

Wireless LANs: Improving Productivity and Quality of Life

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1.0 Introduction

IT professionals in large organizations have more technology choices to make now than ever before. Which primary operating system do I use? Is Voice over IP an option that I may want to explore? Will outsourcing to an ASP be beneficial to my organization?

Increasingly, IT professionals are also debating whether or not to deploy wireless LANs (WLANs). Are there certain job functions or applications that justify the investment? What will my organization gain by deploying a WLAN? What are the risks? What are the benefits? Will the benefits outweigh the cost? Will end-users embrace the new technology?

However, little data exist that show the actual benefits realized by WLAN adopters. While cost saving are difficult to quantify, the “soft” benefits of using WLANs such as productivity, flexibility and accuracy are widespread and compelling. These soft benefits—which indirectly lead to actual cost savings—are the main drivers behind the increasing number of organizations that are deploying WLANs.

To provide specific cases of WLAN use, Cisco Systems commissioned Sage Research to conduct qualitative discussions with employees of large organizations that use WLANs. This research effort uncovered relevant customer attitudes that reveal a variety of real-world benefits—as well as some challenges—to deploying WLANs. All of these results are summarized in this white paper.¹

2.0 Who Uses WLANs?

Before delving into WLAN benefits and challenges, it is important to keep in mind who the typical users are of this technology. There are two main ways to think of WLAN adoption—the industries that use WLANs and the employee types within those industries that use WLANs.

When one thinks of WLAN users, the industries that come to mind are healthcare and education. While it is true that these two industries may be more liberal adopters than other industries, WLAN use has expanded to other industries as well. In fact, retail, government, manufacturing, and even financial organizations are all deploying WLANs

¹ The data in this report is based on qualitative discussions with 20 participants. To qualify, participants were required to be employed by organizations with 1,000 or more employees that have been using WLANs for at least one month. Respondents were also required to have personal involvement for specifying the budget or approving the purchase of WLAN equipment and/or access the organization’s WLAN at least once per week. The final sample includes participants from various industries.

at an increased rate. As this document illustrates, organizations from each of these industries—as well as many others—have benefited from WLANs.

Within organizations that use WLANs, an average of 15% of employees have access to the technology—although actual results vary widely from a low of 1% to a high of 80%, and most organizations have plans to expand their WLAN deployment.² While most wireless LAN users fall under the functional areas of IT, executive management, and sales, it is also worthwhile to understand the specific functions that merit WLAN use. Some of these job functions include frequent travel, working from home on a regular basis (telecommuting), attending frequent meetings, attending conferences away from the office, working outdoors where WLAN access points have been made available along the building's periphery, working in a large warehouse or factory, taking inventory of supplies, and instant access to server-based information.

3.0 Productivity Benefits of Wireless LANs

Through interviews with actual WLAN users, this study uncovers widespread WLAN productivity benefits, particularly:

- Time savings
- Flexibility
- Quality of work

The following subsections detail each of these productivity benefits in more depth.

3.1 Time savings

In today's high-pressure world, no one can dispute that time is money. Where WLAN use sees its strongest, most quantifiable benefit is in terms of time savings. Based on primary research, actual WLAN users indicate that, on average, *a wireless LAN user can save up to eight hours per week* versus a wired LAN user. Of course, time savings equates to monetary savings. Using these figures, on average, a wireless LAN user saves his or her organization *\$260.50 per week* due to time savings.³

² Users were asked, "Approximately what percent of your organization's employees have wireless LAN access?" These responses were tallied and 15% is the average of this total.

³ Interviewees were asked to estimate the amount of time WLANs save an average user per week. Interviewees were also asked to estimate the average annual salary of a WLAN user. Based on this data, the average WLAN user saves \$260.50 per week in time savings—although savings ranged from \$30/week/user to \$750/week/user. This data is for directional purposes only and should not be considered statistically significant due to the small number of interviews that were conducted.

The following illustration shows some examples of organizations that are saving time by using WLANs.

Organization type	Types of WLAN users	Average time saved	Average money saved
Government	Executives and IT	5 hours/week/user	\$150/week/user
Healthcare	Nurses	15 hours/week/user	\$472/week/user
Finance	Executives and IT	15 hours/week/user	\$750/week/user

Table 1 ? Time saved by using WLANs

WLANs enable users to save the most time when *responding to email*. This is especially true for IT professionals. In fact, an employee within the IT department may receive over 100 emails each day. By accessing the wireless LAN while in meetings, in the cafeteria, or at other locations, employees are often able to catch up on their email while doing other things.

Not only does the wireless LAN user save time, but other hard wired employees also save time indirectly. For example, a mobile employee may not need to call a colleague to obtain information. Instead, the mobile user can access the LAN via a wireless connection and obtain the information on his or her own. Another example is a nurse working on one floor of a hospital may need access to patient information. Instead of calling the administrative assistant or receptionist, the nurse can access the patient's file on the LAN by using a wireless device. As seen later in this paper (see the following two sections), by using a wireless LAN, both the quality of work as well as flexibility improves in this scenario. It is often these "soft" benefits such as quality of work and flexibility that cannot be quantified that drive WLAN adoption.

As noted by users:

I can use my laptop for work during meetings now. I can communicate and don't have to wait for six hours to use my notes. In the meeting room, I have no place to go, so productivity increases. - VP MIS, Finance

The benefit is that when you need to check something, you can do it right there on the sales floor. Whatever you are looking at, you can check it right then. As far as efficiency, it is more efficient. You can check a lot more at once with that. The merchandise can stay right there. – Store Manager, Retail

I would say an average user is now saving probably at least three hours a day so in an average week, they save 15 hours a week. That is a very significant gain, because we are talking about freeing them up from having to call the lab for results, looking up radiology results. They used to have to call the department,

which is freeing up people on both sides because we used to have the secretaries answering and pulling files. – IT Manager, Healthcare

With the wireless on the forklifts, you scan the pallet and you know where to go. There is no paper manifest. It is all instant, so they can move so much faster. It is all automatically in there. All the data for the merchandise is transmitted over the wireless network. – Store Manager, Retail

3.2 Flexibility

One of the benefits to deploying wireless LANs is the flexibility they offer users. Wireless LAN users are able to access the LAN from a variety of traditional areas inside their building(s) as well as non-traditional areas—sometimes even outside their building(s).

The following table shows the various locations, in order of most common to least common, where users access their organizations' LANs wirelessly.

WLAN access inside the building	WLAN access outside the building ⁴
Conference room	Home
Offices	Another job site
Meeting room	Warehouse
Shipping and receiving area	Train
Inventory area	Bus
Distribution center	Library
Cafeteria	Airport
Training room	Athletic field
Classroom	Restaurant/coffee shop

Table 2 ? Wireless access from many locations

This broad coverage gives users the flexibility to work at their desks or move unencumbered throughout the organization, all the while fully linked to the network. It should be noted that WLAN deployment varies from organization to organization. Not all

⁴ In some cases, end users have both wireless LAN and wireless WAN access, and some examples are based on their experiences in having *both*.

organizations provide such a wide variety of wireless access point locations. However, access from less conventional locations are not uncommon and, according to users, productivity is enhanced by their ability to access from a multitude of locations. As the following quotes demonstrate, users find that WLANs offer them freedom that wired LANs are not able to provide. Once again, even though this freedom is not something that can be measured in terms of dollars saved, increased flexibility translates into increased productivity for WLAN users.

Flexibility and convenience go hand in hand. The following chart shows how WLAN users compare the convenience of using WLANs vs. traditional wired LANs.⁵

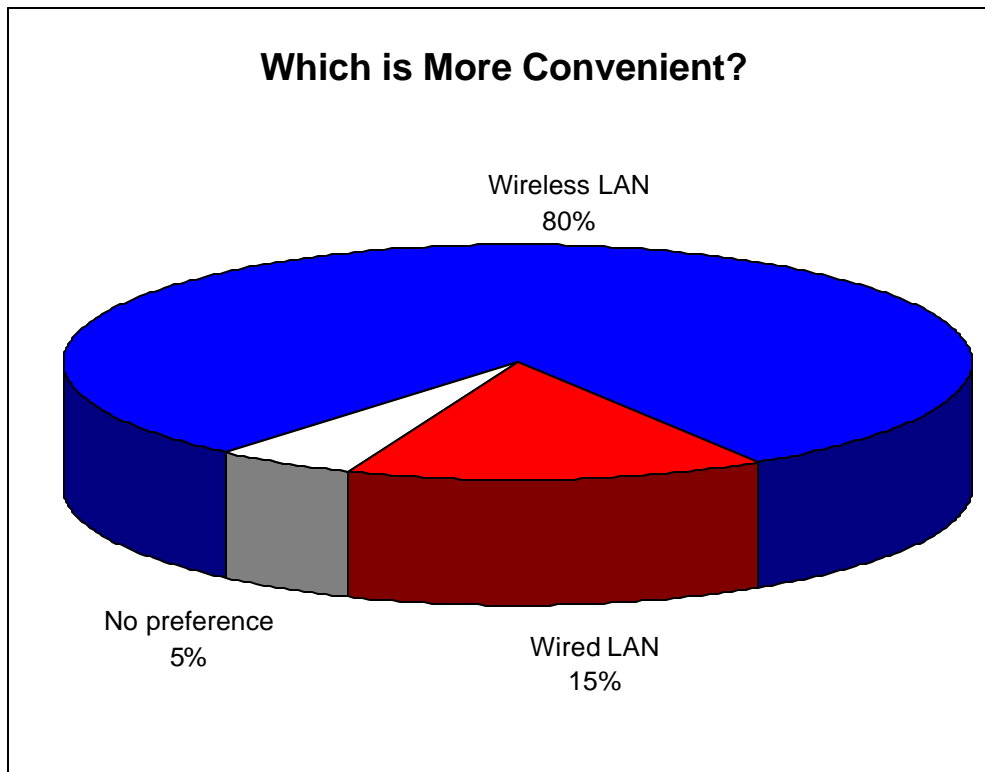


Figure 1 ? Wireless LANs are viewed as more convenient

As noted by users:

I think the benefit is the freedom that it gives you to be able to take the hardware with you to places for meetings and for work. I get people in a big conference room with a wireless system and I don't have to be concerned with plugs. It is the

⁵ The exact question was, "Of wired LANs and wireless LANs, which is more convenient?" Percentages shown in this figure are not statistically significant and should be used for directional purposes only as they are based on 20 respondents.

convenience of it. For example, if I need to see three people I can take a laptop and go to any one of those three offices at their convenience and not have to mess with sitting down and finding a computer that works. – Executive Director, Education

It is nice to not have to worry about tripping over wires. I spend an enormous amount of my time at my desk, and being hooked up to a wire there is fine, but I have found a lot of enjoyment in the freedom that it gives me to be able to undock my laptop and go out and talk with a salesperson on the floor and show them the notes that I may have taken when I was with a customer or show him a presentation that I may have gotten from a supplier or to be able to just bring it with me and work. – Regional Sales Manager, Manufacturing

I have the ability to take my system over to another engineer's desk and show them an error that I'm getting on an application that we're running so we can do tests. I don't have to bring him to me. I can take my same box anywhere I want, to any facility. If it is wireless capable, I have it with me at all times. I'm not limited to go to any desk. I'm not limited to any location. I can go wherever I want, as long as we have the wireless facility. I can sit wherever I want and I can work wherever I want. - Integration Engineer, Finance

3.3 Quality of work

In addition to flexibility and time savings, many users report that the quality of their work has improved by using a WLAN. The biggest benefit on this front is *accuracy*. For example, a government employee is responsible for keeping track of drums of nuclear waste. In the days before wireless LANs, a scientist would need to count the drums by hand, and record the number on paper. Then, the data was entered into a server-based application by an administrative assistant at a later date. This produced an incredibly large margin for error. Now, with access to the wireless LAN, the scientist can use a handheld scanner to read bar codes that are placed directly on the waste drums. By doing this, a great deal of data is fed in real time directly to the server. This has increased accuracy tremendously—instead of knowing where 70% of the waste is located, they are now able to know where 99.9% of the waste is located.

The above example is just one way that accuracy can be improved by using a wireless LAN. The point is that, by using a wireless LAN, data can now be fed directly from various locations instead of being manually input at a later date. This increases information accuracy and timeliness—another widespread “soft” benefit that WLAN users are realizing.

As noted by users:

Number one [benefit to using the wireless LAN] is users have access to the information they need from anywhere within the facility without having to run back and forth. We are not losing any information due to their writing the information down wrong. They would write it down and then run to the machine

to make adjustments and say oh, I forgot. Now, they have it with them. – Manager IS, Manufacturing

One of the main drivers in our business is accuracy. The amount of customer data that can be culled on the front end of our selling, administrative or customer service process has been greatly enhanced [using a wireless LAN]. – Telecommunications Director, Finance

[If the wireless LAN was not present] I would get a lot less accomplished. Inventory and ordering would be less precise. I would get more stuff I don't need and less of what I do. – Store Manager, Retail

I think it [WLAN] is reducing a lot of errors and misreads. When you put something down on paper, people can always read that wrong. On the computer system, it doesn't accept errors. You have to enter the data correctly. – Manager of IT, Transportation

We've been able to get our staff to keep more thorough records on who they're talking to...they're inputting the data as it's happening, rather than taking notes, bringing it back, entering it, maybe losing some details. – MIS Director, Technical Recruiting

4.0 Quality of Life Benefits

In addition to productivity, there are other “soft” benefits of using WLANs. In particular, users cite “quality of life” benefits to connecting to the LAN via a wireless connection. According to WLAN users, the three most important quality of life benefits of using a wireless LAN include:

- Reduced stress
- Improved family life
- Increased status

Each of these quality of life benefits are presented in more detail in the subsections below.

4.1 Reduced stress

Some users view WLANs as stress reducers. This is the case for one primary reason—readily available information. Wireless LAN users do not have to worry about trying to find a wired connection. For example, if a wireless LAN user brings the wrong presentation to a meeting, he or she will not have to worry since the correct presentation can be accessed on the server wirelessly. In this way, stress is alleviated since the user doesn't have to worry about being “plugged in” to access the LAN.

In addition to the ability to download files, users can respond to important queries via email quickly without having to worry about finding a connection. For example, an IT user with a wireless connection can go to lunch in the cafeteria without having to worry about missing urgent emails. Again, the point is that stress is reduced in some ways by having this continuous access to email, files, and applications.

As noted by users:

[The wireless LAN] is a stress reducer, because the information is much more readily available to them [workers]. As long as they are motivated enough to retrieve it, they can do a lot more with it. – IT Manager, Healthcare

I would say that it [WLAN] decreased it [stress] because then they [WLAN users] are not so anxious.... They can get access to send email and to respond and not have to worry that they can't get to that issue or respond to it for a couple of hours.... – Manager of Infrastructure Services, Transportation

If I see a lot of stuff on the shelf and wonder if the system counted right, I can check it right there instead of having to walk up to the office. I would say my stress is less because I am taking care of the things I need to take care of. I am not stressed about skipping over things. - Store Manager, Retail

4.2 Improved family life

Some users are even able to spend more time at home due to WLANs. Some wireless LAN users stated that they are able to reduce the hours they spend at work due to accomplishing more by being mobile at the office. Some users are able to save up to two hours each day at the office, and go home at a more reasonable hour—perhaps 5 o'clock rather than 7 o'clock.

In fact, some users find that WLAN use enables them to be more involved in their children's lives. For example, some say they are able to attend their children's sporting events or choir events due to the freedom they have with this technology.

As noted by users:

I would come home before and only be able to spend two hours with the family and then be on the computer doing work and they would go off doing something. Now I am able to go off with them and catch up. I am adding two hours a night [by using a WLAN at the office]. – Associate Director of Technology and Office Planning, Healthcare

I am not spending that time in the office anymore because I have the tools to do the same thing outside of the office. I am able to be home at a reasonable hour. – Manager of Infrastructure Services, Transportation

4.3 Increased status

For some users, WLANs provide a level of status, in terms of both a personal edge, as well as a competitive edge.

Employees that are using the wireless LAN feel that they have a personal advantage over users who do not have WLAN access. This shows that feeling of having complete access to data at any time is very powerful for wireless LAN users. This feeling of power, in the minds of the wireless LAN users, leads to feelings of having a competitive edge.

The second feeling of having a competitive edge stems from having an edge over the competition. For example, one participant in particular feels a sense of appreciation that their organization provides a technology that allows him to be one step ahead of the competition. This gives the WLAN user a sense of security within their organization.

As noted by users:

It [the wireless LAN] definitely gives me an edge. I feel a little better about the work I do throughout the day. A lot of times if you start getting behind on email, you start feeling that you are going to be overcome by events. Now anytime we have a meeting or I am away from my desk and I have my laptop with me I don't feel like I am going to be rolled over by the snowball. It makes you feel empowered and have a sense of mission accomplishment. – Information Management (Branch Manager), Government

It [the wireless LAN] has a tendency to impress people to some degree that we are on the edge of technology and we are willing to take the risk. – Director of IT, Utilities

5.0 Challenges to Deploying Wireless LANs

In addition to the many benefits of deploying WLANs, there are some challenges. In particular, participants cited security concerns, slow speed, and lower reliability (compared to wired LANs) as primary challenges they are currently facing with their wireless LANs.

5.1 Security Concerns

Many organizations are concerned that wireless LANs do not provide a level of security equal to wired LANs. In fact, some people are concerned that competitors are able to steal WLAN transmissions out of the air. It should be noted, however, that none of the organizations that consider security as a concern reported any instances of data being intercepted as a result of using the wireless LAN. Therefore, security concerns may be more of a perceived problem than an actual problem. In addition, many vendors are beginning to address security concerns more vehemently by designing solutions with enhanced security features.

As noted by users:

We wouldn't want the signals to be intercepted by potentially one of our competitors...that would be one of the bigger reasons why we wouldn't roll it [WLAN access] out quicker. – Regional Sales Manager, Manufacturing

The security standards are vulnerable now. The web security configurations work and we will use that when needed, but we are not going to do a large deployment when the 802.11 body still hasn't come to a consensus on the ultimate standards. – Senior Network Engineer, Healthcare

The way that I see it is if you have a wireless network and you are not real careful about the secure aspects of it, then what keeps anyone from plugging a wireless card into their computer and are close enough to receive the signal? Then they are just kind of on your network getting the information. – Information Management (Branch Manager), Government

5.2 Slow Speed

Some wireless LAN users are disappointed in the speed. The problem for these users is due to shared bandwidth. Wireless LANs can feel like a bottleneck since the bandwidth is being shared by all devices attached to the WLAN. For this reason, some organizations tend to use wireless LANs sparingly based on job function. In other words, unless a compelling reason exists to hook a device up to the WLAN, the wired LAN will be used instead. In addition, many organizations have rolled out Fast Ethernet in the past few years, and end users have grown accustomed to that level of performance.

As noted by users:

I prefer the wired just for the type of work that I have to do. Ten or eleven megabits is not a speed that helps me in my job. Because of the speed limitations of the wireless LAN, it is almost like going back to 10Base-T again. – Director of IT, Utilities

There are certain drawbacks. I think each technology has its own application. Where we can take desktop machines and wire them, we prefer to do so rather than put them on wireless, because you are clogging the wireless, which is an eleven megabit shared on all of the devices speaking on it. – Senior Network Engineer, Healthcare

You're limited in speed, which means that your application is limited in either the data it sends down or the data it returns back. - Systems and Administration Manager, Government

5.3 Reliability

Reliability is also a challenge that many organizations face with wireless LANs—most users concede that wired LANs are more reliable than WLANs.⁶ When discussing decreased reliability, users mention interference and signal strength as the biggest problems. For example, devices that are producing conflicting signals may disrupt the wireless LAN signal. In addition, depending on where the user is, physical objects—such as thick walls—can also decrease signal strength and, thus, reliability.

As noted by users:

With a wireless, somebody is working on their laptop and they happen be sitting in the break room when someone turns on the microwave. That can disrupt the usage. They go around a corner and that can disrupt it. Someone walking in front of the antenna can mess it up. There are things that can cause it to disrupt the service. The wired LAN is more reliable because of the nature of the technology. - Director of IT, Utilities

[The wireless LAN is less reliable] because of the actual range of a wireless are limited based on physical objects. If you have something that outputs interfering signals to the wireless LAN, it would break the connection or a large, thick wall; if someone walks past it, it could break the connection. - Network Administrator, Publishing

I think there is more stress [by using WLANs] because of the [lack of] reliability. If the reliability were the same, then there would be less stress. – Corporate Controller and CIO, Manufacturing

6.0 Conclusions

What is the value of improving your productivity by eight hours a week? For many people, it is worth even more than the value of their salary for that period of time. What is the value of improving your accuracy by even a fraction? For some industries, such as healthcare and finance, this could mean many lives and millions of dollars. This is part of the challenge in trying to quantify WLAN benefits: many of the benefits are clearly widespread, but translating them directly to dollars saved or generated can be difficult. Still, based on the 20 users that took part in this study, an average savings of over \$250 per week per WLAN-enabled employee is certainly a powerful number—and most likely a conservative estimate.

Additional benefits are even harder to quantify—though they are clearly compelling:

- Increased flexibility

⁶ The exact question asked was, “Of wired LANs and wireless LANs, which is more reliable?”

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- Decreased employee stress
 - Increased time to spend with family
 - Improved status
 - Enhanced work quality

Few technologies can claim to result in such a wide variety of benefits. And few technologies deliver benefits that appeal to both an employee and an employer. So it's not surprising that of the 20 WLAN adopters interviewed, 18 report plans for further deployments.

For organizations considering WLAN technology for the first time, the research results in this paper can be used to help make the critical go/no go decision. Consider the following questions:

- Are the examples reported in this paper relevant to your organization?
- How many hours can be saved per employee from having email or server access when away from the desk?
- Is employee stress an issue for your organization?
- Do employees have on-site meetings with clients or other business partners where their sense of confidence and efficacy would be enhanced with WLAN access?
- Do employees in your organization collaborate in conference rooms, colleagues' offices, and/or cafeterias? Would productivity be improved if they were able to do so?
- Does your organization have work processes where the timeliness and accuracy of data entered into mobile devices is critical?

These are just a few of the key questions that would indicate if WLANs can deliver the real-world benefits to your organization that our research participants have enjoyed.

About Sage Research

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