Technology Adoption by California Central Coast Contractors

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Technology is trending in Construction, but it is unclear if smaller contractors have kept up with these trends like larger national companies have. This survey of San Luis Obispo County specialty and general contractors queried technology adoption, specific software use, estimator age, and opinions of various estimating attributes. It found that the majority of contractors use traditional estimating and quantity takeoff methods, the majority of contractors are 31 years old or older, and that local estimators value experience and knowledge as opposed to computer expertise. Local contractors recognize the value technology can provide, but have not adopted it in a majority throughout the surveyed area.

Key Words: Estimating, Software, Technology, San Luis Obispo, Traditional Methods

Introduction

Technology: Construction's big buzzword for the past few years. From project management to estimating, companies have been attempting to increase their technology use with time efficient programs. Estimating specifically has a variety of software programs available to it, from quantity takeoff programs like On Screen Takeoff, to specific estimating programs like Intellibid, the industry is inundated with programs meant to replace traditional estimating methods. Quantity take off programs use plans digitized and scaled with measurement tools that give linear, area, and volume quantities by counting on the images. Traditional methods, referred to often by this paper, are defined as quantity takeoff done with scale and paper without the use of computer software, and estimating using historical knowledge or price books. Most large contractors are fully integrated with takeoff and estimating software, however what about the smaller contractors?

Smaller contractors have to beware, for as the adage goes "garbage-in, garbage-out" (Richards, 2005). Technology only serves to reduce the burden the estimator carries, as it does not fix any fundamental problems that plague many estimators. An estimator needs to have an intimate knowledge of their estimate database, and they still need to consider the unique project aspects (Richards, 2005). The lure of using technology to streamline estimates is strong, but the experience of an estimator is usually key.

The research done in this study aims to discover to what extent estimators have adopted technology in the local market. For those companies that have adopted technology, this study aims to discover what specific software they use for the various tasks estimators face (take off,

estimates, historical pricing). Finally, this study looks to find estimator's opinions on successful estimating and what role technology plays in that.

Hypothesis

The original hypothesis that prompted this study was this – technology is a trend that the local industry is slow to adopt. From working and looking at local specialty contractors, I assume that work is business as usual, with only trend-watching business owners or younger estimators branching out and experimenting with technology. Estimators, especially in the local construction industry, tend to be older with field experience. They utilize traditional methods for takeoff and estimating, and compile proposals using excel. Because of the specific nature of BIM, few specialty contractors and only a couple of general contractors use it. Companies value field experience and knowledge in their estimators, but computer savviness is a trend that many are adopting.

In order to substantiate my hypothesis, I sought out local contractors with these questions in mind:

1. Has technology been adopted locally?
2. Are the majority of estimators older? Is there a sizeable population of younger estimators who value computer expertise?

Research Design

To get information on estimating from the various local contractors, I conducted survey. I contacted both small and large companies. Small I defined as any company with only one office, or no office. Large I defined as any company with four or more offices. The companies that landed between are labeled as mid-size in the results. On the assumption that the majority of contractors with offices in the research area are smaller, I tailored the questions to fit a smaller contractor. Indeed, only one response ended up being from a 'large' company. I stayed away from questions that are highly specialized, for example only one question featured BIM, and it was a simple "How often do you use BIM?"

The list of contractors was first filled by the author's local knowledge from working with the local trades, and then supplemented with contractors from search engine map services. All contractors were marked down for contact, but only ones with emails were contacted. This

obviously creates a bias, as contractors with emails may be more inclined to be technologically savvy. This bias was noted when analyzing the results, and should be noted if any further study is conducted. Contractors were pulled from the geographic area between and including Santa Maria and Paso Robles, but was focused on the city of San Luis Obispo, California. This area will henceforth be referred to as the research area.

I used Google Forms as the survey delivery vehicle, and this allowed for the results to be tabulated. General issues with the email and Google Forms method are as follows:

- Those replying are only contractors with active email accounts.
- The email itself could be ignored as spam due to the link in the email body from an unknown email.
- The list was created off of Google and the authors knowledge, so many smaller back-of-truck operations were excluded.
- Only companies with local offices were selected, as a result large contractors whose ranges included the research area but lack offices there were excluded.

Results and Analysis

Responses

In total, 167 surveys were sent out and 32 replies were received. As per Table 1, 19 were specialty subcontractors, 10 were general contractors, and three were designated as “other”. As predicted the majority of responses came from smaller companies, Table 2 shows that there were 26 responses from smaller companies (no office to one office), five replies from mid-size companies (two to four offices) and one response from a large company (four plus offices).

The total number of responses is unsurprising. Seeing as most emails were sent to general company emails, as opposed to being directed at estimators, most companies would either treat the survey as spam or simply be too busy to answer.

Table 1

Type of Company		
Specialty Contractor	**General Contractor**	**Other**
19	10	3

Table 2

Size of Company		
Small (No Office to 1 Office)	**Mid-Size (2 to 4 Offices)**	**Large (4+ Offices)**
26	5	1

Age of Estimators

This study predicted that traditional methods dominate the industry in part due to the age of the average estimator. Table 3 shows that, as hypothesized, each company has a combined average age of their estimators being above 30. Not a single company replied with an average age below 31.

These results suggest that a new younger generation of estimators is not replacing the older generation. However, as there appears to be no baseline age of estimators to compare that to, it is inconclusive to say such. As they stand, these results simply show that estimators tend to be older.

Table 3

Rough Average Age of Estimators		
31 to 40	**41 to 50**	**51 or More**
17, 53%	9, 28%	6, 19%

Takeoff

One of the major aims of this study was to find exactly how many estimators still used traditional methods. Traditional methods can be broken into two parts, takeoff and estimating. As hypothesized, the survey showed that the majority of contractors used these traditional methods. Figure 1 shows that 56.3% used traditional methods, while 18.8% reported using a combination of both traditional methods and software for their takeoff. A flat 25% had adopted software for their takeoff.

Utilizing software would purportedly increase efficiency and a majority of contractors would agree that utilizing measurement software speeds up the measurement process. (Keng and Ching, 2011). Seeing as utilizing software for takeoff is more efficient, there must be some factor that limits estimators from adopting it in greater numbers. Is the barrier age, as the hypothesis

suggests? Or could it be that estimators partake in the method the company has always used, or how they've been taught? Further study is needed to investigate this.

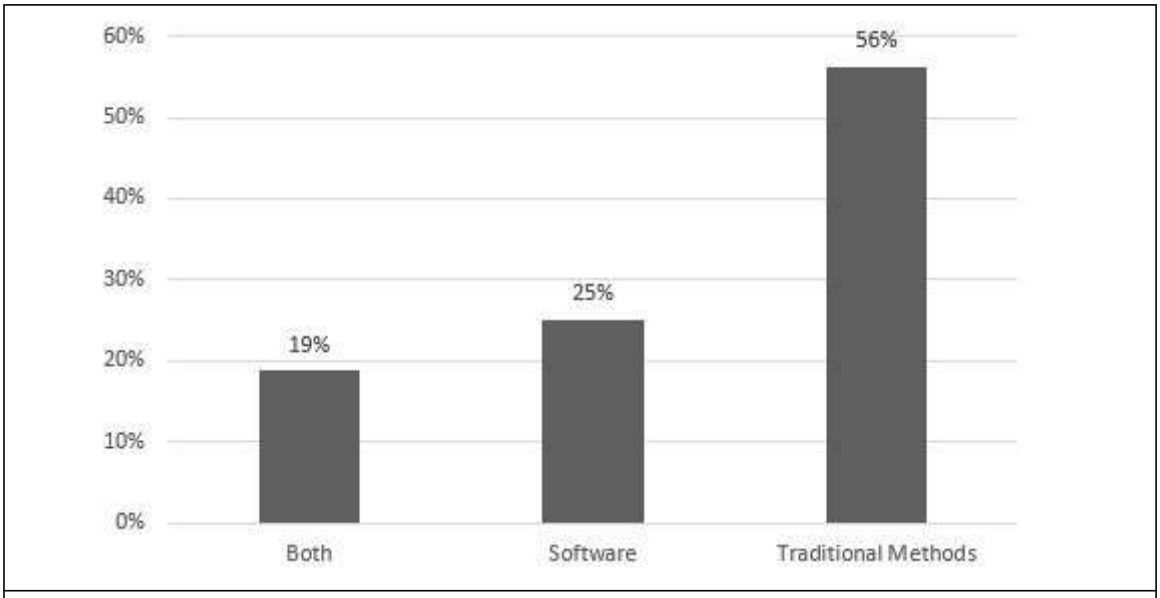

Figure 1. Takeoff Method Responses

Estimating

Figure 2 shows that 63% of companies use software, 31% of companies use traditional methods, and 6% use a combination of the two.

Interestingly, when it came to estimating method the majority of companies used software to compile their estimates as compared to quantity takeoff. Traditional methods dominated quantity takeoff, with 56.3% companies using traditional methods (see Figure 1). However, this differed for estimating, with 62.5% of companies using software to compile their estimates (see Figure 2). Figure 2 also shows that combination use dropped dramatically, from 18.8% in figure 1 to 6.3% in Figure 2. This can be explained in that while takeoff and plan reading can be accurately done by hand on physical plans, the superior math checking software provides for estimate compilation is essential.

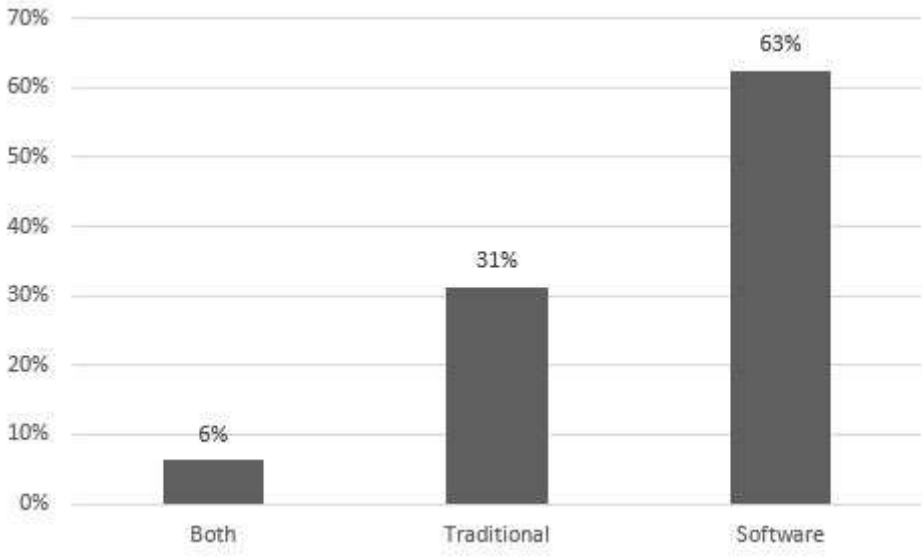

Figure 2. Estimating Method Responses

Building Information Modeling (BIM)

This study only took a cursory glance at BIM and results showed that most companies did not utilized BIM for their work. 69% of respondents never used BIM, with only 31% of respondents ever using BIM. Of those 31%, only 6% used it on a weekly basis (as per Figure 5).

What is interesting is that when comparing BIM usage with software usage in quantity surveying (as per Figure 1 and 5), the percentage of those who use BIM (25%) match the percentage of those who use software to do their quantity takeoff. However, when matched together per response, it shows that there is no connection between takeoff software usage and BIM usage (as per Figure 6).

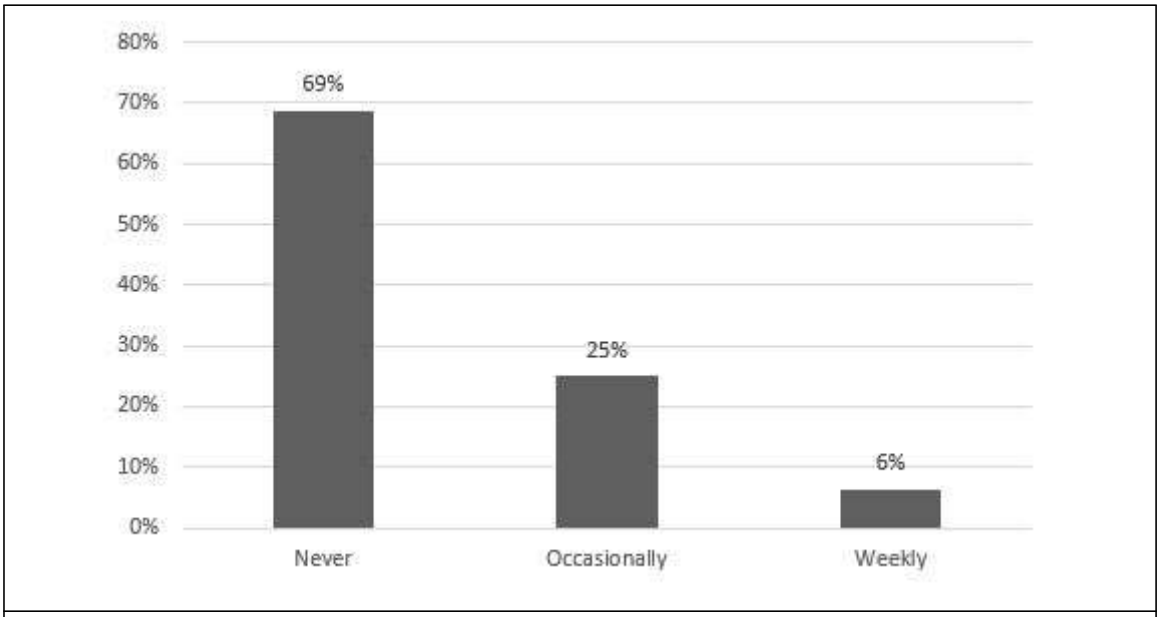

Figure 5. BIM Prevalence

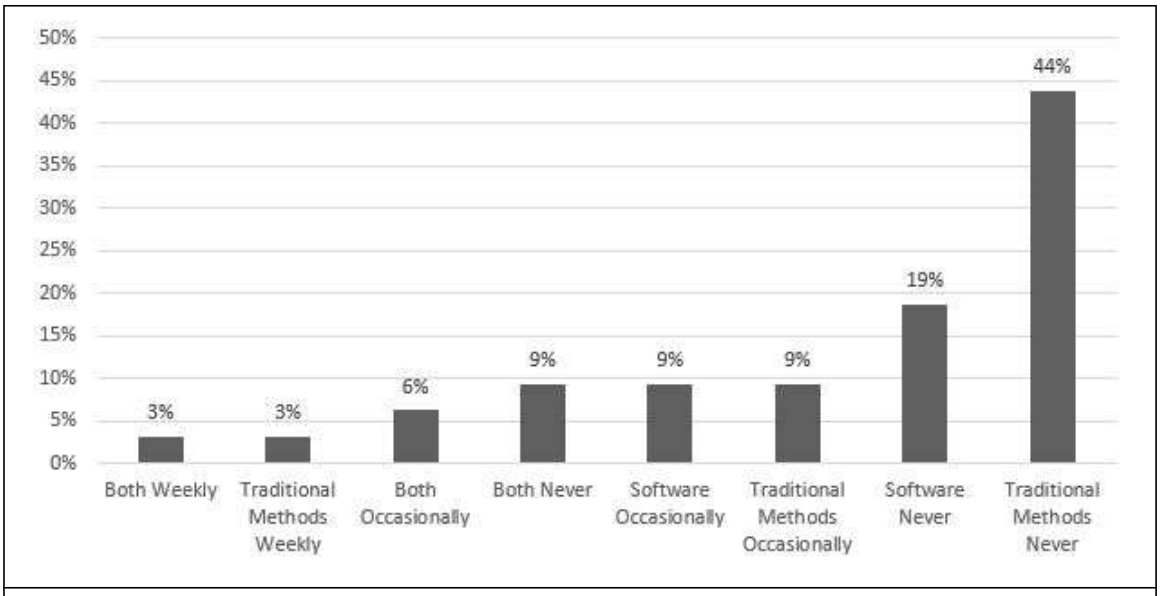

Figure 6. BIM Prevalence and Quantity Takeoff Software Usage

Qualitative Results

As well as the quantitative data, this study also sought to gauge the relative feelings of industry estimators towards technology. The results showed that while most estimators found that technology was not very important to their success, the ones that did were more likely to find it most important to their success. This study measured two qualitative beliefs, one being the

importance of technology for a successful estimator, the other being the attributes of a successful estimator.

Importance of Technology

From the qualitative side, this study also polled the importance of technology for a successful estimator. As per Figure 3, 60% of contractors found technology to be very important or most important to their success.

Figure 7 shows that companies with younger average aged estimators tend to find technology more important, with 38% of companies with average age 31 to 40 rating the importance of technology as very or most important. On this graph, a lower score is finding the importance of technology to be less, and a higher score indicates the importance of technology to be more.

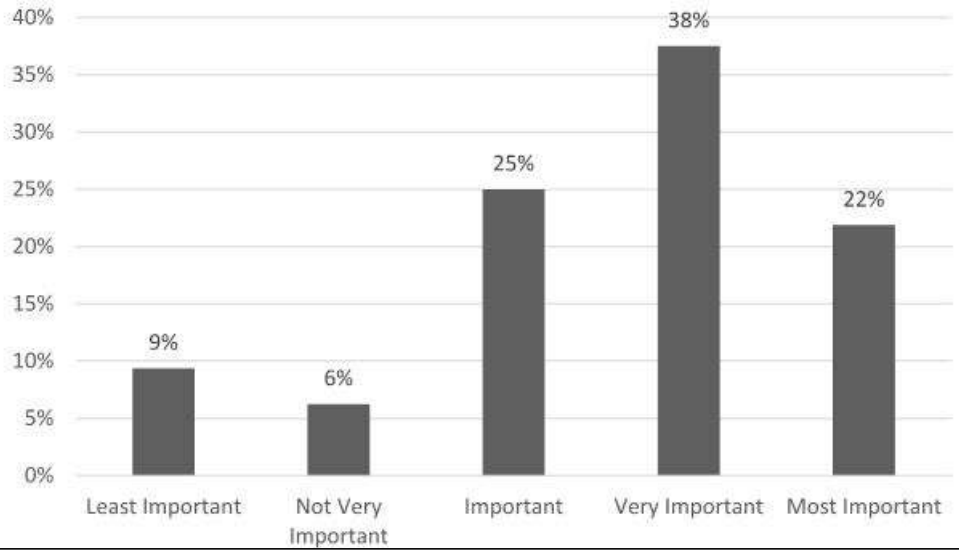

Figure 3. Importance of Technology for a Successful Estimator

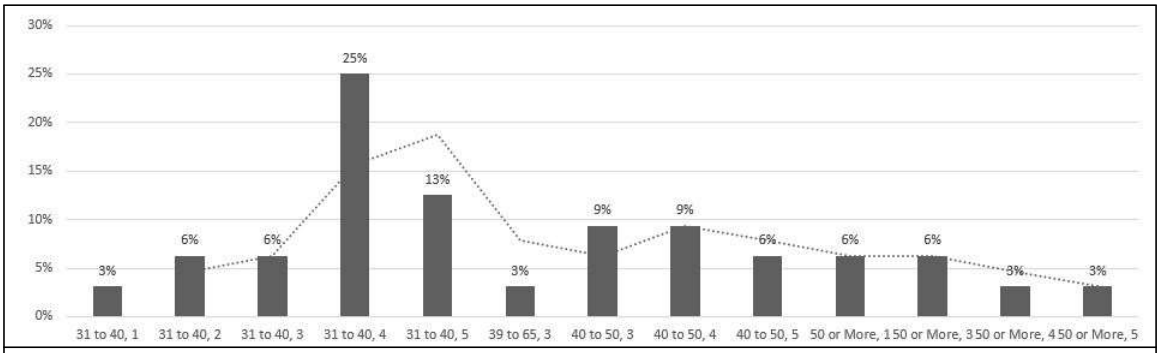

Figure 7. Importance of Technology and Average Age of Estimators

Attributes of a Successful Estimator

When ranking the various attributes by their importance to a successful estimator (five being the most important and one being the least important), it was found that being ethical, being experienced, being hard working, and being knowledgeable were "most important" to an estimator. The only attribute that estimators did not consider a 5 was being computer savvy (or having computer expertise). The results for computer savviness differed from the importance of technology for a successful estimator, suggesting that knowing the software was enough for estimators.

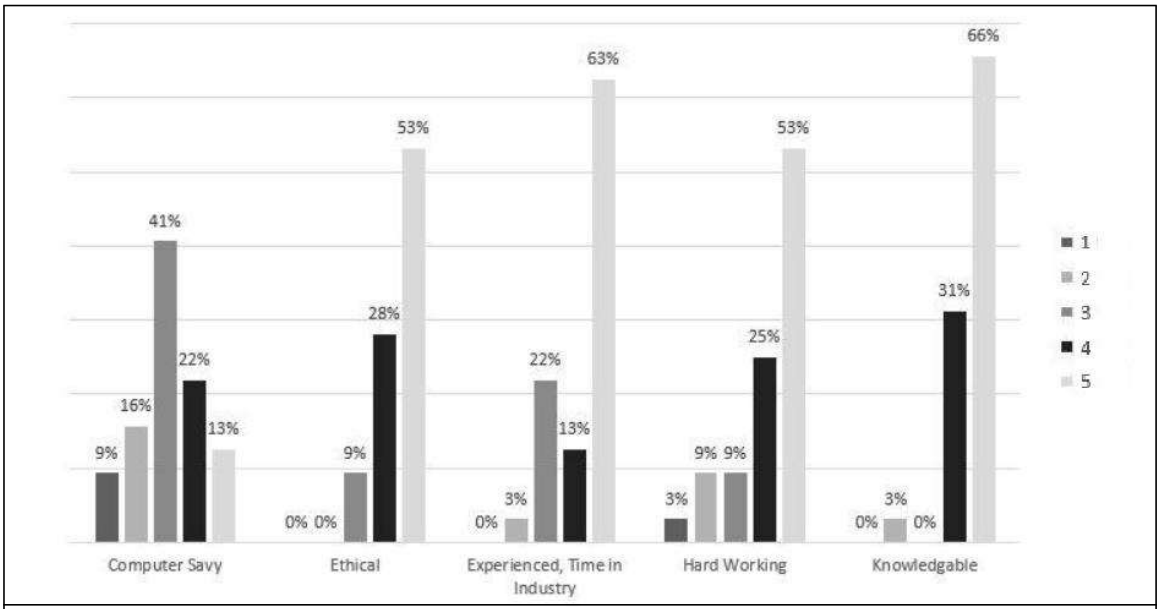

Figure 4. Attributes of a Successful Estimator

Conclusion

Technology is constantly evolving; are estimators evolving with it? This study is just a snapshot in time, and the current state of technology adoption would suggest that no – estimators are not completely adopting technology.

1. Has technology been adopted locally?

With only 44% of estimators (as per Figure 1) currently using software for quantity takeoff, it can be said that local estimators have not adopted technology. A previous baseline and future survey would be required to state that technological adoption is increasing or stagnate. At this time, the majority of estimators continue to use traditional methods.

1. Are the majority of estimators older? Is there a sizeable population of younger estimators who value computer expertise?

As per Table 3, the majority of estimators in the research area are aged 31 to 40 (53%). The rest are above 40 (47%). Without having a baseline or future numbers it is impossible to answer whether or not they are being actively replaced, but it can be stated that at this time local estimators are skewed towards the older generation. This makes sense, as Figure 4 shows that estimators value knowledge and experience, as opposed to computer knowledge. The younger generation needs field experience and knowledge before they can bring their computer skills to estimating.

Technology is important, but in the local industry it is not the most important. Estimators value knowledge and experience, and the traditional methods of scale and pen continue to satisfy the needs of local companies.

Further Study

The most important facet for further study would be finding the point at which adopting technology is necessary for a company to maintain a competitive edge. As companies become larger, their competition becomes more sophisticated. The degree of uncertainty for labor and material is reduced, and so reaches a level similar to their competitors. Then, to cut costs even more, a contractor must look at their overhead costs out of necessity. Quicker takeoff is required, however precision and accuracy must be maintained. To achieve this, technology must be adopted. There must be a point, in either project size or company size, that technology is vital to compete.

Branching out, studies should focus on whether it is the sophistication of the competition that drives technology adoption, or the degree of market saturation that exists.

Another avenue of potential study is the degree of adoption by individual trades. Many trades prepare shop drawings themselves, or have as-built plans that are very specific. PDF editing software can be very beneficial. Physical hand-edited as-built plans are very time consuming to create, and errors can be very costly. A PDF editor like Bluebeam can speed up this process, and any error can be swiftly rectified by the contractor. The complexity of takeoff differs between trades as well as between the specialty and general contractors.

In reference to the question brought up in the Takeoff section of the Results and Analysis, further study should be done to uncover the barrier that impedes technology adoption. It might be age, but it could also be a variety of other factors, including tradition, no issues with current system, or even ignorance.

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