Serialization Reality Check:

Where are all the numbers?

The failure of serialization-based technologies to drive brand protection, digital marketing and loyalty programs in the consumer products sector

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Executive Summary

Mass serialization has now become the foundation for global Track & Trace programs to help reduce the trade in counterfeit medicines. The past few years have seen a dramatic rise in the number of countries that require a unique serial number to be placed upon a drug package to support a mandated global supply chain traceability program.

Another proposed use for mass serialization is with regard to consumer engagement, where the unique number and 2D barcode on a package supports an interactive link between the product and its buyer for use in digital marketing, loyalty schemes, sweepstakes, health and wellness information, and other personalized programs.

Despite its many promises and early potential, the consumer products sector in Western markets has not embraced mass serialization to drive brand protection and loyalty programs. Brand owners provide many reasons for their reluctance to do so. This paper describes five of the most commonly cited factors, briefly summarized as follows:

Implementation
Difficulty in undertaking package artwork changes; challenges in undertaking variable printing on the packaging line or at the package supplier; packaging material is a difficult surface for placing new print matter; time and cost involved in program implementation

Adoption
QR codes are present everywhere now; consequently, consumers need to be educated that the serialized QR code on their package is something different; significant expense required to educate consumers

Ownership
Most solution providers are responsible for both the serialization and consumer engagement technologies; the brand owner is therefore locked into an exclusive relationship; longevity of solution providers is of concern in an uncertain marketplace

Security
Barcodes can be easily replicated and placed on counterfeit products; phantom websites can mislead customers in very effective ways; investment in the serialization program will have a short half-life if counterfeiters co-opt the brand owner's loyalty program; a possible PR disaster down the road

Value
Benefits of mass serialization remain unclear; costs of program deployment may be prohibitive; serialization represents a long-term programmatic strategy, whereas marketing heads want quick ROIs; there remain significant uncertainty in the value proposition of a voluntary serialization investment

The problems associated with mass serialization open the way for the development of new technologies that can mitigate the risks identified here and therefore provide brand owners with a more robust security platform, while preserving all of the properties of consumer engagement associated with mass serialization.

Introduction

The United States FDA made a seminal proclamation in 2004 — that *mass serialization* was the single most powerful tool available to combat counterfeit drugs [1]. Since then, regulatory bodies around the world began to issue mandates that require unique product serialization through a data carrier such as RFID or more commonly 2D barcodes. There are now over forty countries that have issued guidelines for the pharmaceutical industry whereby a serialized barcode is either currently mandated or soon will be on individual medicinal products. The serialization platform is then used to support an authentication regime at the point of dispense or to drive a supply chain traceability and reporting program [2,3].

There is no argument now as to which methodology has prevailed in the long running battle to contain the menace of counterfeit medicines. It is also an unfortunate fact that counterfeiting is not just restricted to the pharmaceutical domain but also plagues an ever-expanding portfolio of consumer products, accounting for staggering losses to brand owners in virtually all global markets - $225 Billion in the U.S. alone [4]. It would therefore be expected that the widely acclaimed benefits of mass serialization would also be embraced by owners of consumer brands — even in the absence of any regulatory measures — to protect their brand equity as well as their customers.

A further enticing feature with regard to consumer products is that serialized barcoding can be used to create an interactive link between an individual product item and the buyer of that product. This in turn opens up a host of interesting sales and promotional opportunities for brand owners. By having customers voluntarily engage with the serialized barcode through a mobile app, the unique serial number on that product can be used to drive loyalty programs, support a sweepstake or lottery, provide personal wellness information and education, or drive a digital marketing program around the brand or related products. In short, serialization opens up vast opportunities to tap into a consumer's overall brand experience, enhanced and fueled by information on demand using a mobile device to create marketing programs via a unique new methodology. This kind of targeted engagement may then be used to drive sales and improve the customer experience, all the while protecting the brand and consumer from the encroachment of counterfeit variants.

Despite the high expectation that serialization would positively impact the consumer product sector in ways similar to pharmaceuticals, it is simply a fact that very few brands have to date embraced mass serialization for protective, marketing, or loyalty purposes. Most digital marketing discussions do not revolve around mass serialization and there is barely any serious consideration of serialization-based technologies in the various halls of social media dedicated to digital and mobile marketing. Similarly, serialization as a technology construct is rarely taken up at mobile marketing conferences, and barely registers as a solution of choice among the coveted marketing firms that propel innovative ideas into the corporate consciousness.

Here, we examine why serialization has failed to take a foothold in the consumer products sector. We approached this issue by relying on our own respective experiences and the learnings gathered through discussion with executives from various consumer product companies. To ensure that our report was rooted in market insights, we additionally took up this issue with a broad group of industry professionals. And finally, this report was subjected to peer review by professionals in the industry, as acknowledged at the end of the document. Through this exercise, we identified five salient factors that largely accounted for the limited uptake of serialization among consumer product companies — *implementation, adoption, ownership, security,* and *value.*

1) Implementation

The most common concern expressed by brand owners in moving ahead with a mass serialization initiative is the impact it would have on their packages. The real estate on brand packages is one of the highest valued properties, accounting for nearly every square millimeter down to perfection in terms of content and creativity. To throw in an extra barcode not only disrupts the look of the package but also creates concern about the consumer's ability to find and interact with the barcode. And finally, the manufacturing or production division in virtually all companies raise significant concerns about implementing a serialization program on their packaging lines, as discussed later in this section.

Artwork changes to my package are a nightmare

Marketing professionals devote significant resources to ensuring that the brand image is perfectly reflected by the style, content, and imagery on consumer packages. Many in the pharmaceutical industry, for example, are going through significant angst in having to redesign their packages to accommodate the 2D barcodes that will be mandated from late 2017 as part of the US federal law to combat counterfeiting. The motivation to undertake a similar exercise on consumer products is simply lacking in the absence of a legal requirement, making the exercise a high-risk and painful proposition to find the extra space needed to accommodate a voluntary additive component to an already well-crafted design [5].

An extra barcode will simply get lost in the noise

Assuming that the space can be found to insert an extra barcode, the concern that emerges is whether such content can even stand out in the midst of all the other text and images that are typically present. An additional barcode in this mix will not only add to the noise, but will actually become embedded within the existing content, making it difficult to stand out. In some cases, there may even be a requirement for two barcodes, further confusing the customer.

And this leads to another challenge — if the purpose of the additional barcode is to engage consumers, then how does the brand owner direct the consumer's attention to that barcode in the first place? A significant amount of marketing effort will then be needed to ensure that most consumers find and interact with the extra barcode, a proposition that is both expensive in terms of the outreach efforts needed and risky in terms of the engagement payoff at the end of the day.

Variable printing is an intrusive process on my line

Whereas the above two concerns fall within the domains of the marketing and brand heads, the issue of implementation becomes the headache of the production people, where an entirely new set of challenges arise. The process involved in modern printing of all packaging material is fast, streamlined, and repetitive. The print content of every package of a given product is an exact replica of the next, even the linear barcode. As a result, the practice generally involves flexographic printing at very high speeds, creating massive sheets of identical content that are then sent out in roll or sheet form to the brand owner [6].

In the above scenario, there is absolutely no variable printing involved — i.e., changes in content from one package to the next. The introduction of variable 2D barcode printing creates an extra intrusive process. Nowhere is this challenge more evident than among the pharmaceutical companies that are now going through the painful and costly process of implementing variable barcode printing on their packaging lines in preparation for the US drug traceability law. A parsimonious view is that pharmaceutical companies are investing upwards of one million dollars per line and undertaking the work over a period of up to two years [7].

It's not easy to print on my packages

Given the wide array of materials, such as glass, metal, plastic, and laminates that make up most packages, the path to ensuring an adherent print is no easy task. And add to this scenario the fact that multiple tracks are sometimes present in any given line, the need arises to articulate multiple print heads, which in turn adds to the cost and complexity of the arrangement.

To mitigate such online printing challenges, some companies have explored an alternative approach — to undertake a pre-serialization regime at the vending source where the label or package is made in the first place [8,9]. But here too, implementation challenges arise. Modern day presses run at extremely high speeds, often in excess of 300 meters/min, making it impossible to introduce variable printing directly on the press. As a result, a supplemental offline effort is needed, adding to the processing cost and reducing production efficiency.

A final complication involved with additive variable printing concerns the package substrate itself. Given the non-porous nature of laminate packaging, ink adherence becomes a particular challenge to ensure that the barcode will become a durable component of that package. There are special inks available, such as those containing UV-curing dyes. However, these have restricted usage in consumer materials and are even banned from many food packages due to past concerns of ink contamination that have led to recalls of major branded products [10-12].

The foregoing concerns clearly highlight substantial challenges to introducing a variable printing scheme wherein each and every product contains its own unique serial number and barcode. And on top of the mere implementation challenges lies the additional requirement of convincing the brand and marketing heads to undertake changes to the very artwork that they covet, and whose final versions had been reached after significant forethought and planning. The pain being experienced by the pharmaceutical industry is very telling and does not bode well for a voluntary embrace of the same effort in the consumer product sector where there is no similar regulatory drive.

2) Adoption

Another serious concern expressed by brand owners is the difficulty of getting consumers to engage with a 2D barcode. There are many reasons for this apathy. For one, the consumer will first require downloading an application on their Smartphone, whether it is a generic barcode reader or one that has been specifically created for the brand owner's program. If it is the latter, then the question arises as to how many such specific mobile apps a consumer is reasonably expected to download and use on a regular basis. A troubling new report outlines the significant reduction in app downloads by consumers, noting that the average American Smartphone user downloads zero new apps per month [13]. This fact combined with a related concern among marketing professionals regarding the overuse of QR barcodes in the marketplace makes for a bleak outlook for introducing yet another new use case.

The ubiquitous presence of the QR code

The QR code was invented in 1994 and since then has become a common fixture in advertising, appearing in virtually all media from newspapers to billboards [14,15]. In nearly all cases, these barcodes merely direct the consumer to the corporate website after it is scanned. In other words, these are *static barcodes* with fixed content and therefore easily printed in a repetitive manner as part of the overall print design. This difference is significant because the barcode to be used in a serialization program requires each package to contain its own unique number, and therefore the barcode itself is also unique in terms of content and specific to that package.

The ubiquitous use of the QR code has become highly criticized by marketing specialists [16-18]. The zeal with which many marketing heads started placing QR codes on their promotional materials without the forethought of their judicious use has led to the inevitable outcome of consumer fatigue. This shortsighted use of an otherwise excellent technology has created the barrier now to their acceptance in the serialization space. This fact is evidenced by a question that commonly arises whenever the discussion veers toward consumer engagement programs via the use of serialized QR codes.

How will consumers know that this is a special barcode?

The idea promoted by serialization vendors is that a serialized QR code is something unique and very distinct from the run of the mill static code that currently populates the marketplace. But given the high consumer fatigue with this very technology, how would a brand owner distinguish their use of the QR code to do something special, something more engaging, and something that could benefit the consumer? After all, they all look the same — a serialized QR code appears visually to be no different than a static QR code.

The path to that knowledge creation would require significant investment by brand owners in educating and even training the public if a serialization program is to be launched. The prior overuse of QR codes now places a burden to differentiate their own use. That education would need to take the form of training customers first to find that barcode in the midst of everything else on the package and then use a customized mobile app designed only for their particular use. For many, that is a tall order and evidently one that has weighed heavily in favor of expending their limited marketing funds on other programs that give faster results.

Given the substantial challenges of implementing a serialization program to begin with, the additional concern that consumers may struggle to interact with the technology itself provides significant pause. Whereas the production people always bring up the implementation challenges, it is the very real worry with consumer adoption that remains foremost among the marketing heads.

3) Ownership

Assuming that the implementation obstacles can be worked out and a decision made to invest in program marketing for adoption, an important issue to be resolved at the outset is the following — exactly *who* would own and run the consumer loyalty and digital marketing program on behalf of the brand owner? As this section makes clear, this issue can represent significant adversity down the road in the absence of clarity at the beginning of program design. The following questions and concerns appeared foremost among brand owners.

Who runs the consumer engagement program?

One reason why mass serialization became adopted in pharmaceutical regulatory circles throughout the world is that it empowers traceability in an open way, allowing multiple vendors to compete for the business. That model is unclear in the unregulated world of consumer products, where serialization vendors also insist on restricting brand owners to their own offerings in terms of digital marketing, loyalty programs, and other consumer engagement tools.

All serialization providers have one thing in common — they lock the brand owner into the services around their own serialization platform. The brand owner is restricted to using their services because only they control the authentication gateway that in turn opens up the subsequent engagement programs. A further concern is that many solution providers use their own dedicated mobile apps for the engagement program. Thus, not only is the serialization program entirely in the hands of the vendor, but so is the very portal through which consumers must verify the serial code and thereafter partake in the engagement services.

The longevity of solution providers is of concern

Much of the serialization field is occupied by new entrants who established their businesses only a short time back. Many of them are breaking new ground with new technologies, and paving the way with innovative solutions. However, it is also true that the longevity of solution providers is often unclear. Several companies have gone out of business and there is significant consolidation taking hold in the marketplace.

The question often heard is — will the company be around down the road, and if not, what happens to my serialized products in the market? And will a disruption in the gateway to the digital loyalty program that was rolled out with great fanfare suffer an ignominious PR disaster if the solution cannot be fulfilled as promised in the marketplace? These concerns are not insignificant, given that most solution providers are startups being funded by venture capital in a competitive landscape with many active companies fighting in this space.

A dual-vendor approach makes business sense

A sound business approach under these circumstances would produce a model in which a dual engagement is considered. There are two sets of operators — a technology company that is adept at generating large volumes of serial numbers and which can work effectively with system integrators or converters to print data on the packages. In this scenario, the vendor is responsible for only the narrow programmatic component of generating, printing, and authenticating serial numbers. As part of the business plan, it would be clearly understood that all digital data belong to the brand owner, whether at their site or that of the solution provider.

The second arm of the service provision is a separate firm with a track record of experience in digital marketing and running loyalty campaigns. Their mandate is strictly restricted to delivering only the services around the serialization program. The actual code authentication is the responsibility of the technology provider, whereas the successful authentication of a given product opens the gateway for the consumer engagement program delivered by a specialized marketing firm.

This duality in program delivery ensures that the brand owner is protected from any business disruption on the part of either contractor because their roles are distinct, separable, and replaceable. This arrangement also has the advantage that the serialization contractor can be any one of the many companies located across the world operating through the cloud, whereas the marketing firm can be a local company that is more in tune with trends and cultural sensitivities in that local market.

A major deterrent to program adoption has been the concern with data ownership, service exclusivity, and contractor longevity. These concerns are likely to remain as long as a convincing case for business continuity is not clearly outlined. One simple solution for brand owners who wish to consider serialization-driven consumer engagement is to separate the twin issues of codification and digital program delivery.

4) Security

Before serialization came to serve as the foundation for global Track & Trace programs, it started out as an anti-counterfeiting technology in a somewhat different fashion. The idea was to place a unique number on a product and thereafter empower the consumer to verify that number, either by way of texting (SMS) or more recently, scanning a barcode containing the unique identifier (UID). If the UID is authentic, the argument went, so must be the product. This approach has had some early successes in the pharmaceutical industry, especially in emerging countries [19-21]. However, consumer product companies have largely adopted a slate of other anti-counterfeiting technologies that have emerged in the marketplace [22-24]. There are two dominant reasons why serialization has not been widely embraced as a security tool for consumer products.

Serialized barcodes can be easily replicated (cloned)

The most common problem with mass serialization is that counterfeiters can easily copy a genuine serial code on a genuine product due to its open readability [25,26]. Once a code is captured in this way, it can be replicated on many labels, applied to counterfeit products and introduced into the marketplace. Most solution providers place a limitation on the number of authentications on a single code for this reason. However, there are two problems that arise with a limited authentication approach.

The first set of authentications, before the limit is reached, will always pass the validation stage even though they may be on counterfeit products. As a result, there is a false positive result and therefore false assurance, all the while the illegal products pass through the very technology that was meant to stop the problem. And second, when there is an authentication limit on the technology, the number of instances at which a given product can be validated also becomes limited. And this in turn reduces the efficacy of the application. For example, if there is a limit of one authentication for a given code, then consumers would be unable to validate a product prior to purchase, but only afterwards. Many consumer goods companies have bypassed adopting serialization for this very reason alone because the very intent of allowing consumers to verify a product's authenticity prior to purchase cannot be undertaken with mass serialization.

Another worrying trend is that some counterfeiters have become sufficiently sophisticated that by capturing just a few serial numbers from a set of products in the open marketplace, they are able to insert that data into an algorithm that in turn predicts the entire sequence of numbers that can be generated by the solution provider. This is a worrying possibility because it effectively means that a counterfeiter can replicate a brand owner's serialization program by reverse engineering the actual randomization sequence [27-29].

Phantom websites can mislead consumers

Another pernicious problem concerns the placement of an entirely fake QR code on a product wherein the contents direct the consumer to the counterfeiter's own website. In this scenario, the consumer scans the barcode with one of the many public-domain readers that are available for both Apple and Android phones. The unwitting consumer then is not only falsely reassured about the product, but the site's layout and panache can be so compelling as to simulate the original brand owner's site to near perfection.

The genuine brand owner can take steps to mitigate this possibility by deploying a serialization program that relies on a proprietary app that would detect and warn of a phantom website. However, this effort would require major investment in consumer education to download and use that dedicated app, something that has its own drawbacks as discussed earlier.

Whereas mass serialization has become the foundation of pharmaceutical traceability, it has been less successful in a purely authentication scenario where a consumer is empowered to verify a product via its unique serial number. The early promise of serialization in this regard has not come to fruition, and this fact is largely due to the pervasive concerns of serial number and barcode replication. The substantial investments necessary toward deploying a mass serialization program only to have it undercut by a rather simple act of code replication on the part of a counterfeiter represents an unacceptable risk.

5) Value

The value proposition in any endeavor is directly related to the expected *benefit* and inversely related to the *cost* of the exercise. As discussed in this document, both parameters fail to reach an acceptability threshold in the minds of corporate stakeholders when it comes to mass serialization.

The benefits of mass serialization are offset by uncertainties and risks

The foregoing discussion in this report covered issues of program implementation, consumer adoption, technology ownership, and data security. Given the concerns and risks that have been raised in terms of program benefit across each of these parameters, the overwhelming opinion reflected a sense of unease as to whether deployment of a mass serialization program would indeed usher in the significant benefits when weighed against the uncertainties and risks that have to be taken into consideration at the very outset.

The cost of deploying mass serialization may be prohibitive

In those instances where the benefit argument for a mass serialization program was acceptable, the cost parameter then introduced a further barrier to adoption. For most consumer products, the path to printing variable data on the package is both challenging and intrusive. The cost component of that exercise is often quite exorbitant due to the major investments needed to procure separate industrial printers, vision systems to verify the print matter, and the cost of undertaking change in operational processes that run at exceptionally high speeds either on the packaging lines or at converter sites. Additionally, if the company has to undertake a major advertising campaign to acquaint consumers with the new technology thereafter, then it might be just safer for them to continue using their existing promotional tactics.

The politics of investment

Another factor that is intertwined with the value consideration is the organizational politics of large companies. The cost of a mass serialization program is often appropriated from the marketing department's budget, which in turn can set up a conflict of purpose. Whereas the outcomes of routine marketing investments are tangible and immediate in terms of promotional impact and sales growth on a next-quarterly basis, the benefits of adopting a serialization program are far more futuristic in nature. Marketing executives

are psychologically driven to undertake efforts that boost sales and provide immediate rewards for their department. Furthermore, an expenditure from their budget toward combating counterfeiting — if that is in scope — often does not fit the political goals of such a mindset, and especially when the eventual success of their investment is recognized at an institutional rather than a departmental level.

In short, adoption of a mass serialization program suffers from the twin drawbacks of the time needed to retrofit packaging lines to permit variable printing, as well as the prolonged time course of benefit realization that comes only through a sustained market education campaign. That is a tough political undertaking for anyone who is required to make difficult calls on funding decisions in a company and thereafter show quick results.

The value proposition or ROI in a mass serialization initiative has been either difficult to assess, or has posed unacceptable risks, or has been judged at the outset to be clearly unacceptable. A further unacceptable risk concerns the security issue of code replication. If all the benefits are weighed and the costs can be borne, the very real possibility then stands out that the entire serialization program can be undone be a security failure due to code replication or phantom barcoding. That is an untenable risk and one that has weighed heavily among key decision makers.

Conclusions

There are now over 5,000 power brands across the world [30]. And yet, most experts would be hard pressed to name any highly visible consumer products that have adopted serialization for brand protection, digital marketing, or consumer engagement. That is not to say that there has been no adoption at all. In fact, there are sporadic reports of companies rolling out a limited serialization program to drive consumer engagement in Western markets [31,32].

Another exception is China where the ubiquitous presence of Smartphones coupled with a plethora of local serialization companies has created a more welcoming environment, with a few reference adoptions in the pastry sector, wines, and engine lubricants [33-35]. Here too, anecdotal reports from local solution providers reveal that consumer engagement levels are quite poor and therefore the longevity of such programs remains unclear at present.

And finally, mass serialization for purely consumer engagement purposes has had somewhat greater success in the pharmaceutical sector. The nation of Nigeria, for example, has used this approach to protect drugs in certain categories through a serialization and SMS-mediated authentication program for consumers [36].

The migration of the same principle to consumer products in Western markets, however, has been very disappointing. The promise of mass serialization was that it offered a way to protect consumers, preserve brand equity, and yet offer tantalizing opportunities for marketing and sales growth. This report has identified many of the key reasons why that promise has not been fulfilled in the global consumer products sector. It is therefore an opportune time for solution providers to introduce new technologies that reduce the risks and burdens of mass serialization, while preserving its core benefits of consumer engagement.

What is needed is to provide a full solution that is secure, protects products, and is enabled for consumer engagement. Creating, in effect, a proxy for mass serialization that can be easily deployed and addresses the shortcomings stated earlier. A new technology has been developed that derives a unique signature or fingerprint from existing print marks on a package and which can then be used for item authentication. This would leverage the power of Smartphones and mobile networks to image these print marks, and be able to authenticate that product immediately. The non-additive nature of the technology represents a substantial cost saving on capital purchase, artwork redesign, and change management. Most importantly, the technology cannot be replicated or reverse engineered by a counterfeiter due to the stochastic nature of its construct. And finally, the new technology empowers brand owners to address the twin fulfillment challenges of securitizing their brand while unleashing a robust consumer engagement program through separate vendors.

A follow-up report will describe this new technology — one that fulfills all of the promises of mass serialization without any of its major drawbacks.

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About Systech

Systech is the global technology leader in anti-counterfeiting, product safety, consumer and brand protection. Systech pioneered serialization and is defining the future of authentication.

Systech unifies and optimizes authentication, enterprise serialization and track-and-trace technologies to ensure regulatory compliance, mitigate risk, and drive efficiency and profitability.

For 30 years, Systech's innovation has led best practices for key brands representing industries across consumer packaged goods, food and beverage, aviation, automotive and life sciences. Systech works globally with 19 of the top 20 pharmaceutical companies.

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