Missile Farm Smart Contract Preliminary Audit Report

Project Synopsis

Project Name	**Missile Farm**
Platform	Ethereum, Solidity
Github Repo	https://github.com/MissileFarm/MissileFarmProtocol/tree/main/Contracts
Deployed Contract	Not Deployed
Total Duration	5 Days
Timeline of Audit	**5th May 2021 to 10th May 2021**

Contract Details

Total Contract(s)	2
Name of Contract(s)	**MSIToken1.sol , FarmChef.sol**
Language	Solidity
Commit Hash	**C017eab9174889068b141d33d89f7381a3ddcb98, 06ffa95b53193792fa24252521d1e0a4ccc4a936**

Contract Vulnerabilities Synopsis

Issues	Open Issues	Closed Issues
Critical Severity	**3**	**0**
Medium Severity	**5**	**0**
Low Severity	**3**	**0**
Information	**3**	**0**
Total Found	**14**	**0**

Detailed Results

The contract has gone through several stages of the audit procedure that includes structural analysis, automated testing, manual code review etc.

All the issues have been explained and discussed in detail below. Along with the explanation of the issue found during the audit, the recommended way to overcome the issue or improve the code quality has also been mentioned.

A. Contract Name: FarmChef

High Severity Issues

A.1 Imperative Contract functions are accessible to everyone instead of Only OWNER.

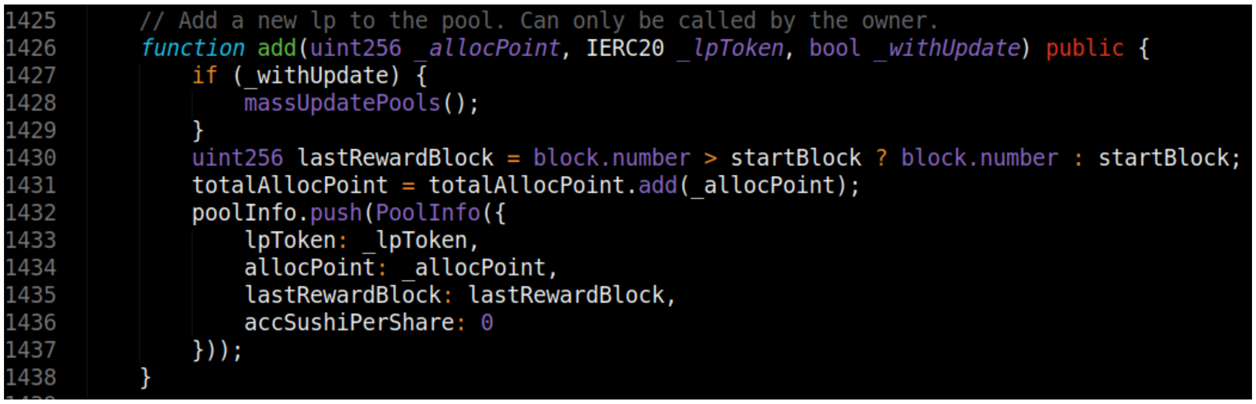
Line no - 1426 to 1438, 1441 to 1447

Description:

The Masterchef contract includes a few functions that include crucial functionality, like adding a new ***_lpToken*** in the Pool, which should be accessible to only the owner of the contract.

However, no such **require statements** or **modifiers** were found in those functions. The following functions should be accessible to only the owner but are marked **PUBLIC** instead:

- ***add function*** *at Line 1426*
- ***set function*** *at Line 1441*



```
1425     // Add a new lp to the pool. Can only be called by the owner.
1426     function add(uint256 _allocPoint, IERC20 _lpToken, bool _withUpdate) public {
1427         if (_withUpdate) {
1428             massUpdatePools();
1429         }
1430         uint256 lastRewardBlock = block.number > startBlock ? block.number : startBlock;
1431         totalAllocPoint = totalAllocPoint.add(_allocPoint);
1432         poolInfo.push(PoolInfo({
1433             lpToken: _lpToken,
1434             allocPoint: _allocPoint,
1435             lastRewardBlock: lastRewardBlock,
1436             accSushiPerShare: 0
1437         }));
1438     }
```

Recommendation:

The **onlyOwner** modifier should be attached to the above-mentioned functions.

A.2 safeSushiTransfer function does not execute adequately if Sushi Token Balance in the contract is less than the amount of tokens to be transferred

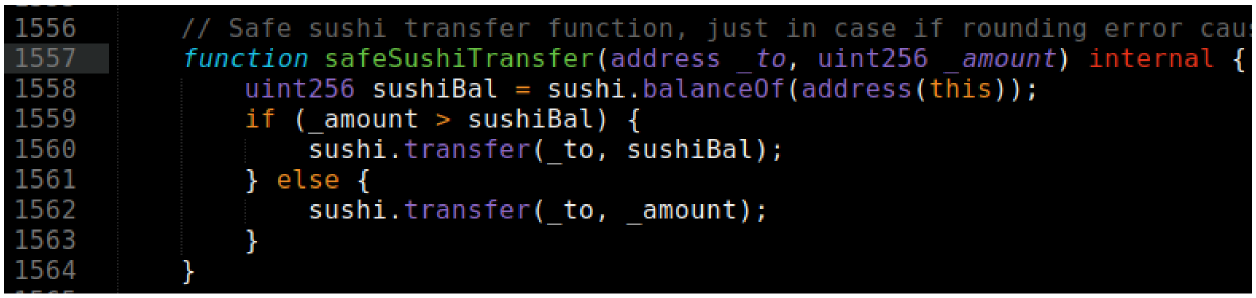
Line no - 1557

Explanation:

The **safeSushiTransfer** is designed in a way that it first checks whether or not the MasterChef contract has more reward token balance than the amount of tokens to be transferred to the user(*Line 1558*).

If the MasterChef contract has less reward token balance than the amount to be transferred, the user gets only the remaining reward tokens in the contract and not the actual amount that was supposed to be transferred(*Line 325*).

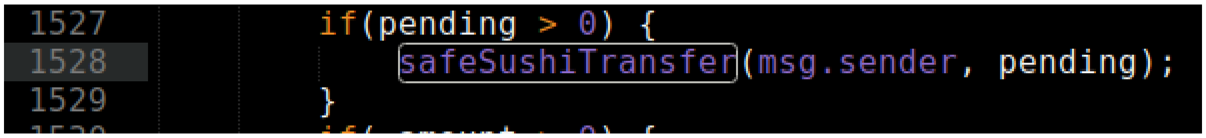
However, the major issue in this function is that if the above-mentioned condition is met and the user only gets the remaining sushi tokens in MasterChef contract instead of the actual sushi tokens that should be transferred, then the remaining amount of tokens that the user didn't receive yet is never stored throughout the function.



```
1556        // Safe sushi transfer function, just in case if rounding error cau
1557        function safeSushiTransfer(address _to, uint256 _amount) internal {
1558            uint256 sushiBal = sushi.balanceOf(address(this));
1559            if (_amount > sushiBal) {
1560                sushi.transfer(_to, sushiBal);
1561            } else {
1562                sushi.transfer(_to, _amount);
1563            }
1564        }
```

For instance, if the user is supposed to receive **1000** pending tokens while calling the **withdraw function**.

The withdraw function will call the **safeSushiTransfer** function(*Line 1528*) and passes the user's address and the pending token amount of 1000 tokens.



```
1527            if(pending > 0) {
1528                safeSushiTransfer(msg.sender, pending);
1529            }
```

However, if the MasterChef contract has only 800 reward tokens then the **if condition** at *Line 1559* will be executed and the user will only receive **800 reward tokens** instead of **1000 reward tokens.**
Now, because of the fact that the **safeSushiTransfer** function doesn't store this information that the user still owes 200 reward tokens will lead to an unexpected scenario where the users receive less reward token than expected.

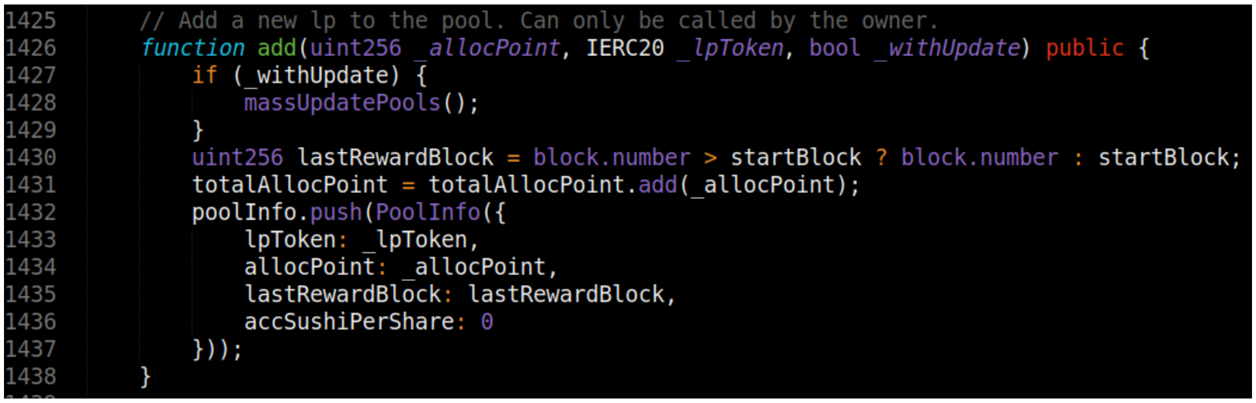
Was this scenario Intended or Considered during the development of this function?

Recommendation:
If the above-mentioned scenario was not considered, then the function must be updated in such a way that the user gets the actual amount of reward tokens whenever the **safeSushiTransfer** function is called.

A.3 add function allows adding similar LP Token Address more than once.

Line no - 1426
Explanation:
As per the current architecture of the MasterChef contract, the **LP Tokens** added in the pool of this contract should not be repeated as the address of an **LP Token** plays an imperative role in the calculation of rewards the presence of a similar LP Token address more than once will break some of the core functionalities of the contract.

However, the **add()** function at Line 1426 allows storing a similar LP Token Address more than once. This will lead to an unexpected scenario where different pools will have a similar LP token address.



```
    // Add a new lp to the pool. Can only be called by the owner.
    function add(uint256 _allocPoint, IERC20 _lpToken, bool _withUpdate) public {
        if (_withUpdate) {
            massUpdatePools();
        }
        uint256 lastRewardBlock = block.number > startBlock ? block.number : startBlock;
        totalAllocPoint = totalAllocPoint.add(_allocPoint);
        poolInfo.push(PoolInfo({
            lpToken: _lpToken,
            allocPoint: _allocPoint,
            lastRewardBlock: lastRewardBlock,
            accSushiPerShare: 0
        }));
    }
```

Is this SCENARIO INTENDED?

Recommendation:

If the above mentioned scenario is not intended, the argument ***_lpToken*** (*LP token address*) passed in the **add()** function must be checked at the very beginning of the function with a **require statement** to ensure no other **LP Token** with a similar address have been passed before.

Medium Severity Issues

A.4 Multiplication is being performed on the result of Division

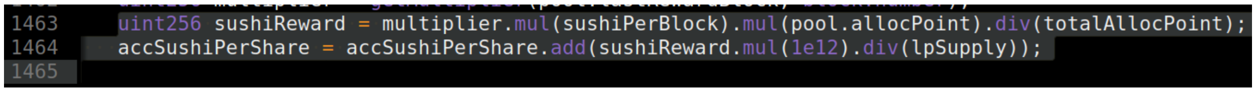
Line no - 1471-1472

***Explanation*:**

During the automated testing of the MasterChef contract, it was found that some of the functions in the contract are performing multiplication on the result of a Division. Integer Divisions in Solidity might truncate. Moreover, this performing division before multiplication might lead to loss of precision.

The following functions involve division before multiplication in the mentioned lines:

- ***pendingSushi***



```
    uint256 sushiReward = multiplier.mul(sushiPerBlock).mul(pool.allocPoint).div(totalAllocPoint);
    accSushiPerShare = accSushiPerShare.add(sushiReward.mul(1e12).div(lpSupply));
```

Recommendation:

Solidity doesn't encourage arithmetic operations that involve division before multiplication. Therefore the above-mentioned function should be checked once and redesigned if they do not lead to expected results.

A.5 Contract State Variables are being updated after External Calls. Violation of Check_Effects_Interaction Pattern

Line no - 1548 to 1555, 1513 to 1516

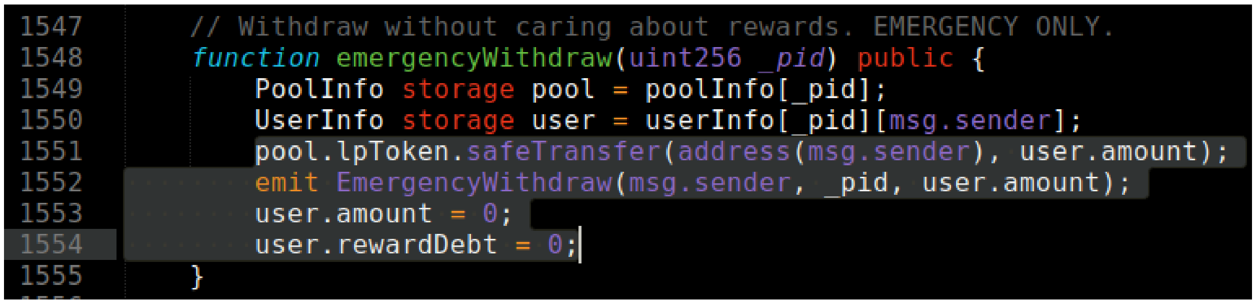
Explanation:

The MasterChef contract includes quite a few functions that update some of the very imperative state variables of the contract after the external calls are being made.

An external call within a function technically shifts the control flow of the contract to another contract for a particular period of time. Therefore, as per the Solidity Guidelines, any modification of any state variables in the base contract must be performed before executing the external call.
Updating state variables after an external call might lead to a potential re-entrancy scenario.

The following functions in the contract updates the state variables after making an external call, at the line numbers specified below, and violates the Check-Effects Interaction Pattern:

- ***deposit() function*** *at Line* **1513**
- ***emergencyWithdraw*** *at Line* **1548**



```
1547    // Withdraw without caring about rewards. EMERGENCY ONLY.
1548    function emergencyWithdraw(uint256 _pid) public {
1549        PoolInfo storage pool = poolInfo[_pid];
1550        UserInfo storage user = userInfo[_pid][msg.sender];
1551        pool.lpToken.safeTransfer(address(msg.sender), user.amount);
1552        emit EmergencyWithdraw(msg.sender, _pid, user.amount);
1553        user.amount = 0;
1554        user.rewardDebt = 0;
1555    }
```

Recommendation:

Modification of any State Variables must be performed before making an external call.

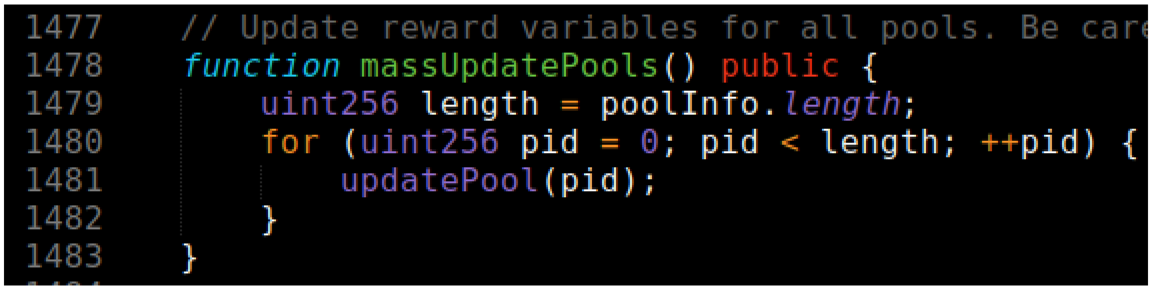
A.6 ***updatePool*** and ***massUpdatePools*** functions have been assigned a Public visibility

Line no - 1478, 1486

Explanation:

The **updatePool** and **massUpdatePools** functions include significant functionalities as they deal with updating the reward variables of a given pool.
These functions are called within the contract by some crucial functions like **add(), deposit, withdraw** etc.

However, instead of an **internal visibility,** these functions have been assigned a public visibility.



```
// Update reward variables for all pools. Be care
function massUpdatePools() public {
    uint256 length = poolInfo.length;
    for (uint256 pid = 0; pid < length; ++pid) {
        updatePool(pid);
    }
}
```

Since **public** visibility will make the ***updatePool & massUpdatePools function*** accessible to everyone, it would have been a more effective and secure approach to mark these functions as **internal.**

Recommendation:
If both of these functions are only to be called from within the contract, their visibility specifier should be changed from **PUBLIC** to **INTERNAL**.

Low Severity Issues

A.7 External Visibility should be preferred

Explanation:
Those functions that are never called throughout the contract should be marked as ***external*** visibility instead of ***public*** visibility.
This will effectively result in Gas Optimization as well.

Therefore, the following function must be marked as **external** within the contract:

- ***mint***
- ***add***
- ***set***
- ***deposit***
- ***withdraw***
- ***emergencyWithdraw***
- ***dev***

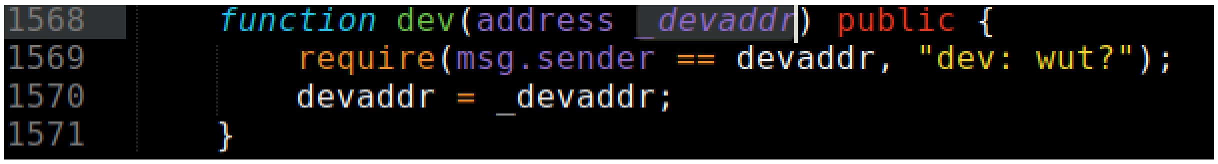
Recommendation:
If the PUBLIC visibility of these functions is not intended, the visibility keyword must be modified to EXTERNAL.

A.8 Absence of Zero Address Validation in dev function

Line no- 1568 to 1572

Description:
The ***dev*** function in the contract updates the devAddress state variable which is a crucial variable in the contract.

However, during the automated testing of the contact it was found that no Zero Address Validation is implemented for the ***_devaddr*** argument passed to this function.



```
    function dev(address _devaddr) public {
        require(msg.sender == devaddr, "dev: wut?");
        devaddr = _devaddr;
    }
```

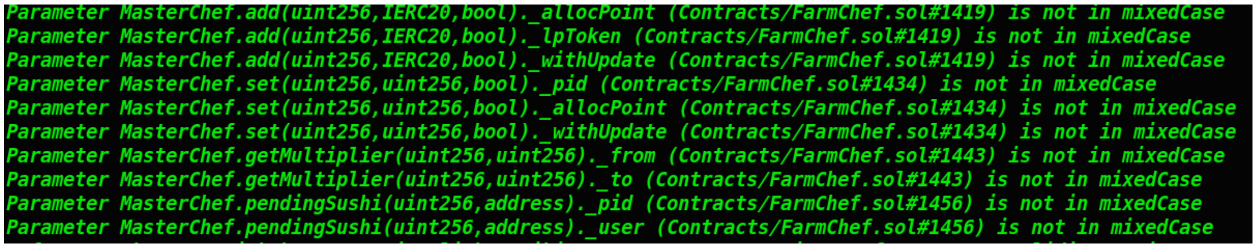
Recommendation:
A **require** statement should be included in such functions to ensure no invalid address is passed in the arguments.

Informational

A.9 Coding Style Issues in the Contract

Explanation:
Code readability of a Smart Contract is largely influenced by the Coding Style issues and in some specific scenarios may lead to bugs in the future.

During the automated testing, it was found that the MasterChef contract had quite a few code style issues.



```
Parameter MasterChef.add(uint256,IERC20,bool)._allocPoint (Contracts/FarmChef.sol#1419) is not in mixedCase
Parameter MasterChef.add(uint256,IERC20,bool)._lpToken (Contracts/FarmChef.sol#1419) is not in mixedCase
Parameter MasterChef.add(uint256,IERC20,bool)._withUpdate (Contracts/FarmChef.sol#1419) is not in mixedCase
Parameter MasterChef.set(uint256,uint256,bool)._pid (Contracts/FarmChef.sol#1434) is not in mixedCase
Parameter MasterChef.set(uint256,uint256,bool)._allocPoint (Contracts/FarmChef.sol#1434) is not in mixedCase
Parameter MasterChef.set(uint256,uint256,bool)._withUpdate (Contracts/FarmChef.sol#1434) is not in mixedCase
Parameter MasterChef.getMultiplier(uint256,uint256)._from (Contracts/FarmChef.sol#1443) is not in mixedCase
Parameter MasterChef.getMultiplier(uint256,uint256)._to (Contracts/FarmChef.sol#1443) is not in mixedCase
Parameter MasterChef.pendingSushi(uint256,address)._pid (Contracts/FarmChef.sol#1456) is not in mixedCase
Parameter MasterChef.pendingSushi(uint256,address)._user (Contracts/FarmChef.sol#1456) is not in mixedCase
```

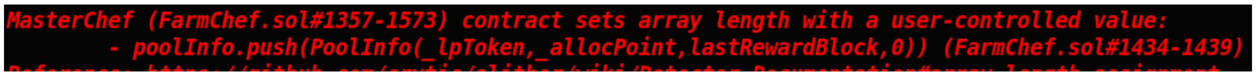
Recommendation:
Therefore, it is highly recommended to fix the issues like naming convention, indentation, and code layout issues in a smart contract.

A.10 NatSpec Annotations must be included

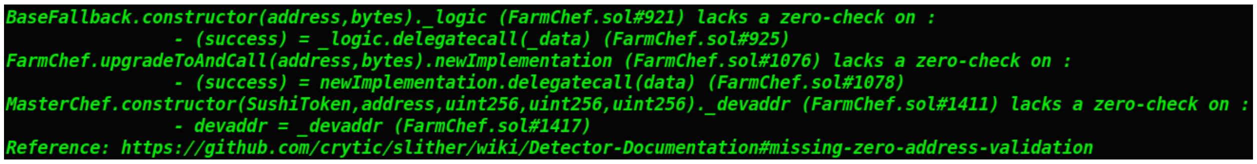
Description:
The smart contracts do not include the NatSpec annotations adequately.

Recommendation:
Cover by NatSpec all Contract methods.

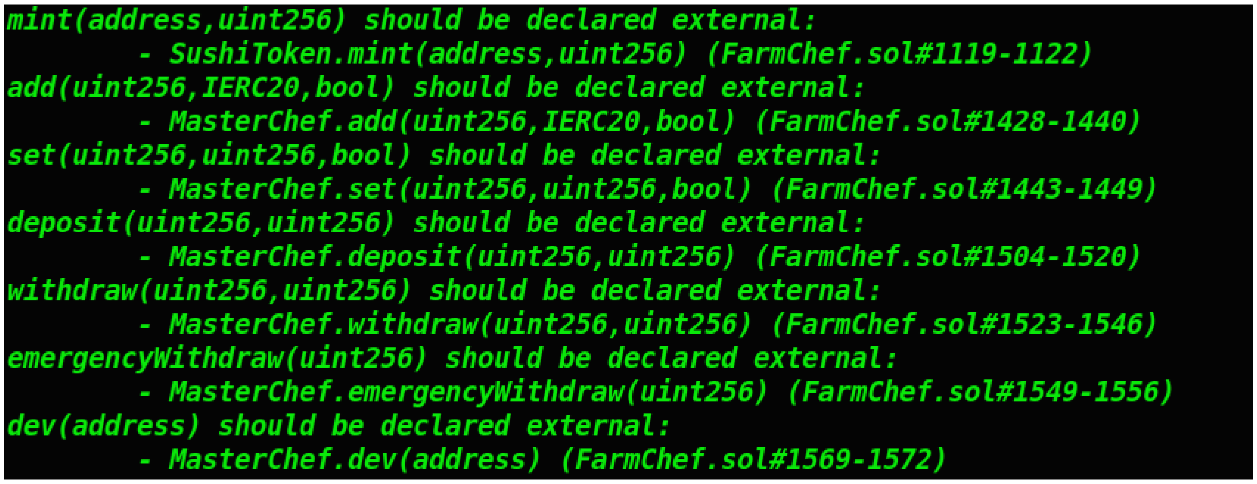
Automated Test Results



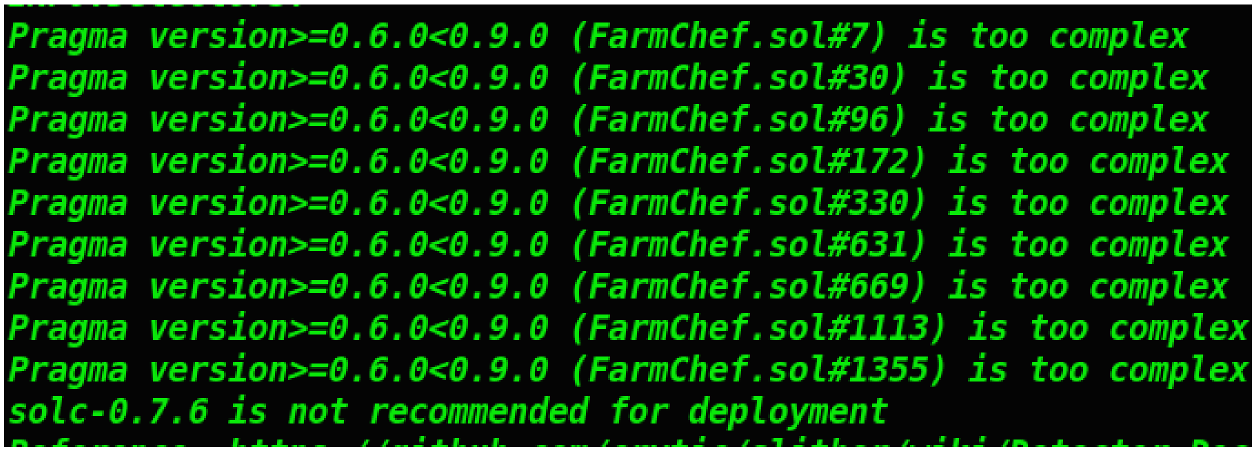
```
MasterChef (FarmChef.sol#1357-1573) contract sets array length with a user-controlled value:
	- poolInfo.push(PoolInfo(_lpToken,_allocPoint,lastRewardBlock,0)) (FarmChef.sol#1434-1439)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#array-length-assignment
```



```
BaseFallback.constructor(address,bytes)._logic (FarmChef.sol#921) lacks a zero-check on :
		- (success) = _logic.delegatecall(_data) (FarmChef.sol#925)
FarmChef.upgradeToAndCall(address,bytes).newImplementation (FarmChef.sol#1076) lacks a zero-check on :
		- (success) = newImplementation.delegatecall(data) (FarmChef.sol#1078)
MasterChef.constructor(SushiToken,address,uint256,uint256,uint256)._devaddr (FarmChef.sol#1411) lacks a zero-check on :
		- devaddr = _devaddr (FarmChef.sol#1417)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#missing-zero-address-validation
```



```
mint(address,uint256) should be declared external:
	- SushiToken.mint(address,uint256) (FarmChef.sol#1119-1122)
add(uint256,IERC20,bool) should be declared external:
	- MasterChef.add(uint256,IERC20,bool) (FarmChef.sol#1428-1440)
set(uint256,uint256,bool) should be declared external:
	- MasterChef.set(uint256,uint256,bool) (FarmChef.sol#1443-1449)
deposit(uint256,uint256) should be declared external:
	- MasterChef.deposit(uint256,uint256) (FarmChef.sol#1504-1520)
withdraw(uint256,uint256) should be declared external:
	- MasterChef.withdraw(uint256,uint256) (FarmChef.sol#1523-1546)
emergencyWithdraw(uint256) should be declared external:
	- MasterChef.emergencyWithdraw(uint256) (FarmChef.sol#1549-1556)
dev(address) should be declared external:
	- MasterChef.dev(address) (FarmChef.sol#1569-1572)
```



```
Pragma version>=0.6.0<0.9.0 (FarmChef.sol#7) is too complex
Pragma version>=0.6.0<0.9.0 (FarmChef.sol#30) is too complex
Pragma version>=0.6.0<0.9.0 (FarmChef.sol#96) is too complex
Pragma version>=0.6.0<0.9.0 (FarmChef.sol#172) is too complex
Pragma version>=0.6.0<0.9.0 (FarmChef.sol#330) is too complex
Pragma version>=0.6.0<0.9.0 (FarmChef.sol#631) is too complex
Pragma version>=0.6.0<0.9.0 (FarmChef.sol#669) is too complex
Pragma version>=0.6.0<0.9.0 (FarmChef.sol#1113) is too complex
Pragma version>=0.6.0<0.9.0 (FarmChef.sol#1355) is too complex
solc-0.7.6 is not recommended for deployment
Reference: https://github.com/crytic/slither/wiki/Detector-Doc
```

B. Contract Name: MSI Token1

Medium Severity Issues

B.1 Require Statement could be preferred instead of IF Statement

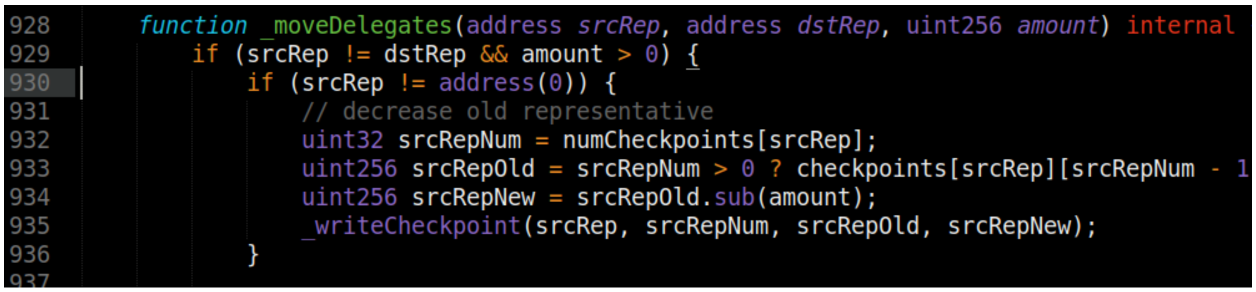
Line no - 928 to 946

Description:

The **_moveDelegates** function ensures that that the function is executed only if:

- The **srcRep** address and the **dstRep** address should be different, and
- The amount passed should be greater than **Zero.**

According to the current function design, if any of these conditions is not fulfilled, the function will not be executed.



```
928     function _moveDelegates(address srcRep, address dstRep, uint256 amount) internal
929         if (srcRep != dstRep && amount > 0) {
930             if (srcRep != address(0)) {
931                 // decrease old representative
932                 uint32 srcRepNum = numCheckpoints[srcRep];
933                 uint256 srcRepOld = srcRepNum > 0 ? checkpoints[srcRep][srcRepNum - 1
934                 uint256 srcRepNew = srcRepOld.sub(amount);
935                 _writeCheckpoint(srcRep, srcRepNum, srcRepOld, srcRepNew);
936             }
937
```

Therefore, keeping in mind that the function strictly checks the arguments passed and stops the function execution if the above-mentioned conditions are not met, it would be more effective to use a **require statement** instead of **IF-Else Statement.** Its not only considered a better practice to use **require statements** for input validation but it also improves the code readability and helps in gas optimization.

Recommendation:

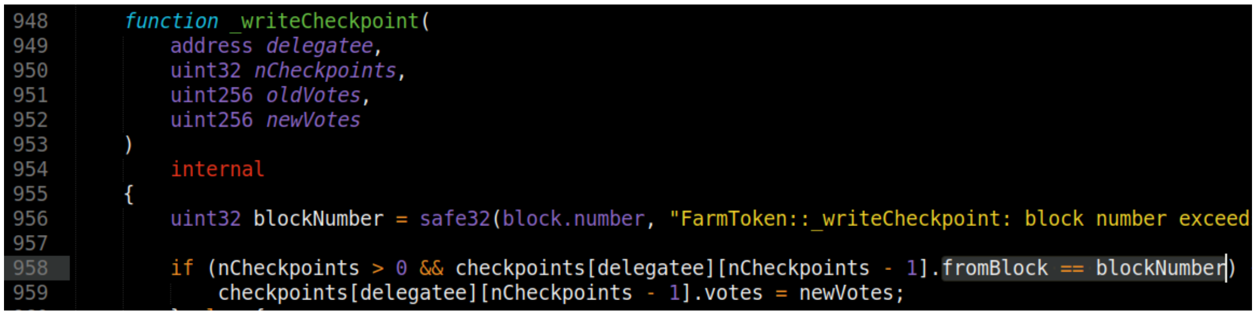
It is recommended to validate the user inputs using **require** statements for the above-mentioned function.

B.2 Strict Equality is being used in the IF statement

Line no: 958

Description:

During the automated testing of the contract, it was found that the **_writeCheckpoint** function includes a *STRICT EQUALITY* check in the if statement.



```
    function _writeCheckpoint(
        address delegatee,
        uint32 nCheckpoints,
        uint256 oldVotes,
        uint256 newVotes
    )
        internal
    {
        uint32 blockNumber = safe32(block.number, "FarmToken::_writeCheckpoint: block number exceed

        if (nCheckpoints > 0 && checkpoints[delegatee][nCheckpoints - 1].fromBlock == blockNumber)
            checkpoints[delegatee][nCheckpoints - 1].votes = newVotes;
```

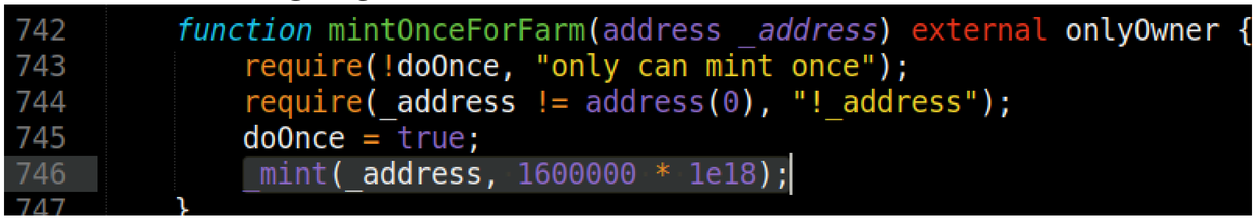
Is this Intended?

Recommendation:
It is not considered a better practice in Solidity to implement a *Strict Equality* check in the **If** or **require** statements.
If the above-mentioned logic is not intended, then the **if statement** should be modified.

Low Severity Issues

B.3 User ETHER Units instead of Large Digits

Line no: 739, 746
Description:
During the automated testing of the contracts it was found that the **MSI Token** contract includes large digits in the contract.



```
742     function mintOnceForFarm(address _address) external onlyOwner {
743         require(!doOnce, "only can mint once");
744         require(_address != address(0), "!_address");
745         doOnce = true;
746         _mint(_address, 1600000 * 1e18);
747     }
```

The globally available Ether Units can be used instead of multiplying amounts to 1e18 while minting a particular token amount. This will enhance the readability of the contract code.

Solidity provides some globally available units like **ether** which symbolizes **10^18.**
For instance,
"_mint(msg.sender, 400000 * 1e18);" can simply be written as
"_mint(msg.sender, 400000 ether);"

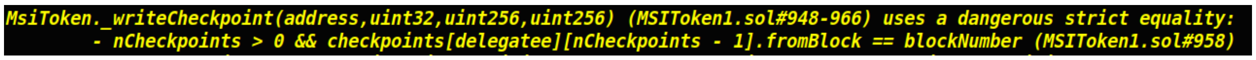
Informational

B.4 NatSpec Annotations must be included

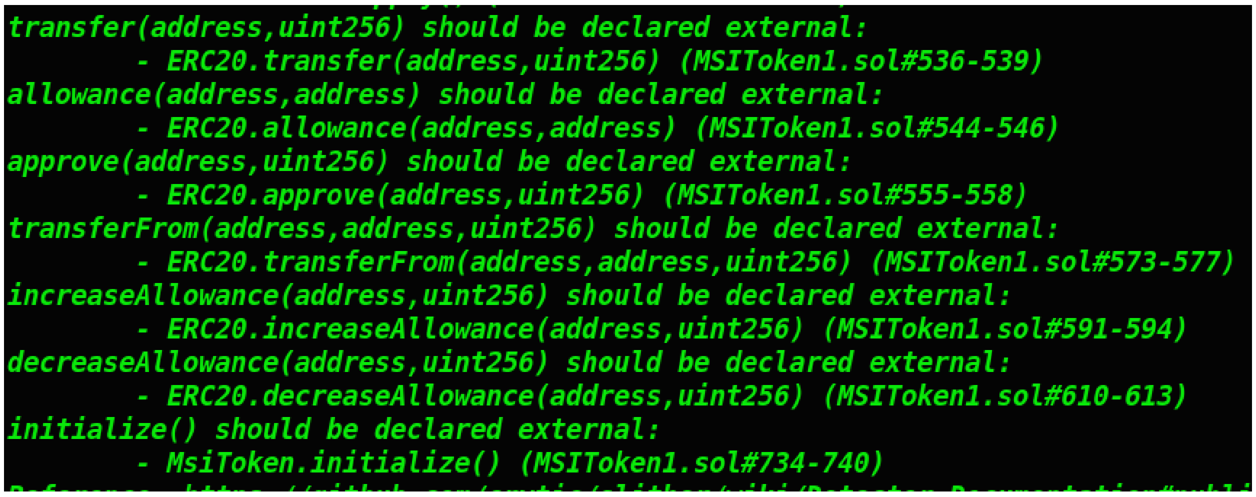
Description:
Smart Contract does not include the NatSpec Annotations adequately.

Recommendations:
Cover by NatSpec all Contract methods.

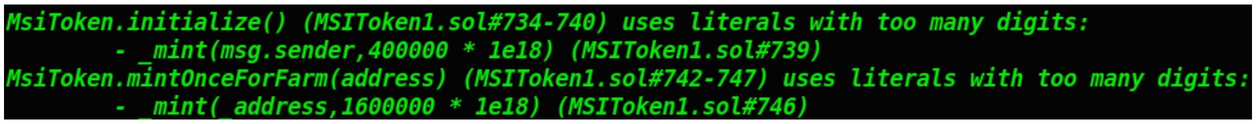
Automated Test Results



```
MsiToken._writeCheckpoint(address,uint32,uint256,uint256) (MSIToken1.sol#948-966) uses a dangerous strict equality:
        - nCheckpoints > 0 && checkpoints[delegatee][nCheckpoints - 1].fromBlock == blockNumber (MSIToken1.sol#958)
```



```
transfer(address,uint256) should be declared external:
        - ERC20.transfer(address,uint256) (MSIToken1.sol#536-539)
allowance(address,address) should be declared external:
        - ERC20.allowance(address,address) (MSIToken1.sol#544-546)
approve(address,uint256) should be declared external:
        - ERC20.approve(address,uint256) (MSIToken1.sol#555-558)
transferFrom(address,address,uint256) should be declared external:
        - ERC20.transferFrom(address,address,uint256) (MSIToken1.sol#573-577)
increaseAllowance(address,uint256) should be declared external:
        - ERC20.increaseAllowance(address,uint256) (MSIToken1.sol#591-594)
decreaseAllowance(address,uint256) should be declared external:
        - ERC20.decreaseAllowance(address,uint256) (MSIToken1.sol#610-613)
initialize() should be declared external:
        - MsiToken.initialize() (MSIToken1.sol#734-740)
```



```
MsiToken.initialize() (MSIToken1.sol#734-740) uses literals with too many digits:
        - _mint(msg.sender,400000 * 1e18) (MSIToken1.sol#739)
MsiToken.mintOnceForFarm(address) (MSIToken1.sol#742-747) uses literals with too many digits:
        - _mint(_address,1600000 * 1e18) (MSIToken1.sol#746)
```