# “Should I throw away my old iPad?” - Reconsidering usefulness in obsolete devices

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**Abstract.** Device obsolescence contributes to the rising levels of annual e-waste. The research presented in this extended workshop paper summarises the findings of two studies conducted in 2021 and 2022 that highlighted the difficulties faced by consumers in downloading and installing applications on a legacy device classified as ‘vintage’ and, then subsequently, as ‘obsolete’. The results of both studies demonstrated that few applications could be downloaded directly but, with the help of a non-legacy device’s purchase history, the majority of applications could be downloaded and, furthermore, were functional. These results raise important questions about legacy devices and whether devices classified as vintage or obsolete could have longer lifespans as functional and useful devices. Informed by discussions at the ‘Sustainable Human-Work Interaction Design’ workshop at the 2023 INTERACT conference, this paper considers these questions, discusses possible prospects for devices nearing obsolescence and the sustainability implications of continued use of legacy devices.

**Keywords:** Device Reuse, Usefulness, E-waste, Digital Sustainability, Application Installation

## 1 Introduction

Apple Inc. classifies devices that are no longer being manufactured as either ‘vintage’ or ‘obsolete’, dependent on how long ago they were last distributed for sale [1,2]. Products are defined as ‘vintage’ when *“Apple stopped distributing them for sale more than 5 and less than 7 years ago”* and defined as ‘obsolete’ when *“Apple stopped distributing them for sale more than 7 years ago”* [2]. These classification boundaries are significant landmarks where devices transition away from fully supported, functional app-compatible states into patchier territory where they are less supported, where application support is unclear and where consumers are left with few options to make further use of their devices. In most cases, consumers discard or replace their devices, further contributing to e-waste, or they retain them as dormant unused devices [6,7].

The lifespan of Apple devices has been estimated to be approximately 4.3 years [9] and Apple have reported that most device users keep their devices for 3 years on average [10]. Alongside functional lifespans, the ‘durability’ of these devices is also dependent on the emotional attachment of the consumer [11].

Continued use of these devices will help toward reducing levels of e-waste [12]. Methods to improve sustainability are necessary to decrease growing e-waste includes the improvement in techniques to aid device longevity. Sustainability can be defined in several different ways, however in this context, sustainability for legacy devices is heavily focused around the need to reuse. [13]. When the device has long surpassed its reuse phase, efforts to sustainably recycle them should be adapted [13].

Previous studies have identified and quantified the carbon footprint of end user computing devices in work and industry [14], with solutions identified for continued usage, but so far, no research has addressed the usefulness of these devices when nearing their 'obsolete' phase. The usefulness of a device in a human-computer interaction (HCI) context can be defined as *"anything that helps you get closer to or meet your goals"* [15]. For example, the usefulness of a legacy iPad Mini (the device used in the studies) would be a subjective judgement of the user based on its ability to achieve their usage goals. For some users, usefulness ends when the device no longer has 100% application support. Other users may deem their device useful if it provides a specific utility or service. Nevertheless, quantifying device usefulness is an area of research which has little to no exploration.


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**Fig. 1.** Examples of popular press headlines about legacy devices

[1] Image Sources: https://www.thesun.co.uk/news/1993244/old-iphone-obsolete-apple/ https://www.the-sun.com/tech/6380200/millions-iphones-obsolete-dangerous-check-model/

As illustrated in the popular press examples in Figure 1, older devices are not uncommonly portrayed as "worthless", and their use described as "dangerous". Such reports suggest there is potential misunderstanding that obsolescence equals dangerous. Based on studies conducted in previous papers [3,16], comparisons are made between two separate studies conducted when an Apple device was 'vintage' and then 'obsolete' to evaluate a) the decrease in device usefulness and b) to attempt to benchmark the quantification of device usefulness by analysing application compatibility [3,4].

## 2 Method

Two studies were conducted with a first-generation Apple iPad Mini 1st running iOS version 9.3.5. First produced in 2012, this device was significant as the last 32-bit product manufactured by Apple [8]. At the time of the first study (Sept 2021), the device was in the transitional state between 'vintage' and 'obsolete' classifications. At the time of the second study (May 2022) the device was newly classified as 'vintage'. For both studies, the top-10 free applications across 23 popular categories were selected and attempts were made to download them directly onto the device. If the application failed to download directly, then use was made of a modern, non-legacy device (Apple SE) with a pre-existing purchase history. This workaround is required because there are compatibility barriers in place to directly downloading applications on legacy Apple devices. Applications that could be downloaded directly (DD) or 'downloaded via another device' (DvAD) were then checked for whether they could be installed, if they opened, and finally if they were functional. Table 1 provides a summary of the device materials used in the studies, and Figure 2 provides a summarised flowchart of the study methodology.

**Table 1.** Materials Summary for the Study Devices: Direct Download (DD) and Download via Another Device (DvAD)

| **Device** | **Classification** Study Sept 2021 | **Classification** Sequel Study May 2022 |
|---|---|---|
| **STUDY DD device:** Apple iPad Mini tablet, 16GB (Wi-Fi), 1GHz dual core ARM Cortex-A9. Released: 2 Nov 2012. Discontinued: 19 Jun 2015. Last OS update 25 Aug 2016: iOS 9.3.5 | Vintage | Obsolete |
| **OTHER DvAD device:** Apple iPhone SE. 16GB Released: 31 March 2016. Discontinued 21 March 2017. Last OS update 13 Dec 2022: iOS 15.7.2 | Current | Current |

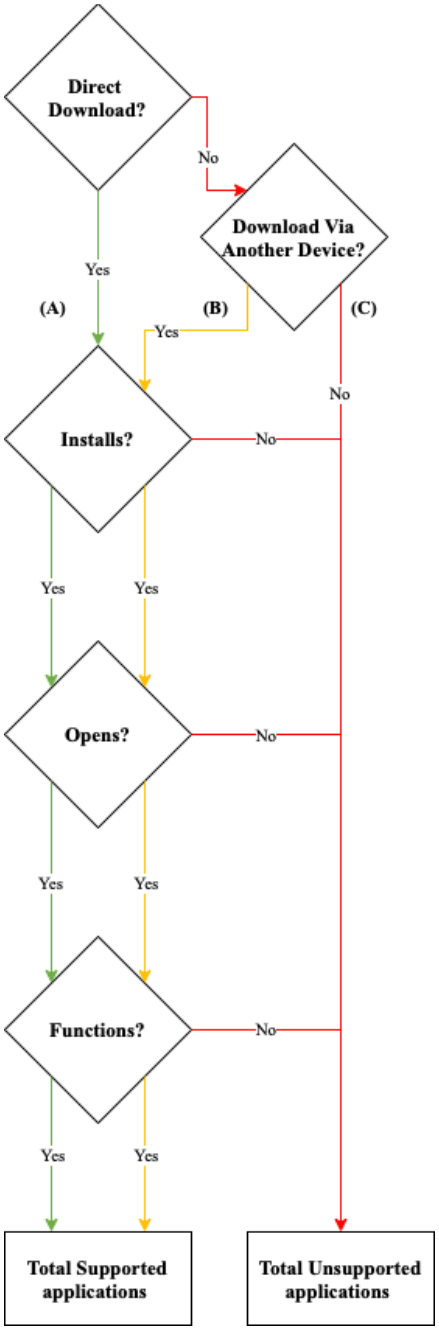


**Fig. 2.** Flowchart of the experiment application installation process A) Applications that downloaded directly. B) Applications that are downloaded via another device. C) Applications that neither downloaded directly nor via another device.

## 3 Analysis

The complexity of the download via another device (DvAD) process and the need for an additional non-legacy device demonstrates the substantial hurdles in place to both device reuse and continued use. As shown in Table 2, there was a slight overall decrease in application functionality from the first study to the second study (61.3% vs 57%). There was also a decrease in applications that could be downloaded directly (12.6% vs 8.7%) though an overall decrease was anticipated as was the marginal increase in the number of applications that could be downloaded via another device (given that fewer applications could be downloaded directly).

## 4 Discussion

The key discussion point taken from the research is the quantification of obsolescence and device usefulness. Currently there are no metrics to assess device usefulness or obsolescence. The methodology used in the two studies provides a means to quantify both in terms of application functionality. However, for individual users looking to install applications on legacy Apple devices, the DvAD method is a difficult and tedious workaround, and it necessitates the use of an additional non-legacy device. Additionally, there is no official guidance from Apple on how to do this not how to otherwise extend the longevity of these devices (5).

Many of the applications downloaded successfully and functioned. Certain categories were noteworthy in the comparison between applications that could download directly verses those that required the aid of another device. For example, none of the productivity applications could be downloaded directly in either of the studies, however all 10 out of 10 could be downloaded via another device and all 10 were functional in the first study and 9 of 10 were functional in the second. This is particularly significant given that productivity applications might be considered as amongst the most important applications for device utility.

### 4.1 Future Work

Device longevity and the usability and usefulness of legacy devices are neglected but worthy areas of research. Future work could apply or adapt the methodology to similar Apple devices and potentially enable a more automated assessment of application download, installation, and functionality. This could enable a much faster process such that much more than 10 applications per category could be assessed. Furthermore, the research creates a discussion for increasing the longevity of devices in many different environments. Decisions at home for continued usage of legacy devices lie solely with the consumer. However, in many workplaces, particularly creative environments, Apple products are a necessity. Research on device turnover in different work environments could compare device lifespans and, for example, explore work-based perceptions of obsolescence.

**Table 2.** Heatmap of the Comparison of App Functionality for Directly and Indirectly Downloadable Apps in the Two Studies

| App Category | Functional Apps DD (Sep 2021) | Functional Apps DD (May 2022) | Change | Functional Apps DvAD (Sep 2021) | Functional Apps DvAD (May 2022) | Change |
|---|---|---|---|---|---|---|
| Books | 4 | 0 | -4 | 4 | 5 | 1 |
| Business | 1 | 0 | -1 | 7 | 7 | 0 |
| Education | 3 | 1 | -2 | 6 | 6 | 0 |
| Entertainment | 3 | 0 | -3 | 5 | 6 | 1 |
| Finance | 1 | 1 | 0 | 6 | 6 | 0 |
| Food & Drink | 0 | 1 | 1 | 5 | 5 | 0 |
| Games | 1 | 4 | 3 | 1 | 3 | 2 |
| Health & Fitness | 0 | 1 | 1 | 6 | 6 | 0 |
| Lifestyle | 1 | 1 | 0 | 6 | 6 | 0 |
| Magazine & Newspapers | 5 | 0 | -5 | 5 | 6 | 1 |
| Medical | 3 | 2 | -1 | 3 | 4 | 1 |
| Music | 0 | 0 | 0 | 9 | 9 | 0 |
| Navigation | 1 | 2 | 1 | 5 | 5 | 0 |
| News | 0 | 1 | 1 | 8 | 8 | 0 |
| Photo & Video | 0 | 0 | 0 | 8 | 8 | 0 |
| Productivity | 0 | 0 | 0 | 10 | 9 | -1 |
| Reference | 1 | 0 | -1 | 7 | 7 | 0 |
| Shopping | 0 | 3 | 3 | 7 | 6 | -1 |
| Social Networking | 2 | 1 | -1 | 6 | 6 | 0 |
| Sports | 0 | 0 | 0 | 6 | 6 | 0 |
| Travel | 0 | 1 | 1 | 7 | 6 | -1 |
| Utilities | 2 | 1 | -1 | 6 | 6 | 0 |
| Weather | 1 | 0 | -1 | 7 | 7 | 0 |
| TOTAL | 29 | 20 | -9 | 140 | 143 | 3 |

## 5 Conclusion

The research discussed in this paper has highlighted the barriers in place to downloading and installing applications on vintage and obsolete Apple devices. The work questions the notion of device obsolescence when legacy devices still have use in terms of substantial and quantifiable application functionality, albeit more limited than that of modern devices. Security must, of course, be a key concern and legacy devices could be susceptible to security issues over time with continued usage. One major question lingers. At what point do consumers give up on efforts to continue making use of their devices?

In comparison to other devices with open software ecosystems, methods exist to extend the longevity of a device, whether that be different distributions of Linux for older PC's or Android builds for older smartphones. Nevertheless, open ecosystems allow for continued use of these devices, which is something not available to Apple users. Attempts have been made to utilise older Apple devices by installing other operating systems on these devices, but without significant time and resources, this is difficult to see in the future. It is recommended that future research pursues the quantification of device usefulness and the understanding of device longevity with the aim of preventing future devices needlessly becoming e-waste sooner than needed.

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