Recall that the magnetic vector potential $A(\mathbf{r})$ created by volume current distribution $\mathbf{J}(\mathbf{r})$ is:

$$A(\mathbf{r}) = \frac{\mu_0}{4\pi} \iiint_V \frac{\mathbf{J}(\mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|} \, dV'$$

while the magnetic vector potential created by a surface current $\mathbf{J}_s(\mathbf{r})$:

$$A(\mathbf{r}) = \frac{\mu_0}{4\pi} \iiint_S \frac{\mathbf{J}_s(\mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|} \, ds'$$

Therefore, if both volume and surface current densities are present we find that the total magnetic vector potential is:

$$A(\mathbf{r}) = \frac{\mu_0}{4\pi} \iiint_V \frac{\mathbf{J}(\mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|} \, dV' + \frac{\mu_0}{4\pi} \iiint_S \frac{\mathbf{J}_s(\mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|} \, ds'$$

Compare these expressions to the magnetic vector potential field produced by material with Magnetization Vector $\mathbf{M}(\mathbf{r})$:

$$A(\mathbf{r}) = \iiint_V \frac{\mu_0 \mathbf{M}(\mathbf{r}') \times (\mathbf{r} - \mathbf{r}')}{4\pi |\mathbf{r} - \mathbf{r}'|^3} \, dV'$$

We can write also write this expression as (trust me!):
\[
A(\vec{r}) = \frac{\mu_0}{4\pi} \iiint \frac{\nabla' \times \vec{M}(\vec{r}')}{|\vec{r} - \vec{r}'|} \, dV' + \frac{\mu_0}{4\pi} \iint_{S} \frac{\vec{M}(\vec{r}')}{|\vec{r} - \vec{r}'|} \, \hat{a}_n \, ds'
\]

where surface \( S \) is the closed surface that surrounds material volume \( V \), and unit vector \( \hat{a}_n \) is normal to this surface.

We find that this is identical to the expression:

\[
A(\vec{r}) = \frac{\mu_0}{4\pi} \iiint \frac{\vec{J}(\vec{r}')}{|\vec{r} - \vec{r}'|} \, dV' + \frac{\mu_0}{4\pi} \iint_{S} \frac{\vec{J}_s(\vec{r}')}{|\vec{r} - \vec{r}'|} \, ds'
\]

if \( \vec{J}(\vec{r}) = \nabla \times \vec{M}(\vec{r}) \) and \( \vec{J}_s(\vec{r}) = \vec{M}(\vec{r}) \times \hat{a}_n \).

Therefore, we find that the magnetization of some material, as described by magnetization vector \( \vec{M}(\vec{r}) \), creates effective currents \( \vec{J}_m(\vec{r}) \) and \( \vec{J}_{sm}(\vec{r}_s) \) (where \( \vec{r}_s \) indicates points on the material surface). We call these effective currents magnetization currents:

\[
\begin{align*}
\vec{J}_m(\vec{r}) &= \nabla \times \vec{M}(\vec{r}) & \frac{A}{m^2} \\
\vec{J}_{sm}(\vec{r}_s) &= \vec{M}(\vec{r}_s) \times \hat{a}_n & \frac{A}{m}
\end{align*}
\]

Again, note the analogy of these magnetization currents with polarization charges \( \vec{\rho}_p(\vec{r}) \) and \( \vec{\rho}_{sp}(\vec{r}) \).