Money laundering ranks high amongst the factors that crumbles a nation's economy, In Nigeria, From recorded cases Politically exposed persons (PEP) and Yahoo boys are mostly the culprits of money laundering Preventive measures have been put in place to curtail the occurrence of money laundering in financial institutions by the Central Bank of Nigeria(CBN). Traditional approaches of money laundering detection have been proved to be time consuming and labour intensive. Hence Data mining approaches are used to automate money laundering detection (MLD). This paper aims at making a comparison of the effectiveness of Artificial neural network (ANN) and Support vector machine (SVM) in money laundering detection and to investigate suitable parameters to be used for the model. Based on two data mining frameworks; ANN and SVM., some sequence of processes are used in order to classify a transaction as either suspicious or not, the effect of number of neurons and layers on the model was determined, so was the effect of validation or no validation on the SVM. The model was evaluated based on various indicators such as; accuracy, sensitivity, specificity and precision to analyze the effectiveness in MLD of which both performed favorably well, But ANN surpassed SVM.