TOOLS: FAMILIARITY AND OPINIONS

FPGAs are nothing without tools, but one of the unusual characteristics of FPGAs is the depth of “free” tools provided by the FPGA vendors vs. the “paid” tools of a vibrant third party ecosystem. As we discussed in the introduction there are several sources of FPGA tools:

- The FPGA vendors themselves like **Xilinx, Altera, Lattice**, etc. - who usually provide free or low cost tools and “intellectual property” (“IP”) to entice designers to use their FPGAs;
- Third party tools providers like **Altium, Mentor Graphics, Synplicity/Synopsys, Aldec** and others who provide tools for sale;
- Open source FPGA tools; and
- Tools from board vendors like **Pentek, National Instruments, Bittware** or others that work in tandem with their FPGA -based boards.

(See the Interview section for some interesting vendor perspectives on FPGA tools, free vs. third party).

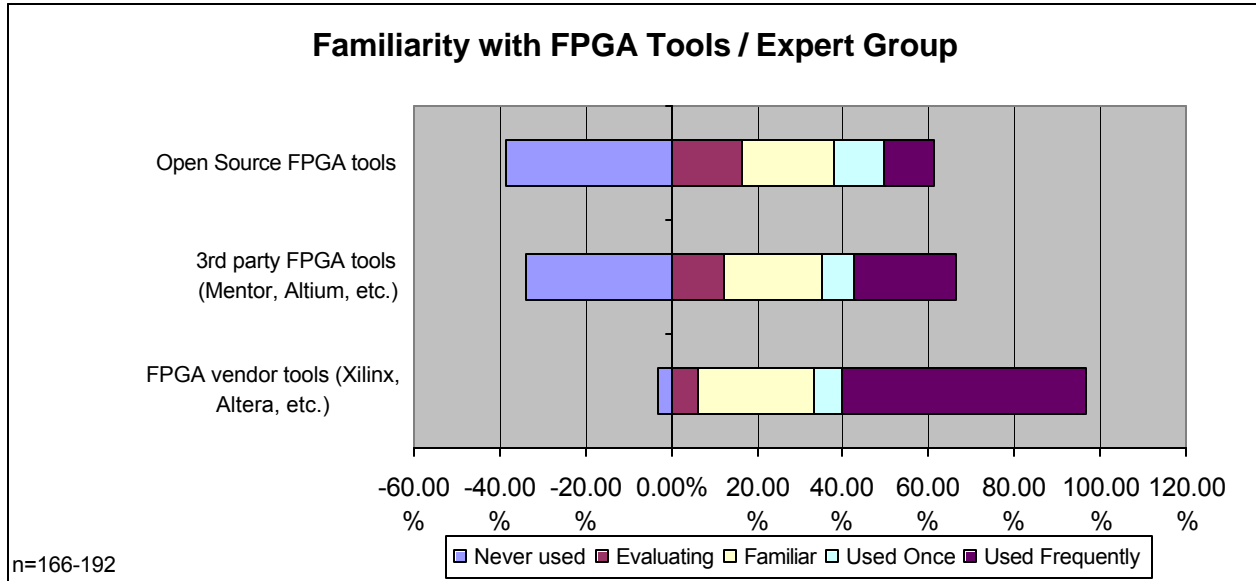
From the community perspective, we asked developers their opinions about FPGA tools and the tools ecosystem focused on three big groups: “free” tools from the FPGA vendors themselves, commercial third party tools, and “open source” FPGA tools.



First, you can see that the “free” vendor tools from **Xilinx** and **Altera** enjoy enormous familiarity. This is a no brainer since everyone who might be interested in FPGAs is going to eventually try out the tool chain of the relevant vendor. And second, in contrast, both the “free” open source and “paid” third party tools have very large unfamiliarity scores. 46.27% have *never* used the tools, a factor which indicates just how undeveloped the FPGA tools ecosystem is. Price can’t be the problem, either, as fully 43.71% have *never* used the open source tools either.

Take Away. The community remains relatively unaware of open source and third party FPGA tools. However, the community’s lack of awareness may be your own “competitive advantage” by finding a (relatively unknown) tool that improves your productivity!

Comparing the total group with the “experts” group, you can see that the depth of the awareness problem:



Even the experts are relatively unaware of the third party and open source FPGA tools at 33.73% and 38.60% “never used.” For the FPGA vendor tools, the “never used” component drops to 3.34% vs. 9.51% for the total group.

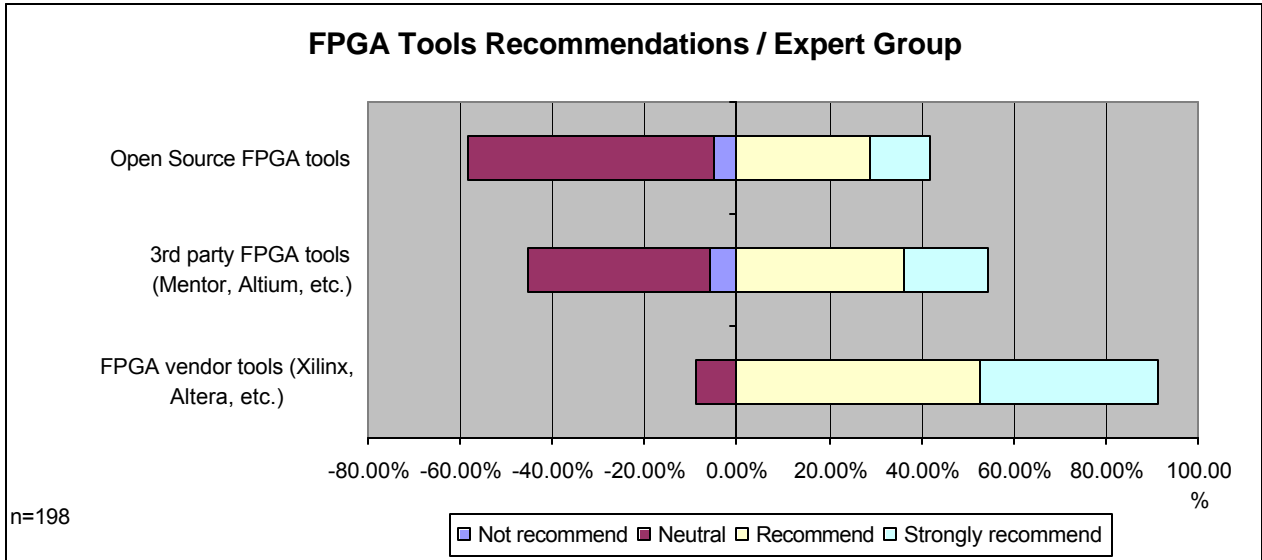
Take Away. When it comes to tools, pay attention first and foremost to the tools of your FPGA vendor. After that, you can be ahead of the pack by doing some research to identify possible open source or third party tools that your FPGA vendor may be unaware of, or not motivated to promote. In many cases, these third party tools may increase your productivity and speed your design so your research may be rewarded.

There are not, of course, great differences between the total group and the experts. What stands out most dramatically is that 100% of the experts are involved with the FPGA vendor tools: these tools are **critical** to using FPGAs. In other words, when you are evaluating an FPGA vendor you should also evaluate their tool chain. Download their “demo” or “free” evaluation tools and make sure that you like the look, feel, and usability of their tools and IDEs. It is not just the technical specifications of an **Altera, Lattice, Actel, or Xilinx** but also the usability of their tools that are important in getting your design to market efficiently and on time.

Following that, 65.45% of experts actively use at least one third party tool, with only 39.62% using open source tools. Clearly, therefore, the third party tools are most often “complementary” and

not fully competitive with the vendor-supplied FPGA tools. Thus in evaluating an FPGA choice you should consider the third party tool ecosystem as well as a factor.

Would the community recommend tools? Are they satisfied or dissatisfied with the FPGA vendor tools, the third party tools, and/or the open source tools? Since only the experts have real in-depth familiarity with tools, let's look at whether or not they would recommend various types of FPGA tools:

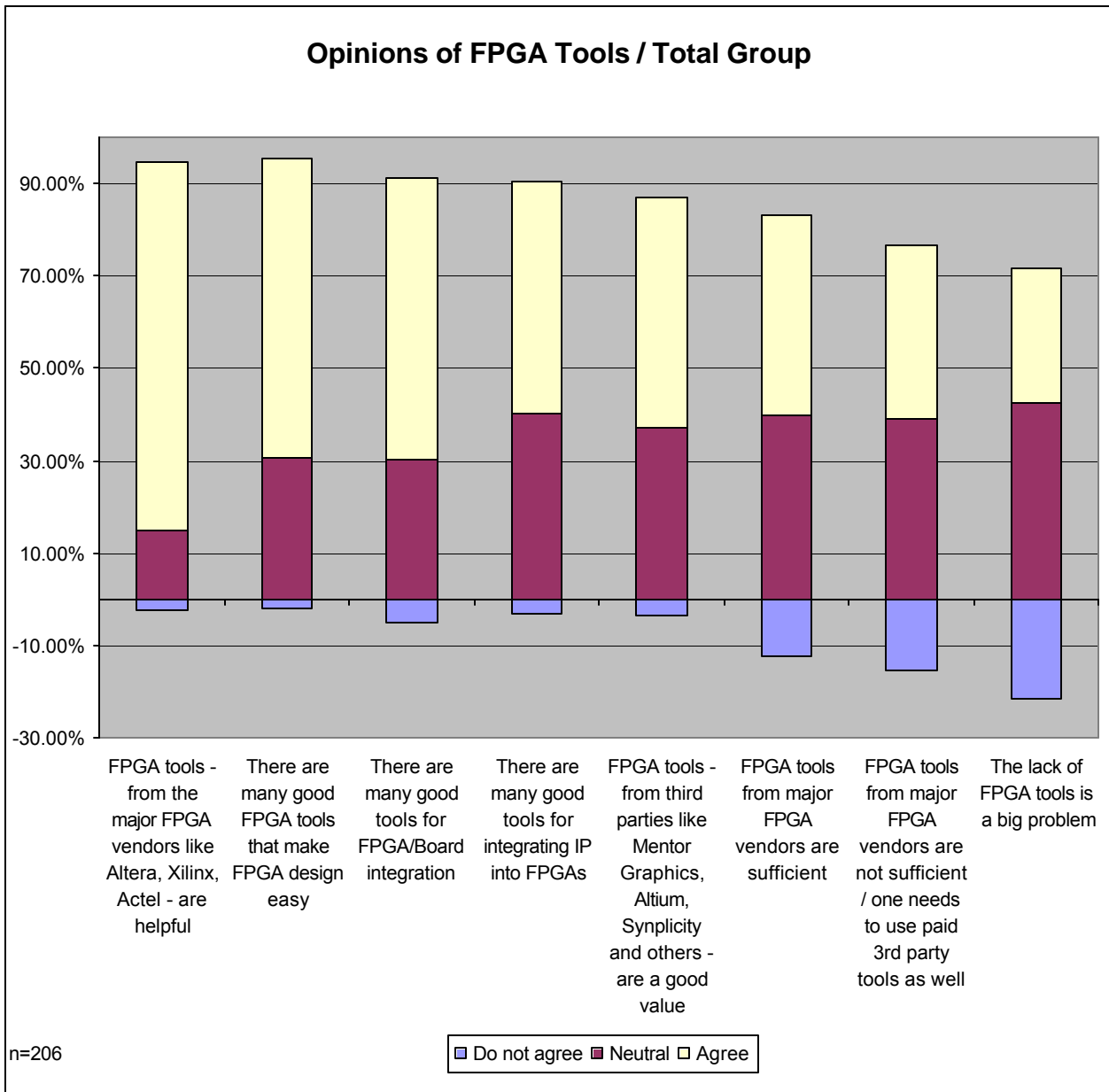


Their most positive experience is with the FPGA vendor tools, which with 198 persons responding, no single person indicated that they would “not recommend” the tools (!). Only 8.67% were “neutral.” This indicates again, that there are very high levels of satisfaction with the **Xilinx, Altera, Lattice, Actel** tool chains at a general level.

With respect to open source or third party tools, the negatives grow somewhat but remain low. Only about 6% would “not recommend” this tools choice. The difference is primarily in the “neutral” area, in which almost 40% of third party and 53% of open source are “neutral.”

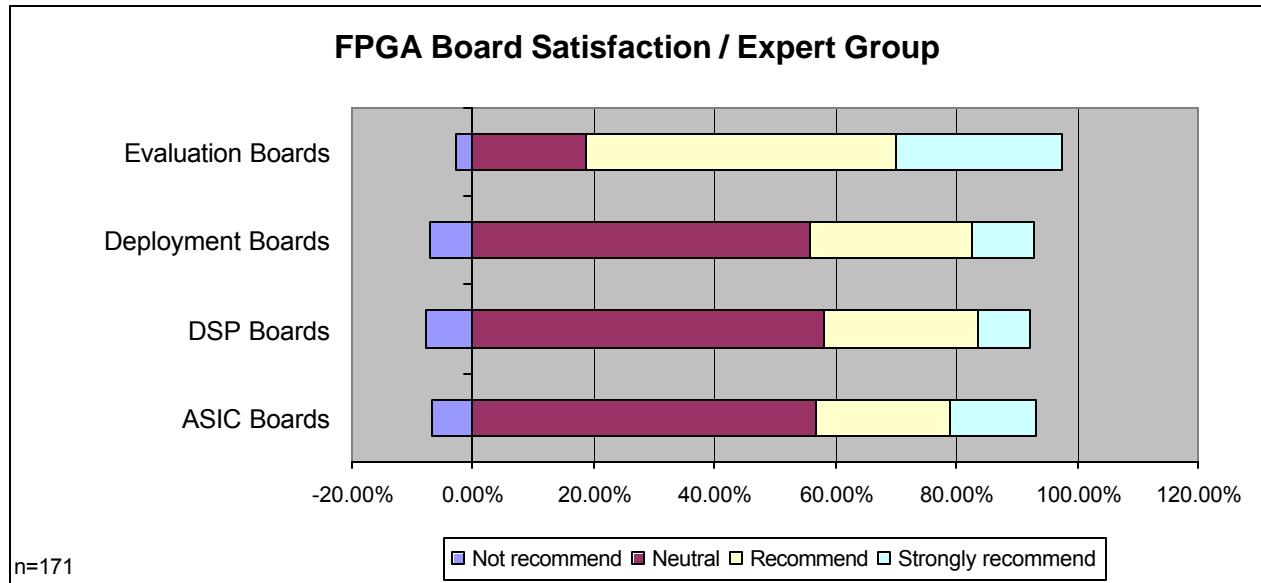
Take Away. Most users “love” their FPGA vendor tools, but are more lukewarm with respect to open source and/or third party tools.

What are the general opinions of tools? We asked a large set of questions about the FPGA tools experience.



Here again, we see a very strong positive opinion of FPGAs and FPGA tools. There is a small but significant minority, however, that sees a need for third party FPGA tools at 12.37% indicating that FPGA tools from FPGA vendors are “not sufficient” and 37.57% indicating that you should use third party tools. 29.32% indicate that the lack of FPGA tools is a “problem.” So, bottom line, the situation is mixed. There is high satisfaction with the existing tools, but a vague underlying desire for “better” tools.

Here is a chart showing the scores and differences between the total group and the experts:



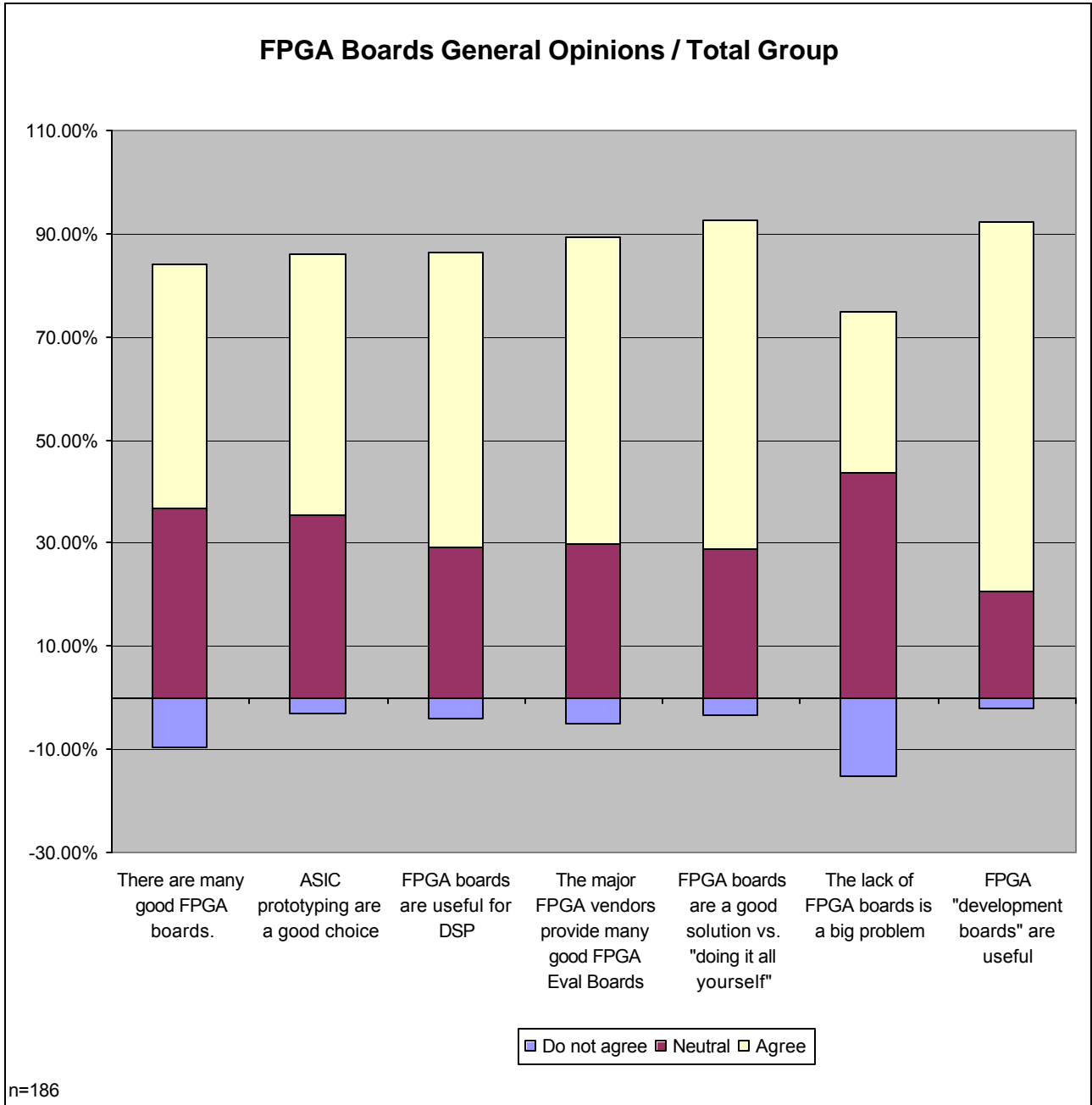
As with many other questions in the survey, it is striking how positive users are about the FPGA vendor products. Clearly, using an evaluation board from **Xilinx** or **Altera** is an excellent choice. For third party boards, the negatives are higher both absolute negatives (e.g., 6-7% typically would “not recommend” a third party choice) and in the lukewarm recommendation of neutral (in the 55% range for all vs. 19% for the FPGA vendor boards).

On the other hand, the awareness of third party boards is also not as great, so it may be a situation in which unfamiliarity with the products creates skepticism and negative ratings.

Take Away. Boards, as so many other FPGA related products, are clearly best for evaluation purposes from the FPGA vendors themselves. For deployment, DSP, and/or ASIC prototyping, the third party ecosystem has positive reviews overall but not near the state of euphoric endorsement that characterizes the FPGA vendor boards.

In this situation, we would recommend choosing a third party board from a vendor that works closely with a semiconductor partner.

What then were the “general opinions” about FPGA boards? As for the other research areas, we asked a series of questions on the topic.



Here again most of the responses were highly positive. Only in the area of the relative lack of "good" FPGA boards were there some negatives at 9.60% indicating "do not agree." Evaluation and development boards scored the highest marks.

FPGA DESIGN INFORMATION

eg3.com is all about finding the best information on the Internet for topics in embedded systems, and in this case about FPGAs. Our information on FPGAs is updated weekly and each

week we send out new alerts via e-clips to interested engineers based on keyword topics, including FPGAs (<http://www.eg3.com/eclips/>). That said, it was interesting to poll the audience on what sources of information they have found useful in their hunt for FPGA educational information.

Here is one final graph in the survey indicating the relative popularity of various sources of information, both on and off the Internet.

“Advertising and sparkle sheets are not real products, nor does the purchase of an FPGA guarantee quality factory support.”

“You have to change your mind regarding FPGA programming in comparison with MCUs. Parallel vs. sequential logic!”

“FPGA designs are much dependent on design architecture and description. Careful understanding of design entry (usually VHDL/Verilog) is per is not sufficient to achieve good results. It's necessary to know implementation.”

“Be very careful while designing PCB with FPGA.”

“It takes a lot of patience to study them. The “crossing the desert” phase takes a lot of time, but it is satisfying!”

“The start-up of new designs can be slow. The idea of using 3rd party IP can be very misleading and time consuming as you try to integrate an IP that you should have designed from scratch yourself.”

“There has been no problems so far other than timing mismatch between prototype FPGA and final product ASIC.”

“Try the free tools , try samples , try EVERYTHING before you buy. Stay AWAY from companies who doesn't offer samples and at least some trial tools.”

POSITIVE MESSAGES

“High performance, freedom of design.”

“We use FPGAs and CPLDs to teach Digital Circuits and develop new projects. Working with them is easy and permits us to modify the circuits very quickly.”

“High level design tools such as Handel-c allows to reduce time to market. However, it is specific for special boards and vendors.”

“The FPGA world is about to come and every Computer Engineer should be familiar with it.”

“These FPGAs are going to rock the world!”

“That [FPGA is] going to rule the future [of] technology - so be prepared for it!”

“FPGAs allow you to do almost anything you can imagine.”

“FPGAs give you a lot of design power and are robust for deployments, and don't forget that they are reprogrammable, offering you simple ways to upgrade your systems.”

“For systems with small production runs or long life cycles part obsolescence can be factored out. FPGAs when used wisely can be extremely cost-effective in this regard. In the long term it makes systems more reliable when systems can be returned years into the future and still have a replacement without replacing software implementations.”

“Very good base for verifying implementation before actual ASIC is developed. Reprogrammability is very useful and mistakes can be avoided before the actual IC is taped out.”

“With FPGAs simultaneously we can find power, speed and area consumption and in short it is the best way of optimization of any digital circuit.”

“They are a quick , simple solution. On 3- 4 recent projects we could save time, money and the final Gerber files showed us more than 30% savings between hardware, board size etc.”

And, our all time favorite user feedback on the FPGA experience, from last year’s survey:

“One can perform thousands of mistakes, [and] every mistake is a great experience!”