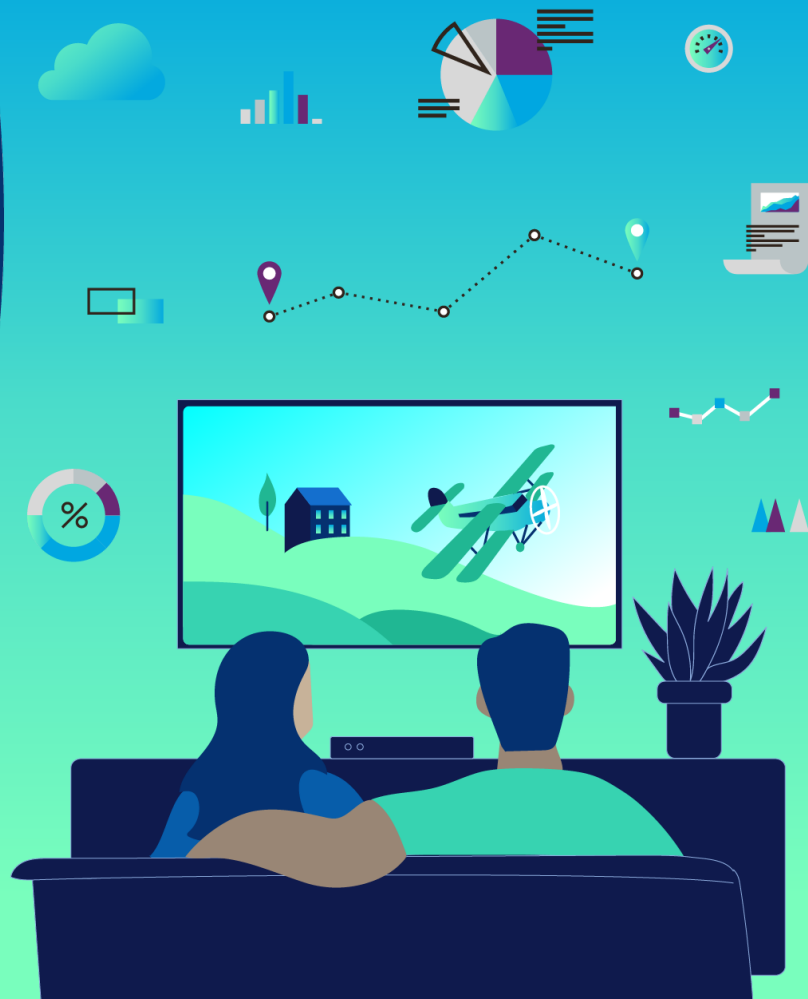




Building a Data-Driven Streaming Service

A Practical Guide for Product Teams



The Power of Data

In today's rapidly-evolving video entertainment landscape, harnessing the power of data is critical to our industry. Properly selected, measured and analyzed, metrics surrounding video consumption and user behavior hold enormous value – empowering business leaders to make informed decisions and constantly improve their products, services and technology.

The good news is that pay-TV operators, consumer electronics companies and video service providers have more data at their fingertips than ever before. The bad news is that gaining access to, navigating and parsing out which metrics are meaningful from this vast sea of data can be difficult.

All too often, service providers aren't measuring or can't measure insights any deeper than “How many users do I have?” or “What is our most popular content?”. With the right tools at their disposal, they could do so much more.

We have an opportunity to match best-in-class standards of analytical rigor – deriving meaningful insights that capture real business value.

When we learn to navigate the data sea, the places we can go are endless.



About This Guide

This guide is the product of interviews with several subject-matter experts within TiVo who are defining how we look at the world of data science and analytics.

Where available, we've provided benchmarks from business customers or internal case studies, and our learnings through years of providing services to TiVo end users.

With most highlighted metrics, we've included an example of how we measure and influence results with homegrown TiVo solutions that your business can take advantage of as well.

Contact us at business.tivo.com for more information on our suite of entertainment technology and data products.

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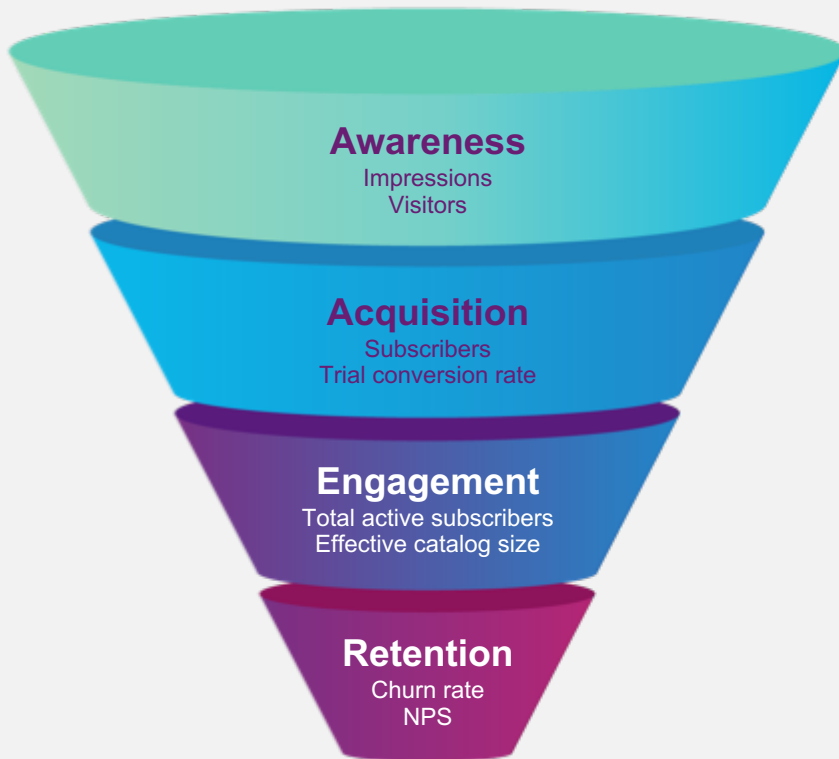


Measurement Frameworks

To capture business value from your data, you must first understand how various kinds of metrics fit together to make a larger whole. One of the first steps in creating a data-driven approach to user analytics is choosing the framework within which you will analyze your metrics.

For example, you might **look at how metrics fit into a funnel** if your team is focused on understanding how different metrics affect revenue.


Sample Funnel Stages and Related Metrics



Measurement Frameworks (Continued)

Or, you may choose to look at your metrics **as key performance indicators of the different aspects of your business** if you want to benchmark and identify opportunities for improvement.

Examples of KPIs by Focus Area

	Business	Active subscriber rate Average revenue per user (ARPU) Churn rate
	Catalog	Effective catalog size Conversion to views
	User Experience	Time to discovery Net Promoter Score (NPS) Click-through rates



Measurement Frameworks (Continued)

For our purposes with this guide, **we'll be applying an *Effort vs. Value* framework** as a helpful way to review and understand what you have today, as well as prioritize for the future.

The metrics in this guide will fall somewhere on the Effort vs. Value Matrix. On the bottom left of the matrix, metrics are fairly easy to measure, but it is more difficult to demonstrate business value. In the top-right quadrant, metrics are more difficult to measure, but the business value is more readily apparent.

When using or analyzing a particular metric, it can be helpful to identify the quadrant into which that metric falls. The matrix serves as a quick reference map, helping you answer questions like "How clearly does this measure correlate to business value?" and make strategic decisions accordingly.

Effort vs. Value Matrix



How do you find the metrics that matter?

The sheer amount of measurable data available can be overwhelming. To make sense of it all and derive meaningful insights, careful selection is crucial.

“It’s fine to have a wealth of data that you can dig into when needed,” explains TiVo Director of User and Market Research Adam Bates. “But when trying to answer big questions like ‘How do we make people use our product more and therefore never give it up?’ you want to have a very small number of measures. Narrowing your focus to three to five measures is going to clear the fog.”

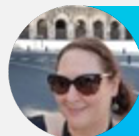
Which metrics matter most? How do you choose?

We spoke to four of TiVo’s sharpest data experts and asked them those very questions. The following pages are a distillation of their answers – the **SEVEN KEY METRICS THAT MATTER**.



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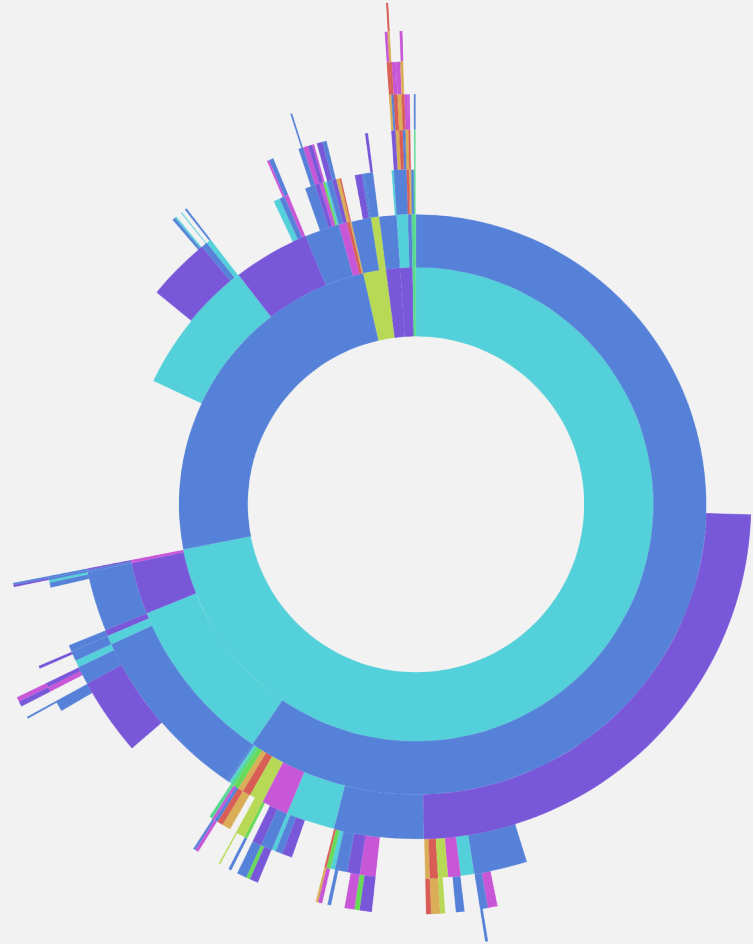


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Seven Key Metrics That Matter



#1. Click-Through Rate (CTR)

	What it indicates	Indicates users' interest in or attention to a particular set or piece of content
	Where to measure it	Promoted content campaigns Purchases Navigational screens
	How to measure it	Number of clicks on the item being measured Number of times the item of measurement is displayed
	How to influence it	Target campaigns with audience segmentation A/B testing of carousels Editorial experimentation
	TiVo benchmarks	Increases of 2-5% for view reach and 50-60% CTR in promoted content campaigns

Effort vs. Value

Click-through rate (CTR) measures user attention or interest, but does not necessarily indicate conversions, purchases or if a user even liked the content selected. Thus, while CTR is one of the easiest things to measure in a recommendations system, it is difficult to use this metric to show clear business value.

High Business Impact Easy to Measure	High Business Impact Difficult to Measure
Low Business Impact Easy to Measure	Low Business Impact Difficult to Measure

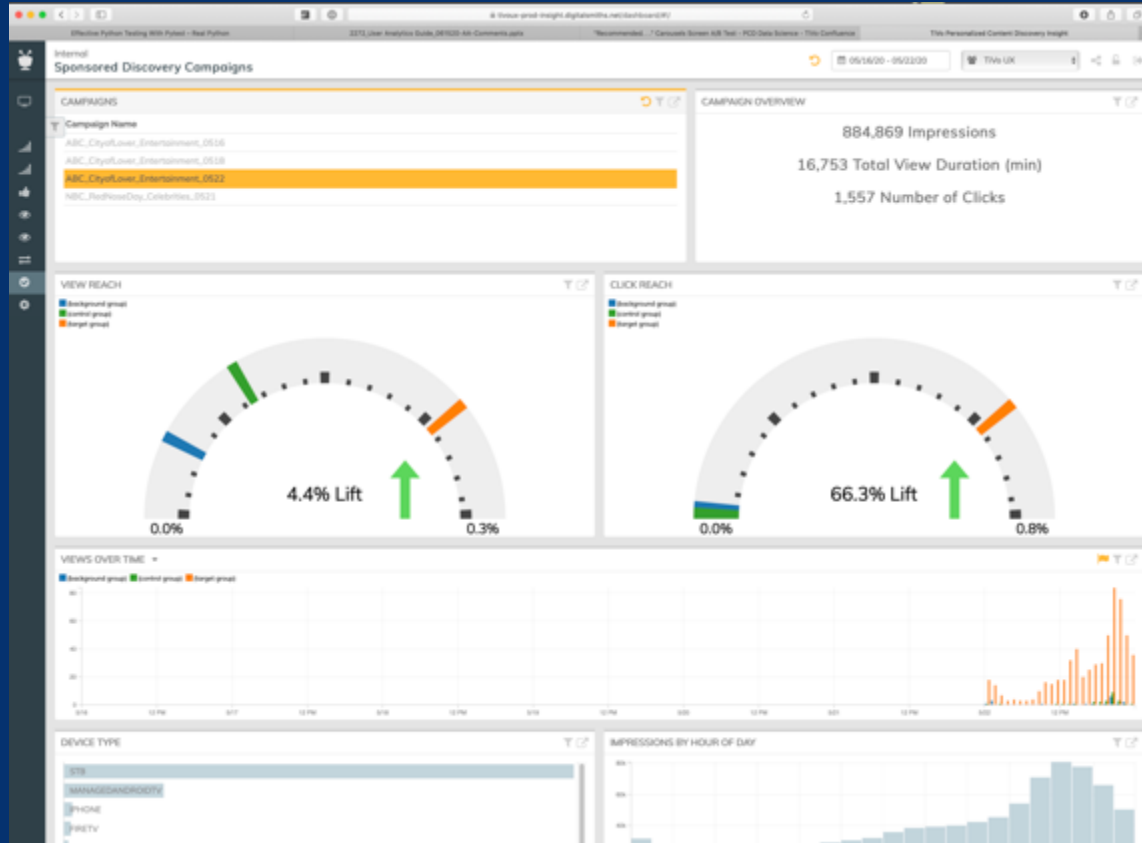


Keep in mind that when you improve the CTR in one area, you may be just taking away clicks that user would have made somewhere else. In this case, the net total number of clicks has not increased, so total consumption is unchanged.

Rather than using CTR as a stand-alone indicator, think of it as a puzzle piece or a building block – not terribly useful on its own, but necessary for creating the bigger picture.



Click-through rate on a promoted content campaign



Here we're measuring the viewing and click-through behaviors of a target group for a Sponsored Discovery campaign, seeing lifts in engagement through audience segmentation and highly-targeted promoted content.



Influencing CTRs with A/B testing

The screenshot displays a Netflix-style user interface for an A/B test. The top bar includes a 'For Me' tab, navigation icons, a 'Live Preview' indicator, and a toggle switch between 'A' and 'B' groups. The main content area is split into two columns: 'A Group' and 'B Group'.






A Group	B Group
Fixed	Fixed
Watch Now Predictions for Users with Favor... Smart - 6 Sources	Watch Now Predictions for Users with Favor... Smart - 6 Sources
Movies On Now Smart - 1 Sources	Recommended Movies Suggestive Recommendations Smart - 1 Sources
Shows On Now Smart - 1 Sources	Recommended Series Suggestive Recommendations Smart - 1 Sources
Recommended Movies Suggestive Recommendations Smart - 1 Sources	Personalized
Recommended Series Suggestive Recommendations Smart - 1 Sources	90s Nostalgia Automated - 3 Filters
On Next Smart - 2 Sources	Chillout Favourites Automated - 2 Filters
Personalized	Gripping Murder Mysteries Automated - 2 Filters
Comedy Dramas drama comedy-drama Automated - 6 Filters	Laugh Along Movies with Automated - 4 Filters

Below the comparison table, the 'Live Preview' section shows the actual content layout for each group. Group A's layout includes 'Watch Now' (Predictions for Users with Favorite Channels), 'Recommended Movies' (Suggestive Recommendations), 'Recommended Series' (Suggestive Recommendations), and 'Drama and Suspense' (Fantasy Suspense/Thriller). Group B's layout is identical but uses the 'Personalized' recommendations for the 'Recommended Movies' and 'Recommended Series' sections, reflecting the A/B test variables.

Note the differences in fixed and personalized content displayed on a specific screen to an A group and B group in a week-long A/B test.



#2. Conversion Rate

	What they indicate	It indicates how relevant the content on the screen is Answers key questions like “How good are our recommendations?” and “How good are our search results?”
	Where to measure	Where you have specific goals in mind for a user like signing up for your service, watching/purchasing specific content, beginning to use a specific feature
	How to measure	Number of times users complete a desired action (such as watching, viewing or recording) Total times presented with the option
	How to influence	Highly-relevant content on the screen Editorial experimentation
	TiVo benchmarks	Average conversion rates of ~3% for new content and 30% for repeat (e.g., “Keep Watching”) content

Effort vs. Value

Conversion rates are relatively easy to measure and are a key metric for measuring system performance, but do not directly correlate with business value. For example, let's say that you successfully increased the conversion rates in one area. If users would have viewed or purchased that content anyway, then business value has not actually increased as a result of increased conversion rates.

High Business Value Easy to Measure	High Business Value Difficult to Measure
Low Business Value Easy to Measure	Low Business Value Difficult to Measure

BETTER SYSTEM
PERFORMANCE

HIGHER CUSTOMER
SATISFACTION

HIGHER
RETENTION



While in most cases measuring conversion rates may not result in the most business value in a vacuum, they become more interesting in certain use cases. TiVo constantly tests the first slot in the SmartBar® feature of our TiVo Stream user experience, which is one click away from where the consumer starts using the product. In that case, we want conversion rates of 20 percent plus; the first slot is a key piece of UI real estate.



Conversion rate testing with recommendation variables

Carousel	Boost Weights	Carousel Filters
Recommended Shows	<ul style="list-style-type: none">All Time Popularity: 0.02Buzz Popularity 30 Days: 0.50Deboost Previously Viewed: 0.26Genre Time Affinity: 0.10Metacritic: 0.30Recency: 0.05Similar To Favorites: 0.25Similar To Likes: 0.25Trending Popularity: 0.02	<ul style="list-style-type: none">Object Type includes at least one of: SeriesGenre does not include any of: children, preschoolUS TV Rating does not include any of: TVY, TVY7Originals does not include any of: trueGrouping:<ul style="list-style-type: none">Linear: Linear On NowVOD: VOD

The screenshot displays the TiVo Engagement Console interface. On the left, a sidebar lists various content categories like Comedy, Crime, and Drama. The main area shows a 'Comedy Dramas' filter with options for 'Object Type' (Movie), 'Genre' (comedy-drama, Drama), and 'Live Preview' showing movie thumbnails. On the right, a 'Boosts' panel allows adjusting weights for different recommendation variables.

Variable	Weight (%)
Personalize Movies	15%
Personalize Series	34%
Popularity	67%
Ratings	41%
Recency	57%
Trending	73%

A 'Clear All Boosts' button is located at the bottom of the Boosts panel.

This table is a snapshot in time of variables we manipulated to test conversions on three sets of rails in the home screen.

Once test parameters are defined, the variables are dialed in via TiVo's Engagement Console and content recommendations are personalized via TiVo's Search & Recommendations offerings.



Conversion rate improvements with engaging carousel titles

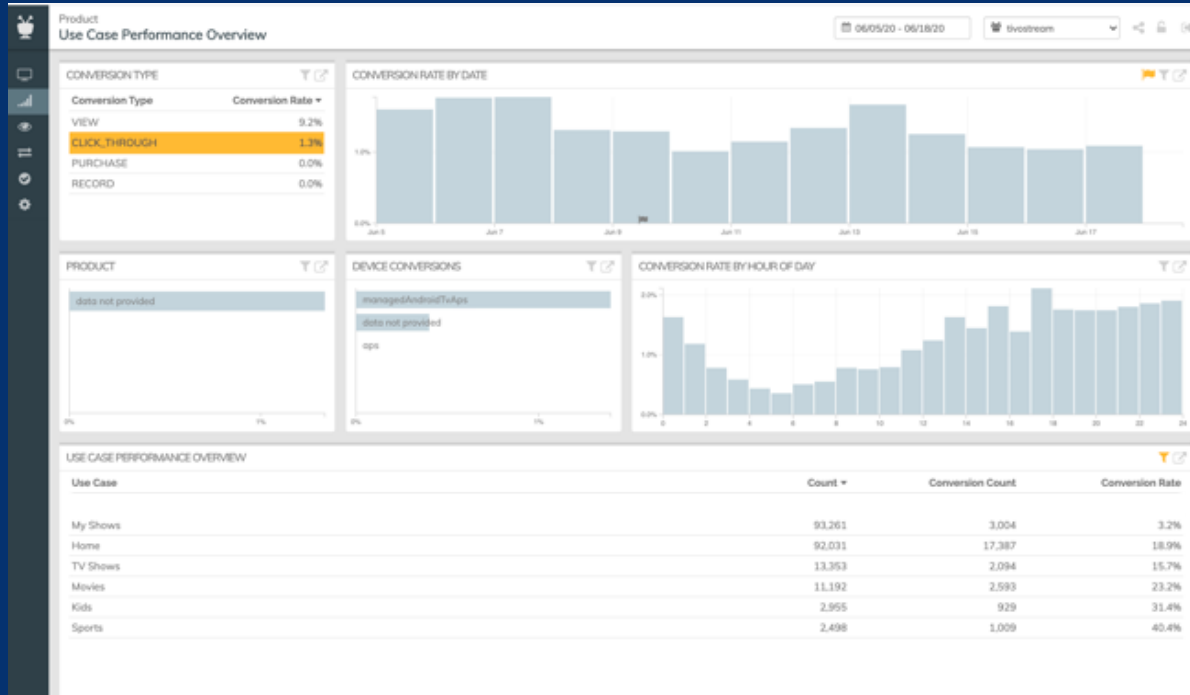
The screenshot displays the TiVo 'Deep Discovery' filter interface. On the left, a sidebar lists various filter categories: '90s Nostalgia', 'Chillout Favourites', 'Gripping Murder Mysteries', 'Laugh Along Movies with Unlikely Heroes' (highlighted in yellow), 'Documentary', 'Drama', and 'Family'. The main panel shows the configuration for the selected filter. It features four filter rows, each with a 'Filter' dropdown, a 'Type' dropdown, and a 'Values' section with selected tags. The filters are: 1) Object Type (Includes at least one of...) with 'Movie' selected; 2) Themes (Includes at least one of...) with 'Unlikely Heroes' selected; 3) Tones (Includes at least one of...) with 'Silly' selected; 4) Genre (Does not include any of...) with 'animated' and 'preschool' selected. Below the filter settings is a 'Live Preview' section showing a horizontal carousel of movie posters, including 'Game Night', 'Kevin James', 'Airplane!', 'The Other Guys', 'Johnny English', 'Dumb & Dumber', 'Evolution', and 'A Man Called Otto'.

TiVo tests have shown improvements up to 2X in view conversions when using more engaging carousel titles over standard genre-based or “Because You Watched” carousels.

In this example, we constructed a “Laugh-Along Movies With Unlikely Heroes” carousel using metadata descriptors of *Theme* and *Tone* included with TiVo’s Video Metadata offering Deep Discovery.








Conversions by navigational screen



Note the wide distribution of conversion rates (viewing a show or movie) from specific navigational screens in the TiVo Stream UI – >40 percent for Sports and ~3 percent for My Shows, showing the varying levels of effectiveness in a screen's content resulting in a view.



#3. Time to Discovery

	What it indicates	How much time, on average, it takes users to click, watch and stick with a TV show or movie
	Where to measure	From the beginning to the end of various user discovery paths
	How to measure	Average of amount of time from session initiation to extended engagement with a show or movie.
	How to influence	Increased personalization in search and recommendations Testing of carousel placements and other navigational elements
	TiVo benchmarks	Average time to discovery is 75 seconds

Effort vs. Value

Time to discovery is a key metric because it measures the efficacy of your recommendations system. Without an efficient, easy-to-use, curated experience, users will get lost, frustrated and ultimately abandon your service in favor of one that works better. On the other hand, if you can reduce time to discovery, you can keep your customers happy and ultimately increase or maintain retention rates.

High Business Value Easy to Measure	High Business Value Difficult to Measure
Low Business Value Easy to Measure	Low Business Value Difficult to Measure

REDUCED TIME
TO DISCOVERY

HIGHER CUSTOMER
SATISFACTION

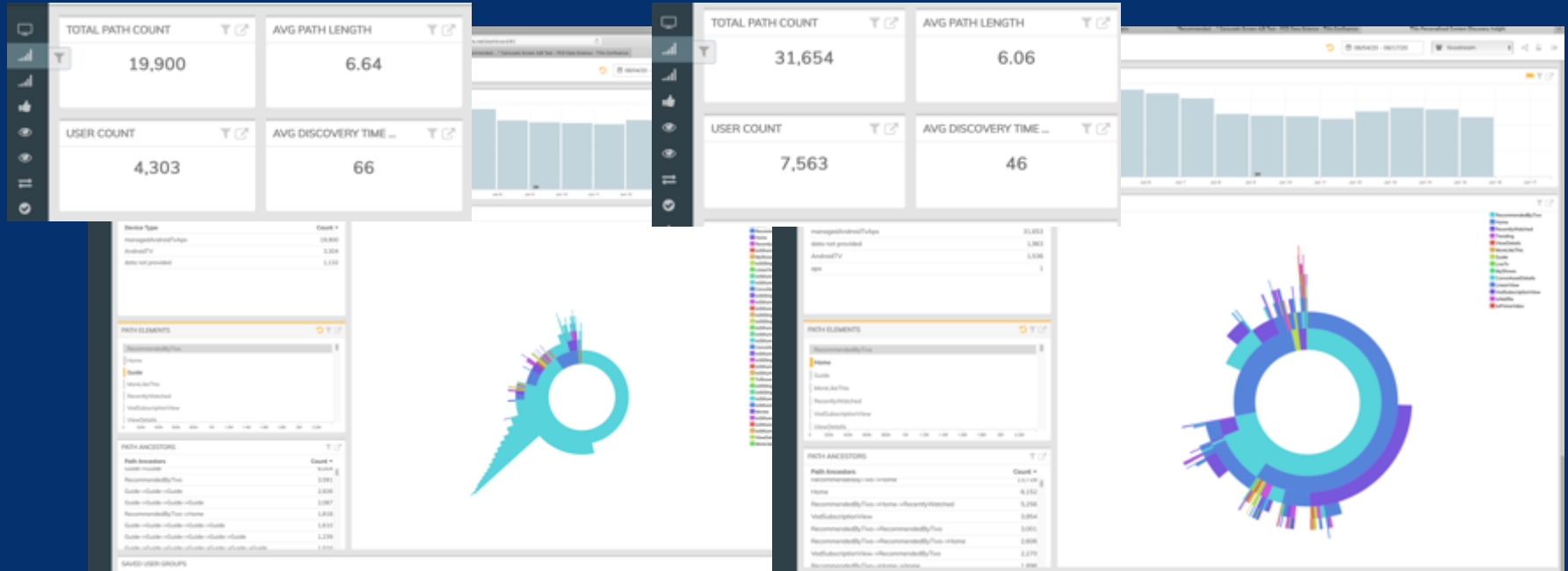
HIGHER
RETENTION



People are busy these days, and when they sit down to watch a TV show or movie, they want it to be easy to find what they want. But with so many options, even compared to just a few years ago, the simple process of finding the right content can be overwhelming. On top of that, whenever a video provider adds new content or new content sources to stay competitive, the time it takes a user to find something increases.








Time to discovery variance by screen

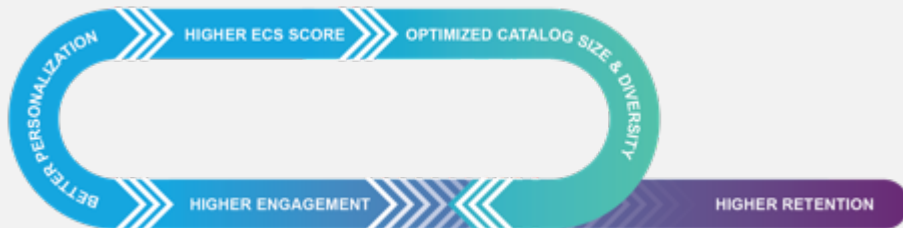


Above, see the snapshot of time to discovery differences for a particular set of users within a specific date range. In this case, time to discovery is 20 seconds less for the home screen than the guide.



#4. Effective Catalog Size

	What it indicates	Optimal amount and diversity of content needed to keep your customers engaged and happy
	Where to measure it	Viewing data
	How to measure it	Viewing distribution across your content catalog; this number will be between 1 and the total number of videos in your entire content catalog
	How to influence it	Get users to watch content that is new to them Expose new content via enhanced personalization, enriched metadata
	TiVo benchmarks	Average 30-day ECS of 33.3 across eight MVPDs/VOD providers, with a low of 1.2 (highly niche VOD provider) and 66.8 (leading MVPD)



Effort vs. Value

Hitting the right balance of both the amount and diversity of the content in your catalog is tough. Effective catalog size (ECS) helps you find that balance and optimizes your catalog by measuring exactly how much of your content is actually being viewed.

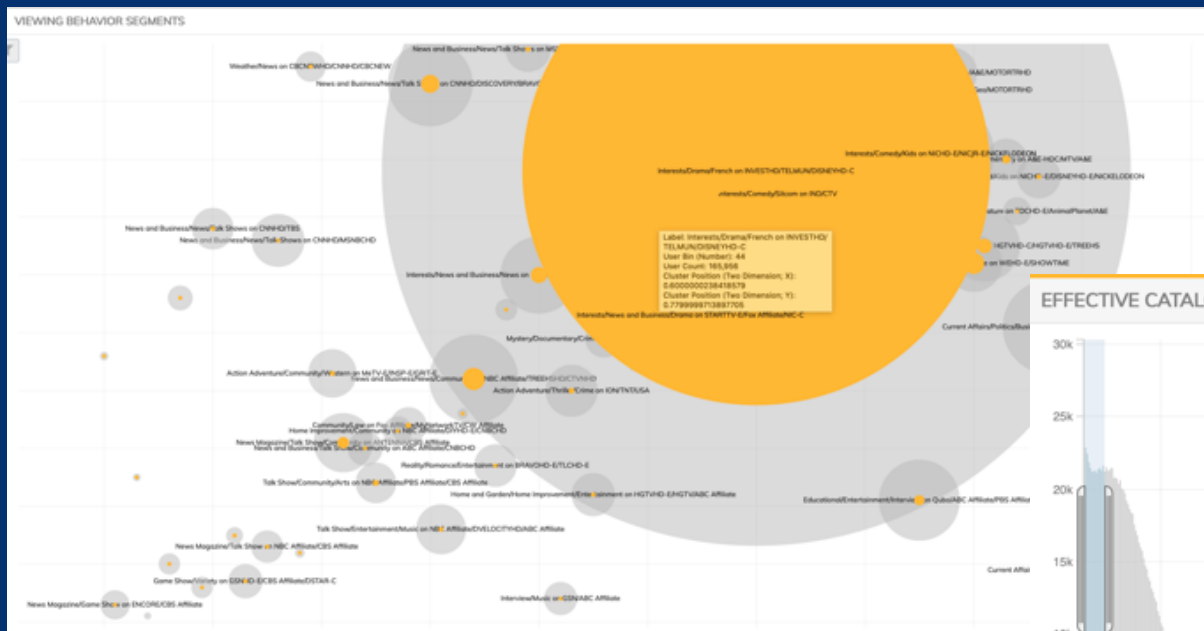
High Business Value Easy to Measure	High Business Value Difficult to Measure
Low Business Value Easy to Measure	Low Business Value Difficult to Measure

Personalization and recommendations systems play a key role here. Done well, personalization tailors different video recommendations to each viewer, resulting in higher user engagement and effectively distributing viewership more widely across the content catalog.

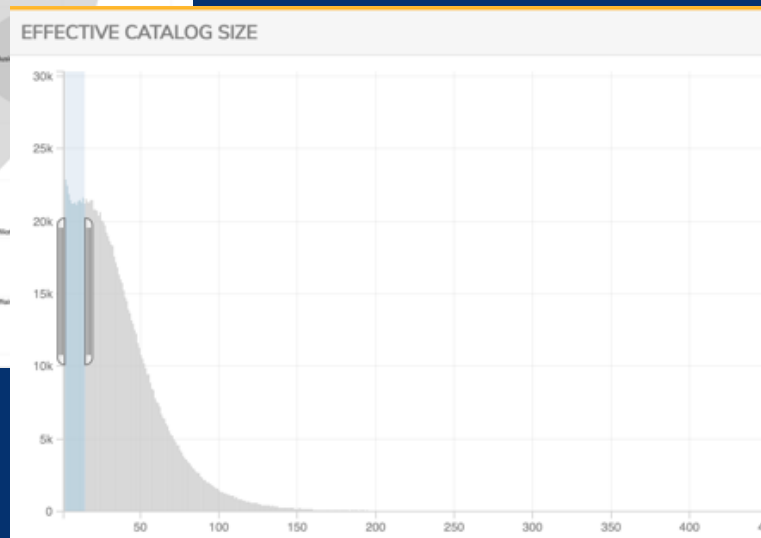
A higher ECS score essentially indicates a more effective recommendations system, and maximizing ECS through personalization allows you to hone your catalog size and diversity to fit your viewers – not too much (overwhelming viewers and making discovery more difficult) and not too little (missing opportunities presented by viewers' niche interests).



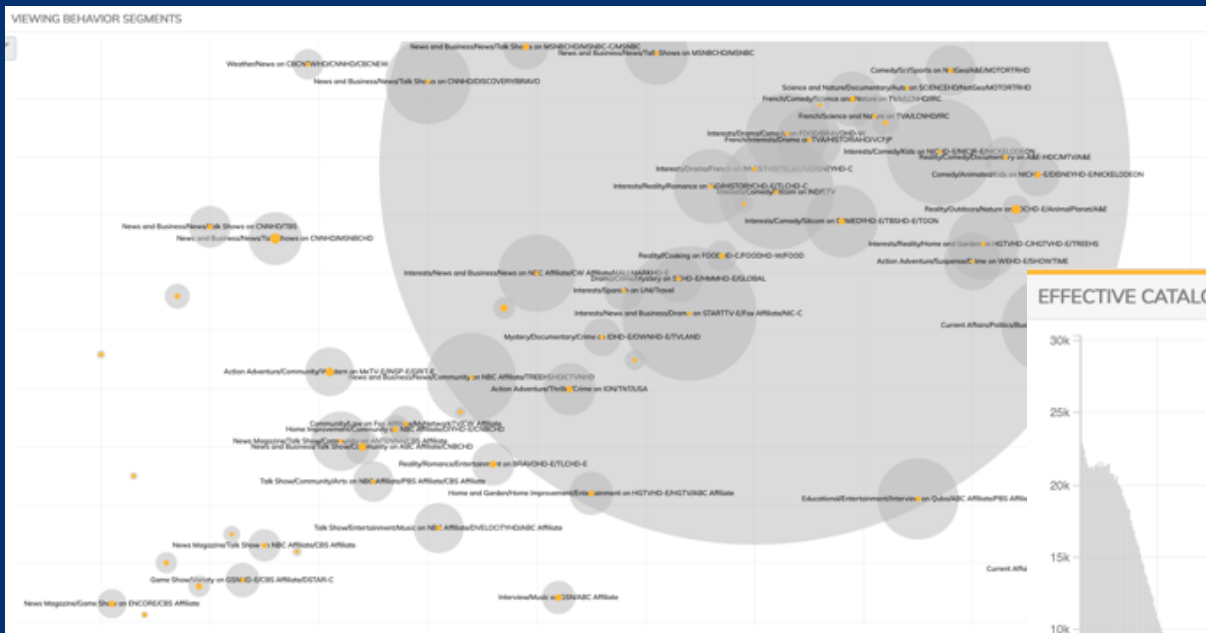
ECS and content diversity



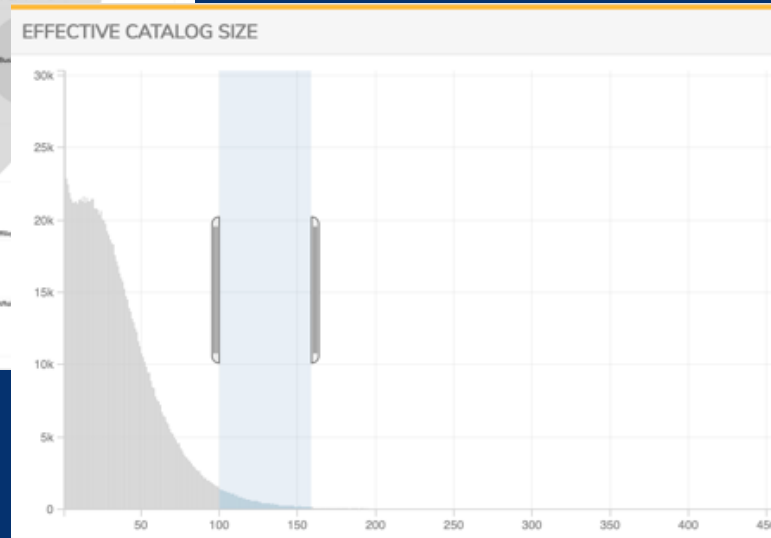
Looking at users with an ECS of <10, the large yellow circles below show the homogeneous viewing behaviors that reflect a lack of diversity in content consumption.



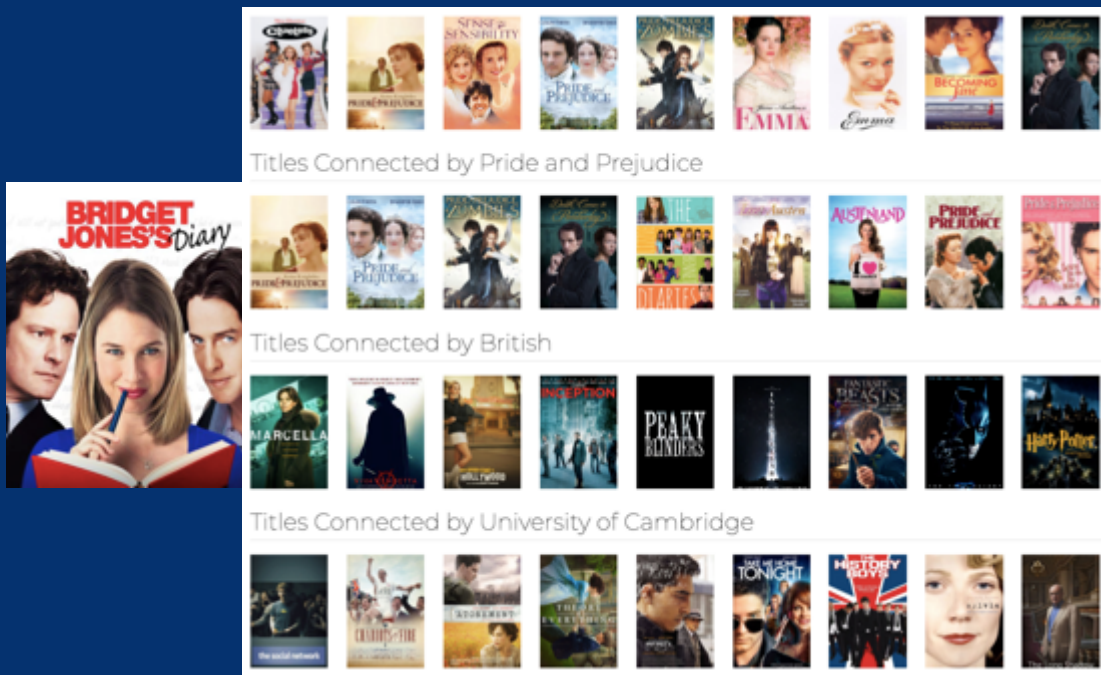
ECS and content diversity



For users with an ECS of >100 , note the smaller and more highly distributed clusters of viewing preferences, representing more diverse viewing behaviors.








ECS and content diversity



Using the Topic descriptor from Deep Discovery, we auto-generate carousels based on topics associated with a movie or show. For example the movie *Bridget Jones's Diary* has Topics including Jane Austen, Pride and Prejudice, British and University of Cambridge.

Including topical carousels in addition to standard “You Might Also Like” or “More Like This” rails increases the diversity of content presented to a viewer, while also maintaining relevance to the content being viewed.

#5. Active Subscriber Rate

    	What it indicates	<p>The number of people “actively” using a service to which they are subscribed</p> <p>User engagement</p>
	Where to measure it	Return rates, viewing time, content discovery tool usage patterns
	How to measure it	<p>Return rate: % of subscribers who use a service for a certain number of times per day/week/month/etc.</p> <p>Viewing time: % of subscribers who watch videos for a certain amount of time per day/week/month etc.</p> <p>Discovery: % of subscribers who use a particular discovery method (text/voice search, carousels, etc.)</p>
	How to influence it	<p>Remove barriers to discovery</p> <p>Get people to content more easily</p>
	TiVo benchmarks	Varies greatly by customer and model (ad-supported vs. subscription)



Effort vs. Value

The active subscribers metric often functions as a “North Star” measure for user engagement. Yet, what constitutes an “active” subscriber can vary by system, company and analyst.

High Business Value	High Business Value
Easy to Measure	Difficult to Measure
Low Business Value	Low Business Value
Easy to Measure	Difficult to Measure

Company A might define “active” as the number of subscribers who use their service at least once per week or month, or three times per month.

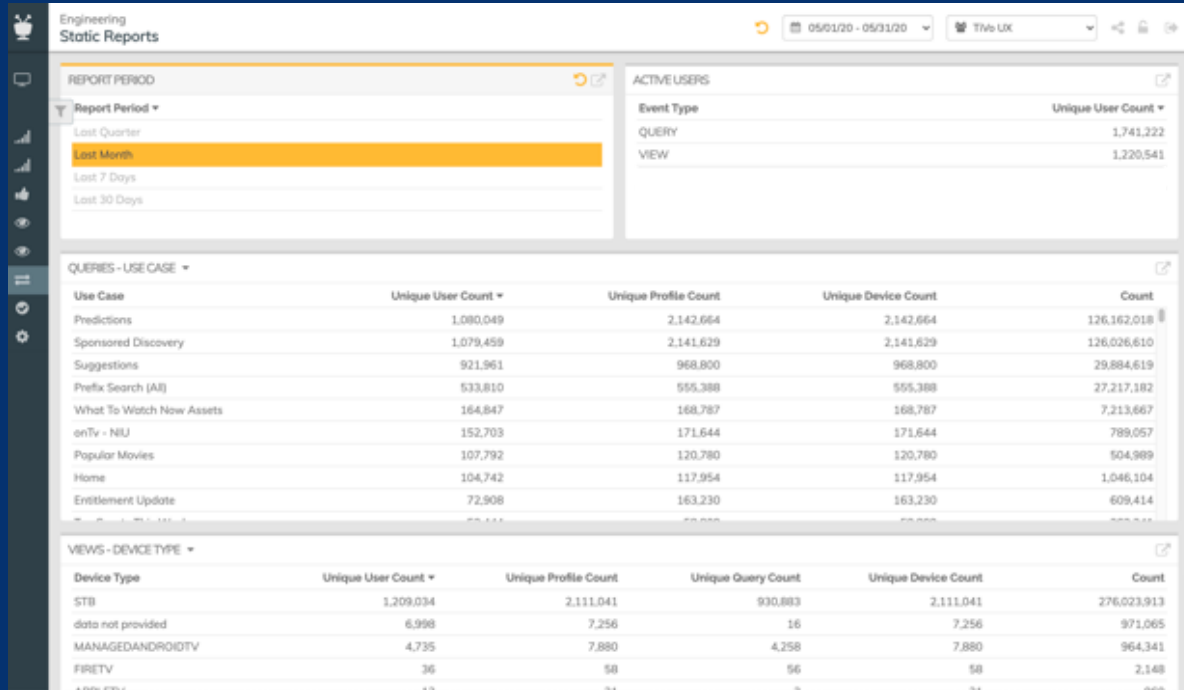
Company B might define “active” as the number of subscribers who watch videos for at least two hours per week (or three hours per day/month).

Company C might define “active” as the number of subscribers who use a particular discovery method, and then compare usage patterns.

In every case, the active subscribers metric seeks to pinpoint and measure user engagement. In general, the more active your subscribers are, the happier they are. And happy users make for higher retention rates or sales.



Active subscribers by engagement type



The screenshot displays the 'Engineering Static Reports' interface. At the top, it shows the report period as 'Last Month' and the date range as '05/01/20 - 05/31/20'. The 'ACTIVE USERS' section shows a breakdown by event type: QUERY (1,741,222) and VIEW (1,220,541). The 'QUERIES - USE CASE' table lists various use cases with their respective user, profile, and device counts. The 'VIEWS - DEVICE TYPE' table lists device types with their respective user, profile, query, and device counts.

Report Period	Report Period	Event Type	Unique User Count
Last Quarter		QUERY	1,741,222
Last Month		VIEW	1,220,541
Last 7 Days			
Last 30 Days			






Use Case	Unique User Count	Unique Profile Count	Unique Device Count	Count
Predictions	1,080,049	2,142,664	2,142,664	126,162,018
Sponsored Discovery	1,079,459	2,141,629	2,141,629	126,026,610
Suggestions	921,961	968,800	968,800	29,884,619
Prefix Search (All)	533,810	555,388	555,388	27,217,182
What To Watch Now Assets	164,847	168,787	168,787	7,213,667
onTV - NIU	152,703	171,644	171,644	789,057
Popular Movies	107,792	120,780	120,780	504,989
Home	104,742	117,954	117,954	1,046,104
Entitlement Update	72,908	163,230	163,230	609,414

Device Type	Unique User Count	Unique Profile Count	Unique Query Count	Unique Device Count	Count
STB	1,209,034	2,111,041	930,883	2,111,041	276,023,913
data not provided	6,998	7,256	16	7,256	971,065
MANAGEDANDROIDTV	4,735	7,880	4,258	7,880	964,341
FIRETV	36	58	56	58	2,148

The report shows a breakdown of user engagement with specific features – any user engaging with a specific feature within a month is considered an “active subscriber.”



#6. Customer Satisfaction

	What it indicates	How likely subscribers are to recommend your service to someone else
	Where to measure it	Net promoter score, likelihood to recommend, overall recommendation measures Regular random sample and transactional survey methods
	How to measure it	NPS: % of Promoters - % of Detractors Likelihood to recommend / product satisfaction: % of customers in positive, negative, neutral ranges
	How to influence it	High quality, engaging product UX improvements Improve leading metrics like time to discovery
	TiVo benchmarks	NPS of 20-50 is positive <5% negative satisfaction

Effort vs. Value

Customer satisfaction metrics like NPS or “likelihood to recommend” are typically measured by survey – either with regular (monthly/quarterly) sampling or via transactional surveys (post-purchase, after a support call).

High Business Value Easy to Measure	High Business Value Difficult to Measure
Low Business Value Easy to Measure	Low Business Value Difficult to Measure

While these metrics have a high value as indicators of business health, we recommend directing initiatives at leading indicators like effective catalog size, time to discovery or engagement with personalization (an active subscriber metric), which can be specifically targeted and have an impact on satisfaction.



Our research team favors likelihood to recommend over NPS, because NPS has the potential to jump dramatically with relatively smaller changes in actual user satisfaction. In addition to high-level satisfaction metrics, measuring sentiment closer to the source is valuable as well. For example, while satisfaction and churn are related, it is more valuable to poll consumers on why they did or might churn, than to simply list satisfaction as a cause of churn.



Overall satisfaction vs. NPS



Overall Satisfaction








NPS

Note the consistency of the overall satisfaction metric over time compared with the volatility of the NPS metric, as measured by TiVo end-user surveys during the same 18-month time period.



#7. Churn Rate

	What it indicates	Customer loyalty/satisfaction The % of users canceling or disengaging with your platform or content
	Where to measure it	Viewership, engagement, subscriptions
	How to measure it	% of users who have canceled or deactivated their subscription + number of users with no views for a least 4 weeks, and who never make a view following that period of inactivity
	How to influence it	Identify churn risk factors and high-risk users Influence-leading indicators like ECS, time to discovery and engagement with personalization features
	TiVo benchmarks	Average of 45.9% churn risk across a sample of 5 major MVPDs – the average user varies between 38-60% risk of churn in a given month.

Effort vs. Value

As consumer choice grows and fragments, video service and content providers are increasingly focused not simply on gaining subscribers but retaining them. Churn rate is a key measure of customer satisfaction.

Viewership and engagement are the best predictors of churn risk – factors include total viewing duration, day of the week and time of day in which viewing occurs, and engagement with recommendations/predictions and prefix search.

TiVo Insight allows video service providers to identify churn-risk factors, predict which users are most likely to churn, and then target these high-risk users with increased personalization. TiVo studies have shown users of personalized content discovery features to churn three times less than those who find content by traditional means.



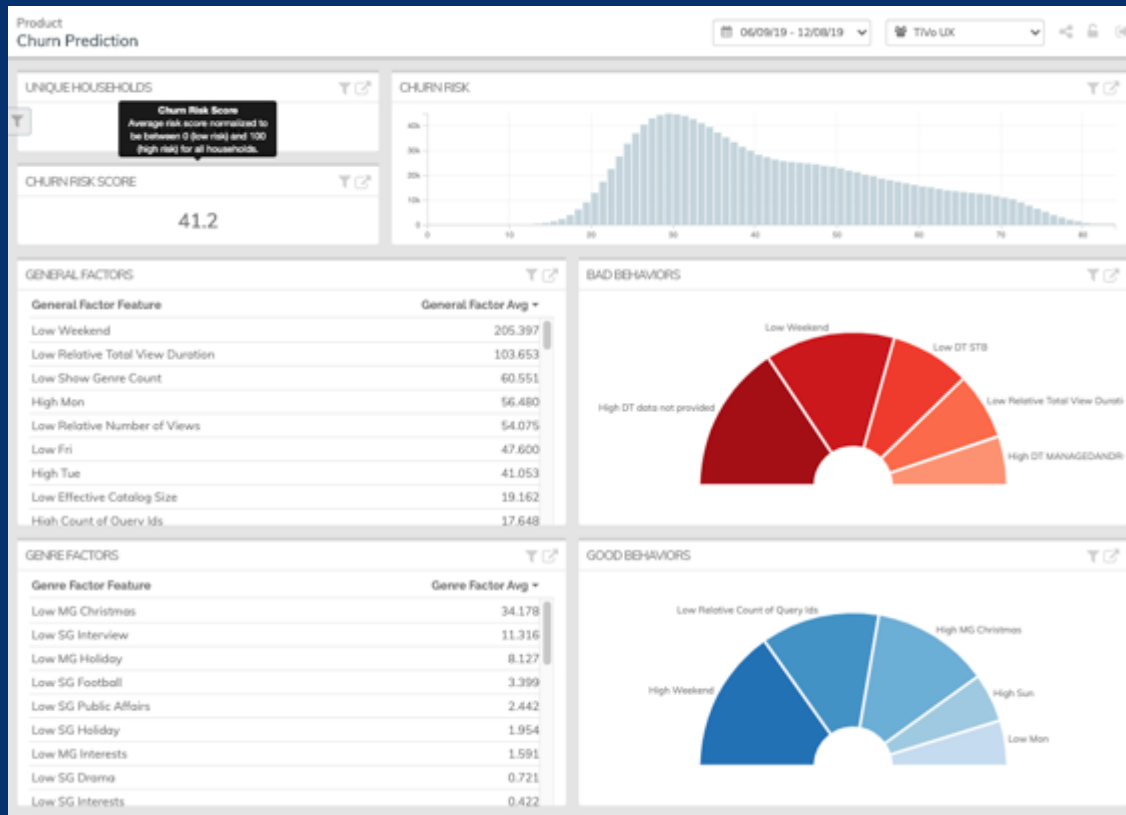
High Business Value Easy to Measure	High Business Value Difficult to Measure
Low Business Value Easy to Measure	Low Business Value Difficult to Measure



Like customer satisfaction metrics, churn rate itself is difficult to predictably influence with a targeted initiative. We recommend focusing on leading indicators like time to discovery or effective catalog size derived from surveys or other means, in combination with user engagement activities to audience segments with a high propensity to churn.



Churn prediction and risk factors



This is an analysis of the churn risk of a set of households over a given period of time.

TiVo Insight weights the positive and negative behaviors to reveal trends a team can use to plan churn-reduction promotions and other improvements.



Key Insights, Captured

Here's the bottom line: with good data, you can make good decisions.

Armed with the right tools and focused on the right metrics, video service providers can capture key insights, identify inflection points and answer crucial “Why” questions like “Why are we losing more customers?” and “Why are people viewing less this month than last month?”. With robust user data analytics, you can stay on the pulse of customer satisfaction, system performance, content selection and more.

These metrics are never the end goal. They are simply tools to empower video providers with the information they need to continually hone their products, refine users' experiences, and ultimately drive retention, sales and total business value.

The time to harness the power of data is now.



TiVo offerings mentioned in this guide

Personalized Content Discovery

Engagement Console

TiVo's Engagement Console is the front end of our Search and Recommendations offering. The cloud-based tool enables content merchandisers to build, test and deploy personalized experiences across a number of end-user touchpoints, finely-tuned based on user behavior and content metadata.

Insight

TiVo Insight is a cloud-based tool that enables business executives, engineers and data scientists to measure, analyze and respond strategically to end-user behavioral trends. Insight is designed exclusively for entertainment services with built-in measurement capabilities for key video consumption, technology-specific and audience metrics.

Video Metadata

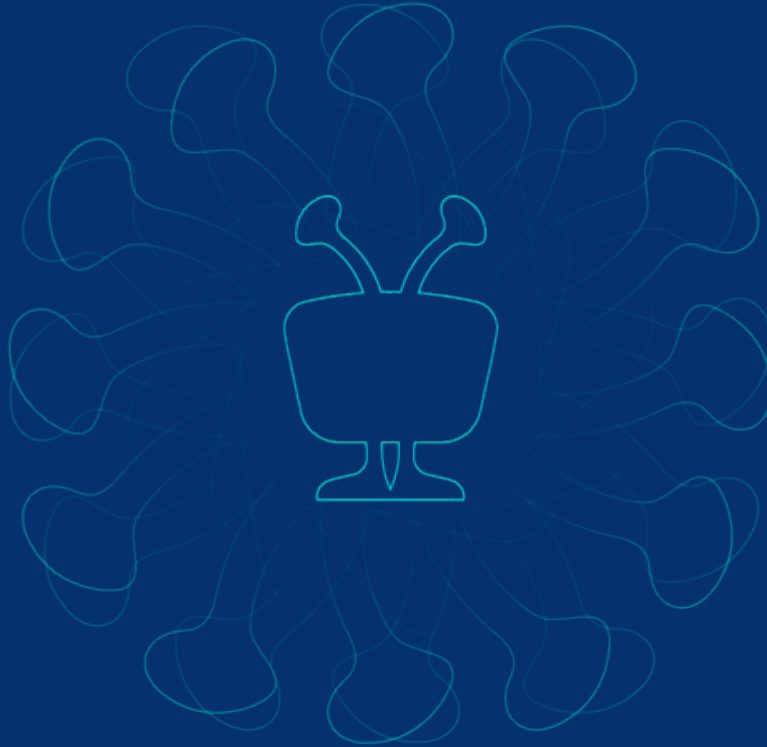
Deep Discovery

Deep Discovery is an enhancement layer of our Video Metadata that can be applied to create deeper content connections and, as a result, a more relevant discovery experience. It includes editorially-generated and machine-learned datasets with qualitative metadata like Moods, Tones, Themes, Time Periods, Topics and Popularity.

For more information:

Visit business.tivo.com for more product information and to contact a sales rep.





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