



# Leveraging Data Science to Reduce Prison Recidivism in the State of Arkansas

Category: Data management, analytics, and visualization  
State: Arkansas  
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## Executive Summary

In 2018, the State of Arkansas (AR) completed a project aimed at reducing prison recidivism that showcases the power of data for decision making and insight. The genesis of the project was the establishment of the office of the Chief Data Officer (CDO) in Arkansas and a Criminal Justice Efficiency and Safety Act aimed at reducing a rising population and high recidivism rate projected to cost the state \$650M in operating costs over the next 6 years if not addressed.

The CDO office worked with public safety agencies to establish an interagency data sharing agreement and coordinated an interagency design thinking workshop to ideate on innovative data-driven solutions to help address recidivism in Arkansas. Based on the outputs of the design thinking process, the state engaged in a co-innovation project with SAP in which an interagency group of state technical and subject matter experts worked with SAP data scientists to develop machine learning models for predicting recidivism risk and prescribing actionable interventions.

These models and other integrated agency and external data sets are leveraged through a set of operational and strategic dashboards, visualizations, and location analytics. Operational dashboards provide individual-level offender risk scores, top risk contributors, and recommended interventions to positively impact an offender's risk of recidivating as well as community resources near an offender's residence. Strategic dashboards provide a comprehensive view of the offender population and the criminal justice resources over time to understand trends, forecasts, and key contributors at a statewide, facility, or specific geographic level.

The significance of this project towards establishment and promotion of data management and analytics in our state is due to a business-driven, collaborative development approach, interagency and external data integration, and analytic model transparency.

The full operational impact of this project on prison population and recidivism will take time to fully operationalize and measure, but it is already providing value for strategic decision support and advancing analytic maturity and data-driven culture in Arkansas.

## Concept

In 2018, the State of Arkansas (AR) completed a project that showcases the power of data for decision making and insight. This project was primarily the result of two key pieces of 2017 legislation:

- Act 423 (Criminal Justice Efficiency and Safety Act) took steps to address a rapidly growing prison population and high re-incarceration rate (recidivism) that is projected to cost an additional \$650M in operating costs over the next 6 years if unchanged. The act calls for measures to increase the efficiency and effectiveness of monitoring probationers and parolees, increased collection and usage of electronic data, and other justice reinvestment reforms.
- Act 912 created the positions of the Chief Data Officer (CDO) and Chief Privacy Officer (CPO) for the state in order to promote and enable the increased sharing, integration, accessibility, analysis, and use of state data assets.

Since recidivism reduction was a top strategic priority for our state, it was a natural starting point for CDO office efforts to demonstrate the transformative value of increased data sharing and use. After forming in September 2017, one of the office's first efforts was to work with five agencies to draft an interagency data sharing agreement for public safety data. The agreement was signed in November 2017 at the inaugural Arkansas CDO forum.

### **Design Thinking for Interagency Collaboration and Innovation**

In order to explore opportunities for leveraging the newly shared data, the CDO office worked with SAP to host a design thinking workshop in January 2018 to ideate on data-driven solutions to help reduce recidivism. Design thinking is a business-driven, collaborative, and empathy-focused approach to breaking down problems and fostering rapid brainstorming and development of innovative strategies and solutions. The workshop included over 30 participants from all levels of the corrections-related organizations including agency directors, a former offender, and the justice reinvestment coordinator from the Governor's Office.

The workshop resulted in 13 potential use cases which were then prioritized based on business value and technical feasibility. The top-voted use case was a set of machine learning models to help predict recidivism risk and prescribe actionable interventions. This included the underlying data foundation to integrate the needed interagency and external data and dashboard applications for accessing the models. Subsequent design thinking sessions mapped the offender journey across agencies to determine actionable touchpoints that could be supported through analytics.



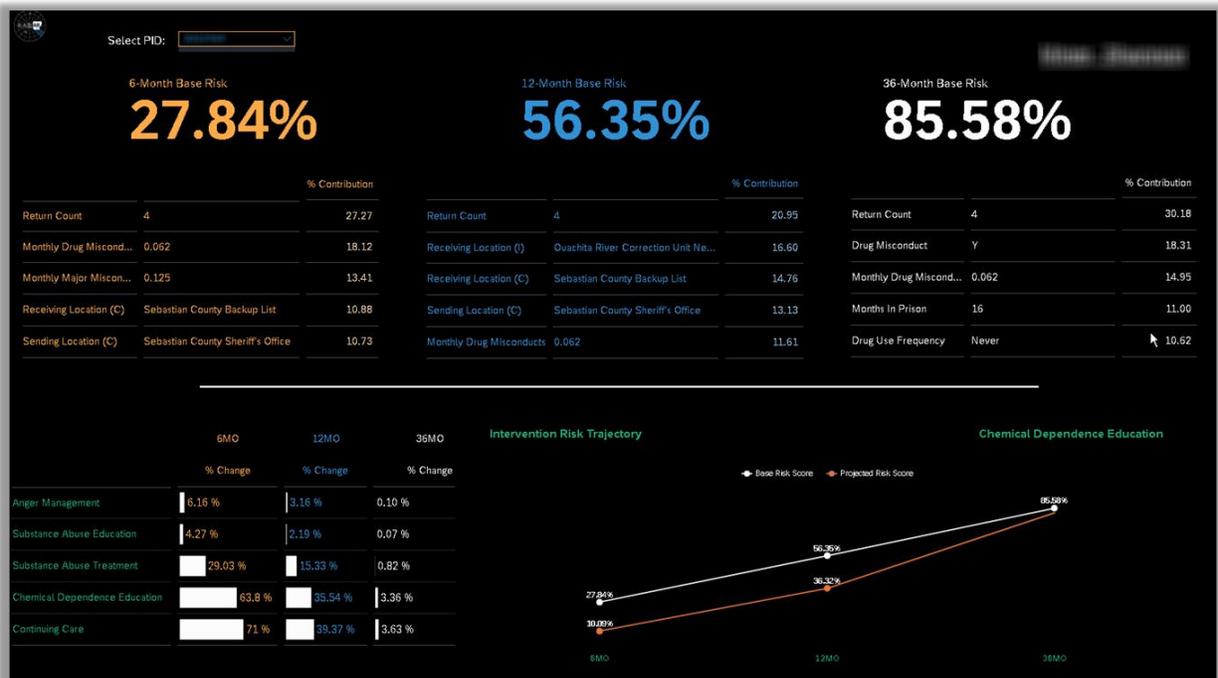
## Predictive and Prescriptive Analytics to Inform and Support Data-Driven Operations

In order to execute on the objectives identified by the design thinking process, the state engaged in a co-innovation project in which experts from the SAP Platform Data Science team and Global HANA Solution Center worked closely with an interagency group of Arkansas technical and subject matter experts to develop predictive machine learning models trained on a decade of multi-agency corrections data for over 100K offenders. The models predict individual offender risk of recidivism at 6, 12, and 36 months as well as the relative contribution of over 900 variables to an offender's likelihood of reoffending.

The predictive model was tested against historical recidivism events and found to have an accuracy of 76% for predicting recidivism within 36 months of release, which compares favorably to models that are providing benefits in other states. The model can be run for the entire offender population in seconds, which enables the capability for much more frequent, automated, and granular assessment of the risk and drivers of recidivism than were previously available.

Prescriptive analytic models were also developed in order to recommend actionable interventions to lower recidivism risk and the projected impact of each intervention.

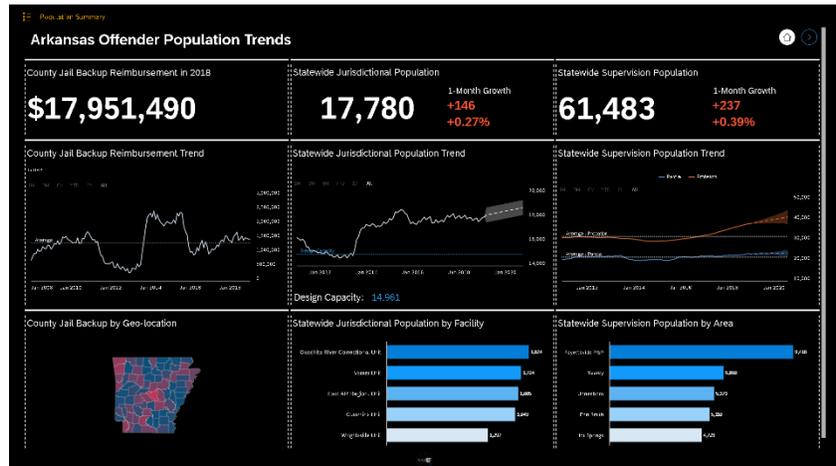
Both models are accessed by an analytic dashboard application that provides offender risk scores, top risk contributors, and recommended interventions to positively impact an offender's risk of recidivating. Selecting intervention options simulates the impact of each intervention on 6, 12, and 36-month recidivism risk to assist officers in building and evaluating action plans. Additional operational dashboards are also available to assist officers with locating community resources within a specified proximity to an offender's residence.



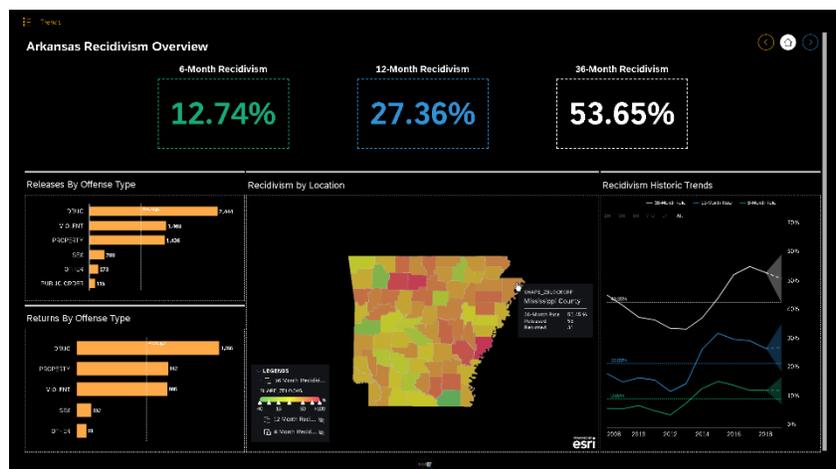
## Dashboards to Leverage Data for Strategic and Public Policy Support

In order to support strategy and policy decisions above the operational level, a series of executive dashboards and visualizations were also developed to provide a comprehensive view of the offender population and the criminal justice resources over time to understand trends, forecasts, and key contributors at a statewide, facility, or specific geographic level.

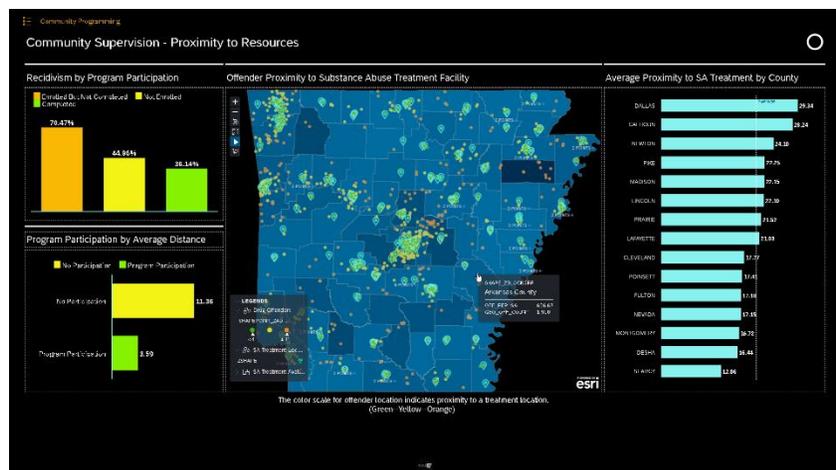
A population trends dashboard provides trends, forecasts, and geographic distribution for prison, probation, parole, and county jail backup in order to track the status and cost of population growth. The avoidable cost of reimbursing county jails due to exceeding prison design capacity in 2018 was almost \$18M.



A recidivism overview dashboard provides rates, drivers, trends, forecasts, and geographic distribution of recidivism. Recidivism trends are generated in real time based on rolling cohort windows for more timely, leading indicators than the previous method of calculating these metrics annually.



Additional dashboards show the impact of specific programs on recidivism rates for relevant offender types and the drivers of program participation. One key insight was that completion of community substance abuse programs can substantially reduce the recidivism rate for drug offenders and that proximity to treatment providers is strongly correlated with program participation.



## Significance

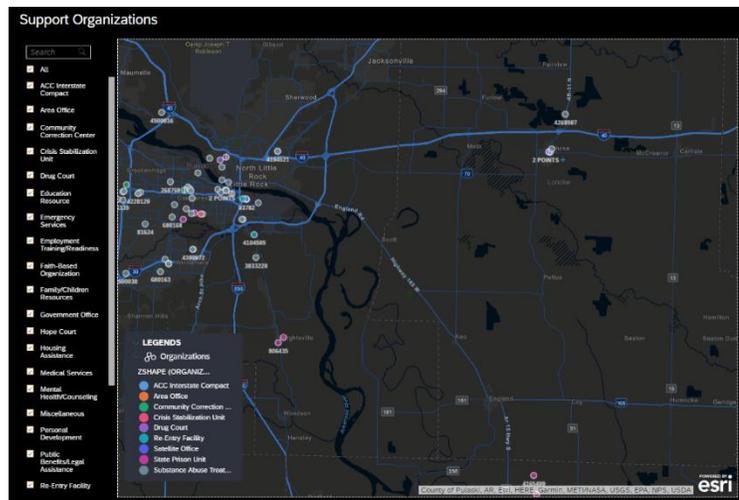
This project has the potential to significantly improve decision support for our corrections system staff, avoiding costs and improving lives. Its primary significance towards establishment and promotion of data management and analytics in our state is due to a business-driven approach, interagency and external data integration, and analytic model transparency.

### Business-Driven, Collaborative Development Approach

While technical resources were involved for project development, an interagency group of business stakeholders and subject matter experts drove the process from initial scoping through solution design and iterative development reviews. This frequent stakeholder engagement and collaboration was not only vital to the design and validation of an effective solution, but also served to demonstrate the effectiveness of working together across organizational boundaries and levels to harness collective experience and insights.

### Interagency and External Data Integration

This project proved to be significant in demonstrating the value of integrating interagency and external data for new insights. Besides bringing together data from across multiple corrections agencies, incorporation of additional sources such as FBI Uniform Crime Reporting, Bureau of Labor Statistics, and Census Bureau enable analysis of recidivism in the context of criminal activity, population, and socioeconomic factors.



The incorporation of data on community programs and support organizations allows for both individual offender support and high-level strategic planning. All external data used was location-specific, so integration with individual-specific offender data accomplished using geospatial queries and the incorporation of point and shape data from our state's geospatial information system clearinghouse.

### Analytic Model Transparency

Public sector analytics applications must be particularly sensitive to the legal and ethical implications of the model outputs and usage. Whereas many machine learning applications are so-called “black-box”, meaning that the inner mechanics of the algorithms are largely opaque and can hide bias derived from patterns in the training data, the platform and tools used for this project (SAP HANA Automated Predictive Library) allow models to be exported in a number of different programming languages for review and revision in intelligible, human-readable formats. This allows for us to be more transparent and accountable as we build algorithms that can have profound impacts on the lives of our citizens.

## Impact

While the operational impact on prison population and recidivism will take additional time to fully operationalize and measure, the project deliverables are already being used to support strategic decision making such as analyzing recidivism impact trends for prison programs and identifying potential sites for new community supervision reporting locations based on offender density and average distance to reporting location.

The project has also had a significant impact on our state's analytic maturity and data-driven culture.

- The design thinking process demonstrated the power of a collaborative interagency approach to problem solving which has resulted in a second workshop addressing a different domain.
- This was the first high-profile example of advanced analytics in Arkansas public sector, and the number and sophistication of questions being asked and solutions being proposed by agencies has increased markedly. Every new stakeholder group for the project deliverables has proposed new enhancements, audiences, and uses that were not previously considered.
- The dashboards, visualizations, location analytics, and insights generated by the project resonated with stakeholders at all levels from operational staff to agency directors and legislators. This has served to generate awareness of, appetite for, and confidence in our state's ability to successfully pursue similar efforts in other domains and make continuous improvements towards becoming a more data-driven government.

